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DIGITAL TRANSFORMATION IN EDUCATION: ACTIVE LEARNERS

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Abstract: *It is argued that the digital technology has made possible the vast range of applications and media forms including virtual reality, digital special effects, digital film, digital television, electronic music, computer games, multimedia, the Internet, the World Wide Web, digital telephony and so on [8]. Digital transformation has been particularly influential in new directions of society. Providing schools with digital technology promises a high return on investment. The presence of computers and Internet access raises technology literacy and skills, better preparing the future generations to participate in the information society [12]. To this end, schools represent ideal access points because they cover a large part of the population, especially in developing countries. Starting from 1990s, many educators have been realised the potential of Internet for educational purposes and began to introduce it into classrooms. According to [10] the popularity of web-based teaching and learning lies in the strengths of its distributed nature and the ease of its browsing facility. Both the use of digital technology and increased interest in student-centered learning may lead to a significant change of the teacher's role, as well as the recognition of the active role of the learner in the learning process.*

Keywords: *Digital, Internet, education, Student-centered learning, active learning*

1. INTRODUCTION

People — and the things around us — are increasingly connected to networks and sharing information, collaborating more across borders and gaining incredibly rich insights from big data. The World Economic Forum calls this the 'hyperconnected world', and it will have a huge impact on the future, especially through its impact on educational systems. Digital transformation in education isn't just about hardware and software. It's about what institutions value and what drives decisions. It's about using practices, processes and technologies of the internet-era to respond with agility and flexibility to the raised expectations of students, faculty and staff. Successful institutions constantly seek ways to improve their processes, specifically the ones that deal with student journeys. Continuous improvement also means using technology in new ways to keep students, faculty and staff engaged, productive and happy [26] (see Figure 1). On the other hand in [2] it is stated that a high-skilled labor force is only attainable if the potential source of young population is capable and willing to push the limits forward. In order to achieve such a momentum, the young population should be aware of what has been, what is and what potentially happen. Thus the quality of education is an important factor for the young population to be aware of how the conglomerates of the world are possibly scheduling their future investments.

Although student-centred education is not a new idea, new technologies developed for the WWW and other Digital Learning Environments (DLEs) allow new forms of educational support to be facilitated, enabling new pedagogical concepts and enhancing learning. As a

consequence, the role of the educator changes from a teacher to a facilitator and the paradigm of active learning can be supported [19].

The WWW can help us re-focus our institutions from teaching to learning, from teacher to student/learner even to curriculum/information. With promises of rich information resources readily available, successful use of the WWW within an instructional setting is tied directly to a pedagogical approach that promotes active learning methods/ways such as inquiry-based learning, collaborative learning as well as problem-based learning [21].

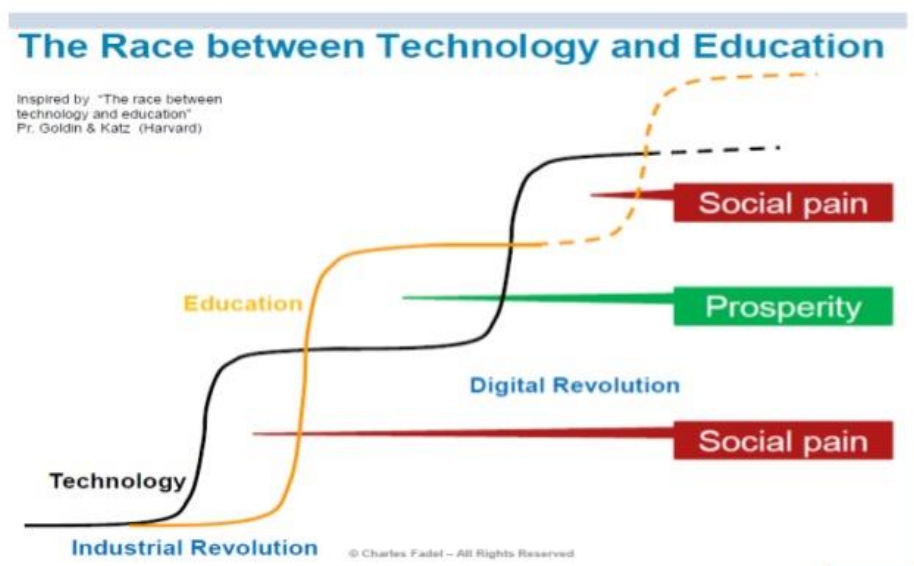


Figure 1: The race between technology and education [26]

2. DIGITAL TRANSFORMATION IN EDUCATION

2.1. Industry 4.0 and Digital Transformation

Information and Communication Tehnologies (ICT) has been particularly influential in new directions of society. There is a hypothesis that societies undergo three phases: archaic, socio-semiotic and techno-semiotic. In archaic phase people and communities live still nature-bound life. The socio-semiotic phase was the avenue chosen by the western world in the emergence of modernity leading to industrialization and democratic institutions. In techno-semiotic phase the society is under the influence of modern electronic and information tehcnology, especially internet and the “extase” of communication, and this changed radically the previous structures of social organization. In this third phase, an end-to-end industrial transformation called Industry 4.0 (see Fig. 2) sets new goals for manufacturing and impacts on business outcomes [6].

[15] argued that since Industry 4.0, that refers to three previous major changes, has been announced as the financial, political and scientific future vision of Germany in Hannover Exhibition in 2011, its importance has gradually increased [1]. In recent years terms like big data, Internet of Things, cloud informatics, mobile devices, digital and big data concepts have become prominent. With Industry 4.0, new terms like “Internet of

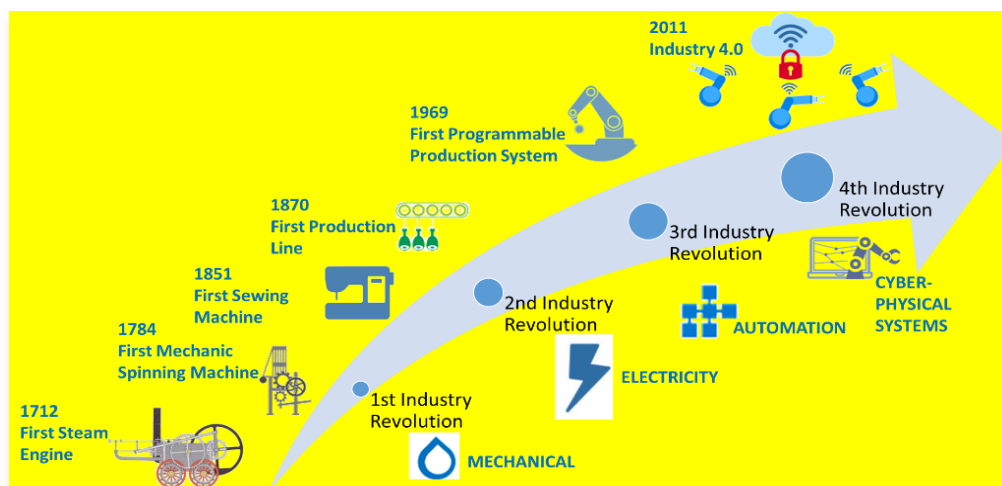


Figure 2: Industrial Revolutions [9].

Everything”, Information of Everything – a concept which was revealed by IBM – and cyber-physical systems have been put forward. [2] stated that with the adoption of Industry 4.0, a high-skilled labor force that can manage the interactions within the smart factories will be needed. In order to bring up such a labor force, education needs to be upgraded as well as be geared toward a more scientific nature that should encourage innovation and improvement.

2.2. Future Trends in Teaching and Learning

Under the influence of ICT, learning has acquired new dimensions, discussed quite regularly on many levels. DLEs are viewed as viable learning solutions because they are scalable, cost effective, flexible and convenient. A DLE can be educational software, a digital learning tool, an online study program or a learning resource. It may thus consist of a combination of different technical solutions and for example be used as the basis for an e-learning program [24]. However, there are some pitfalls to pursuing convenience, speed and scalability in digital learning. Learning leaders can avoid these pitfalls by paying attention to three other criteria: personalization, navigation, experiential learning.

It is known that the human mind is the most powerful problem-solving tool and the ability to extend the power of human thought with computers and other digital tools has become an essential part of the 21st century skills set. This is why we should continue researching how, when, and where computers and other digital tools can support us in solving problems [4]. For example, building and using Augmented Reality (AR) scenes combines active complex problem solving and teamwork to create engaging educational experiences to teach science, math, or language skills, and studies have found that this activity enhances student motivation, involvement, and engagement. For example, the UK government’s National Grid for Learning (NGFL) have been providing a government-funded gateway to educational resources on the internet so as to help both learners and teachers benefit from ICT. Keeping students engaged is a huge challenge the educators deal with every day. Students learn in different ways, and at varying paces. Fortunately, a digital transformation is taking place to drive personalized, digital learning strategies in a really efficient and effective way. As it was stated in previous section and according to literature there are top six digital transformation trends that will have an enormous impact on education in very near future [25].



Personalized Learning: As education technology improves, teachers are finding more ways to create individualized learning opportunities for students. Two ways to personalize the educational experience are Blended Learning (BL) and Adaptive Learning (AL) which are the most important digital transformation trends. BL personalizes lessons, allowing students to focus on discovery and to make their own decisions. The idea is to combine technology such as a mobile learning platform or other online environments with face-to-face interactions that provides students with more ownership. AL on the other hand, allows students more freedom in designing their own educational paths. It analyzes a student's input and instantly adjust his/her learning materials and assessment. Classroom agility and student achievement support can be increased by using adaptive learning tools.

Student-Led Learning: This type of learning has been used in classrooms for years but 21st century education has brought it to the next level with digital wireless presentation systems and mirroring devices. In teaching, the mind is actively engaged and people grow more comfortable with a topic after teaching others about it.

Gamification: It is the use of game design and mechanics to enhance non-game contexts by increasing participation, engagement, loyalty and competition. Teachers are always looking for motivating and engaging games to implement in their classroom. This can be achieved by providing opportunities to earn badges, level up, and fail in order to restart and try again. Gamification encourages collaboration through team play. By employing this digital transformation trend in the classroom, teachers can keep students actively involved while reinforcing both low-level and high-level concepts.

Cloud-Based Technology: This is an essential part of a school's digital transformation that allows students and teachers to have access to content and resources wherever they are.

Learning Data and Analytics: By gathering and interpreting data from learners, analytical technology can improve knowledge retention and learner engagement. Personalizing what the learner receives can better serve the learner's interests and learning style. Data can be used to personalize the learning experience automatically (as with adaptive learning technology), but it can also be used to personalize interactions with students. Teachers can use interactive classroom orchestration tools, such as Windows Ink, and touchscreen displays to give students relevant, real-time feedback directly on their devices in a 1:1 environment. When analytics synthesized from a school's student information system is added, teachers can go even further in adapting content to suit the students' needs.

One to One Ratio Classroom: Literature suggest that the rise of "one computer per student" is a significant digital transformation trend which is expected in near future to increase. Unfortunately, according to PISA 2015 data the number is satisfactory only in few countries: Australia, Iceland, US, New Zeland, Austria, Canada and UK. One-to-one provides educators the flexibility to supplement core curriculum with interactive online content to create more highly customized lessons.

3. STUDENT-CENTERED LEARNING AND ACTIVE LEARNERS

3.1. Theoretical Background

Constructivist theorists contend that learning occurs when learners actively construct their own knowledge and think reflectively when information and concepts are presented to them. Students build their understanding in the context of mentoring from instructors who help them find connections among concepts and connections that are obvious to an instructor may be far from obvious to a pupil. Such connections are made through experience over time. One strategy for providing students with constructivist learning experiences that also gives teachers access to the students' understanding for effectively mentoring is student-generated visualisation [13].



Constructivism as a philosophical view on how we come to understand or know, holds that any so-called reality is the mental construction of those who believe they have discovered and investigated it. Its view is characterized in terms of three primary propositions [23],[25].

- Knowledge is in our interactions with environment.
- Cognitive conflict is the stimulus for learning.
- Understanding is influenced through the social negotiation of meaning.

Student-centred learning is based on constructivist approaches and has become an important theme in the educational theory and practice. The emphasis in the constructivist-based education is on the activities of the learner [17]. In a student-centred learning environment, learners have opportunities and increased responsibility to identify their own learning needs, locate learning resources, and construct their own knowledge based on those needs (rather than having a standard or identical knowledge base imparted to all students). Students are active participants in their learning, instead of being passive recipients. Learning is more individualized and less standardized.

Both the use of technology and increased interest in student-centred learning may lead to a significant change of the teacher role, from the “sage on the stage” to “guide on the side” [20]. What can be said about the role of the learner? According to [18], different teaching methodologies employed in educational institutions do not always take cognisance of the learning needs of students. As [7] states “...findings of research in higher education suggest that web based training programs should be designed to accommodate the learner’s need and to allow learners the freedom to follow unique paths to learning in their own cognitive styles”.

3.2. Examples Including Case Studies/Applications

Example 1: Empowering Learners in the Production of a Web-based Learning Resource for a Science Course

This case study have used an approach based in part on integration of technology (e.g. computers and web) in the curriculum with student-centred learning, the most important feature of active learning philosophy [11]. It is about the issue regarding the design of Resource Interface for Astronautics (RifA), a web site that behaves as a resource interface for Astronautics course, an undergraduate course in the Department of Astronomy and Space Sciences at Istanbul University. What led to this study was first the instructor increasing awareness of the limitations of traditional methods of content delivery and second, students’ satisfaction (in this case dissatisfaction) with the current format of presenting the teaching material. The most important part of the study was the active involvement of students in the development and maintenance of RifA. The interface was integrated to the department’s main web site. It was intended to supplement or complement the main teaching material used by approximately 40 undergraduate students every academic year between years 2000 and 2004, and to help the instructor to act as a mentor. The case study was supported by Research Fund of Istanbul University under the Project B-993/31052001 and Project OR-175/18062001.

The RifA has six modules:

- *Teaching material* (instructor’s lecture notes)

This subject-specific module includes the basic teaching material and it is organized in ten units.

- *Special topics*

The generic part of the interface is fully designed and implemented by students, and is open-ended. If a student finds a topic of interest first s/he prepares the pages containing this material.

- *Lists of references to paper-based information or books*

The aim of this part is inform students about the paper-based sources of information about Astronautics and Space Sciences especially those in their mother tongue. There is also a list for foreign literature.

- *Links to selected Astronomy websites*

External web links were selected carefully and placed in the pages of the site in terms of their relevance to astronomy students.

- *Answer to exercises and quizzes*

- *Selected students' assignments and certificate theses*

As much as possible, students were encouraged to prepare their assignments and certificate theses on Astronautics specifically to be included in the site. Assignment based on creative thinking scenarios and only selected certificate theses were selected in order to be added to this part.

As a web-based interface the RIfA was intended to provide an easy-to-use and rich-in content environment for teaching Astronautics without losing the social aspect of the traditional classroom. Furthermore, it gives students a responsibility for participating in preparing a resource –based course material. Although it does not provide an entirely active learning environment, there is evidence that the involvement of students and taking their preferences into account, first results in a feeling of ownership, and is a useful skill for students to develop themselves as more independent learners. As preliminary version of a supported self-learning tool RIfA helped the instructor to provide students with an effective web based self-learning environment or a DLE.

Example 2: More Active Students

In their study entitled “A Web environment to encourage students to do exercises outside the classroom: A case study” Capus et al. have proposed an online environment called Sphinx, with examples of solved exercises that students are invited to self-explain [5]. The purpose of the online environment was to make students more active during the problem-solving process and to motivate them to work more outside the classroom by giving them feedback within a virtual classroom between lecture sessions. It also allows the teacher to follow the progress of each student using the environment. The Sphinx environment combines learning-by-example and collaborative learning.

4. CONCLUSION

The presence of computers and Internet access raises digital technology literacy and skills, better preparing the future generations to participate in the information society [12]. To this end, schools represent ideal access points because they cover a large part of the population, especially in developing countries. Connecting schools through technology also bring online that part of the population that can learn quickly how to use ICT [14]. Increased interest in student-centered learning may lead to a significant change of the teacher’s role, as well as the recognition of the active role of the learner in the learning process.

When looked at the National Educational Technology Standards (NETS) of the International Society for Technology Education (ISTE), it is seen that the skills required for teachers were no longer limited to knowing the basic processes and concepts related to technology, but developed into a wider spectrum, comprising the integration of technology into education, and knowing and implementing to ethical principles related to use of these technologies [3]. **Lebrun (2005) proposes the IMAIP learning model (Information, Motivation, Activities, Interaction, Productions) which five constituents fit well with the learning factors that can be stimulated by ICT [16].** On the other hand, it becomes important to consider organizations of learning where students get the opportunity to work in groups and to negotiate. It becomes important to consider problem-based and project-organized learning. According to literature Investments and strategies should focus on:

- teachers' digital skills
- well-targetted usage of ICT in those part in teaching-learning process where they make difference
- development of specific and well-adjusted pedagogies: experimental learning (remote and virtual labs, project-based and enquiry-based pedagogies), hands-on pedagogies (game development), interactive and metacognitive pedagogies (real time assessment).

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THE BENEFITS OF INTERNATIONALIZATION IN HIGHER EDUCATION. THE EXPERIENCE IN PORTUGUESE POLYTECHNICS

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Abstract. *The European Commission [4] states that each Member State should adjust its national strategies to enhance its potential and international presence and attract talent. Account must be taken of both the national skills shortage and the lack of intercultural skills and the knowledge and research needs of their developing partner countries.*

Globalization is a process of great expansion, irreversible and with deep implications in all areas. This process will result in new opportunities and new challenges for the next generations of students and teachers looking to develop in an increasingly interdependent context.

The Portuguese polytechnics, through the implementation of a concerted internationalization strategy between the institutions, have already achieved significant results in terms of international affiliations, international student and teacher and non-teaching staff mobility, joint programs and degrees and joint research projects. The internationalization of Portuguese higher education institutions (HEI) in recent years confirms the trend towards globalization of higher education.

Keywords: *Internationalization; Higher education; Portuguese polytechnics; International cooperation*

1. INTRODUCTION

Building European and transnational networks of academic, cultural, scientific and business cooperation on a European and world scale are fundamental to the path of peace and cooperation [10]. The Erasmus program, existing for over 32 years, is an excellent example of this path, inspired by a culture of tolerance and multiculturalism.

During this period the mobility of students and researchers in Portugal intensified. In the last eight years the number of foreign students has increased by 119%, the number of PhD holders has grown by 74% between 2000 and 2010 and Portuguese scientific production has increased by thirty-five times in the last twenty-five years.

Assuming the inevitable globalization of higher education, if on the one hand there are new and diversified markets for HEIs, on the other hand we will see a significant increase in national and international competition.

The challenges will be different, we will be confronted with students with ambitious expectations, looking for applied, differentiating and quality contexts. Further pressure on resources can be expected to reinforce the need to increase the attractiveness of HEIs for students and teachers, which highlights new challenges in research and the opportunities for collaboration.

The Coordinating Council of the Portuguese Polytechnic Institutes (CCISP), in 2014, outlined a strategy and defined a demanding activities plan. The path taken has allowed to strengthen the internationalization of HEIs with very significant results.

2. HIGHER EDUCATION IN PORTUGAL



2.1 Brief characterization

The Law of the Educational System of 1986 established the binary structure of the Portuguese higher education. In Portugal the organization of higher education has many similarities with the systems of other European countries, which have the traditional university subsystem and the polytechnics or universities of applied sciences. These are the alternative and complementary paths that Portugal offers to those who want to attend higher education.

As is well known, the evolution of the binary system has not been the same in all countries. In the United Kingdom and Australia the binary system, even in the last century, has come to an end. With this change to the unitary system part of the polytechnic institutions went to universities and the other part went through a merger process. In many other countries, despite eternal discussion, the binary system continues and is constantly changing. We have countries, such as Ireland and New Zealand, where polytechnics are now able to confer a PhD degree and the latter retaining the name of polytechnic.

We have been watching the drift of both subsystems. As regards [3], “we see vocational drift from traditional universities and academic drift from new universities”. Talking about differentiation in higher education, different missions, different courses and teaching methods is common to most countries. However, cases already reported here and others in which the discussion exists demonstrate that differentiation has lost some strength and has drifted towards institutional homogenization.

The evolution of the number of students enrolled is another indicator that also proves the positive evolution of the polytechnic subsystem. This is manifested in an indicator of increasing recognition by society of the quality of training provided in polytechnic education [9]. It should be noted that in the 2016/17 school year, 292.430 students were enrolled in public higher education institutions, 107.732 of which in polytechnic institutions and 184.698 in university institutions, thus representing the polytechnic sector 37% of the total of students enrolled in public higher education.

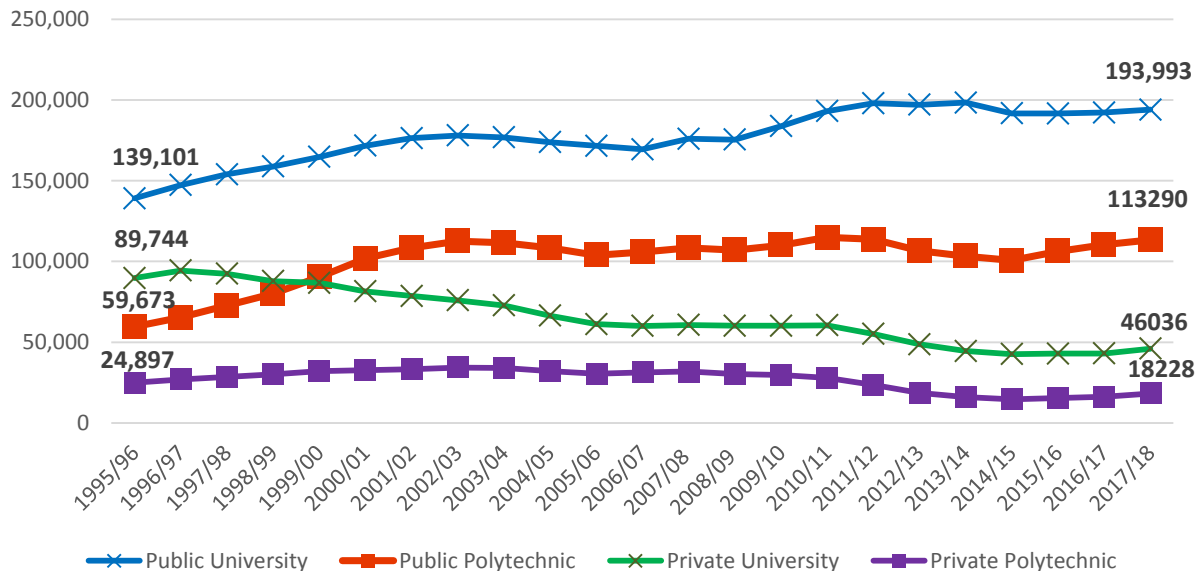


Figure 1. Evolution of the number of students enrolled by subsystem; Source: [5]

The Portuguese higher education network comprises 121 institutions, corresponding to 338 organic units, which are distributed by the university and polytechnic subsystems (public or private). However, it should be noted that public higher education comprises about one third of institutions and almost 60% of organic units [1].

The network of public university higher education establishments consists of 14 universities and 1 non-integrated university institute. To these establishments are added 4 university institutions of military and police sciences [6].

In Portugal, polytechnic education is provided in polytechnic institutes, in non-integrated polytechnic schools and in integrated polytechnic schools in universities. The public polytechnic education network consists of 15 polytechnic institutes, 5 non-integrated colleges, 2 military and police education institutions and polytechnic establishments of 7 universities (Azores, Algarve, Aveiro, Évora, Minho, Trás-os-Montes and Alto Douro and Madeira) [6]. The network corresponds to 27 institutions, 102 organic units, with presence in 45 municipalities in 18 districts and 2 autonomous regions.

Polytechnic institutions provide training at levels 5, 6 and 7 of the European Qualifications Framework.

Also the evolution of faculty qualification is impressive! In twelve years the number of teachers with a PhD degree has increased by around 500%, and currently more than 50% of teachers have a PhD degree and more than two thirds of teachers either hold a PhD degree or the title of specialist. If we consider teachers attending a doctoral program, we can predict that two or three years from now, two out of three teachers in polytechnic education will have a doctoral degree. It is not surprising that the qualification of the faculty, associated with the increasing research capacity installed, allows the Polytechnics to soon also be able to teach doctoral programs.

2.2 The impact of higher education institutions

Additionally, the socioeconomic impact of HEIs is observed as a very present theme in the literature, identifying a strong correlation between knowledge and economic growth [2]. According to the authors, it is through the knowledge acquired by individuals and companies that regions and countries overcome change, promote economic growth and create wealth. On the other hand, higher education is a source of knowledge that generates qualified people, promotes research and consultancy, and transfers results to society [7].

These works demonstrate, above all, the centrality of higher education in the development of regions and countries. HEIs play the role of driving the development of territories, disseminating new knowledge and new technologies.

According to the European Commission, higher education institutions contribute to regional development, sustainable economic, social and territorial cohesion (European Commission, 2007). Vossensteyn [11] also specifically emphasizes the contribution of polytechnic institutions to regional development, portraying these institutions as entities with a markedly regional matrix (both in terms of attracting and recruiting students, and their influence on the labor market of collaboration with the social partners), often with the role of stimulating / supporting the local economy – eg. the Czech Republic, Finland, Denmark, Norway, Switzerland and Ireland (in the latter country these educate for local industry and commerce).

Also in a study involving twelve Portuguese polytechnic institutes [8], these institutions are recognized as important actors in regional development. The Portuguese higher education system comprises both Universities and Polytechnic Institutes, which face an increasing pressure to demonstrate that their presence has an impact on the surrounding communities contributing to their economic development. Moreover, this work portrait the diversity of the

Institutes involved, not only taking into account their different sizes but as well as their socioeconomic and regional contexts. Results of this study show that the economic impact of HEIs ranged from 27 million euros to 172 million, which represents between 1.8% and 10.6% of the local GDP. In addition, the level of economic activity generated, for every euro of government funds, ranges from 1.7 to 4.7 euros. Moreover, these Institutes are, in general, major local employers and, therefore, its impact is even more significant in less developed and isolated regions; furthermore, they have a major role in granting access to higher education to young people that, without the presence of these Institutes in these regions, would not enrol in higher education.

3. THE INTERNATIONALIZATION OF PORTUGUESE POLYTECHNICS

In a global world, the study of the phenomenon of internationalization has to be a focus of reflection at all levels, particularly in an open country like Portugal.

The globalization of higher education has accelerated in recent decades and today internationalization is one of the strategic aspects of any higher education institution. Institutions are increasingly seeking to align internationalization with their mission by devoting more resources to it. Institutional policies for internationalization emerge that go far beyond mobility and education. Thus, since the 1990s, there have been several studies on the quality of internationalization, objectives, strategies and instruments. Assessing the impact of internationalization has received several contributions and has been a concern in several countries [12]. How to measure the success of internationalization and what indicators for this have been permanent challenges.

As already mentioned, in this path, higher education institutions worldwide have been reinforcing their internationalization activities, especially with regard to student recruitment at international level. The internationalization of the institutions staff and their research activities are also gaining importance.

We cannot analyze mobility in higher education without addressing European policies, in particular the Erasmus program. We know that it does not exhaust mobility flows, but it has a huge weight. In the last 40 years more than 4 million European students have had an international mobility experience. This is not strange to the Bologna process and the construction of the European higher education area. In Portugal there has also been a growing evolution in IN and OUT mobility, both for students and teachers.

Nevertheless, studies show that students' socioeconomic conditions continue to significantly influence inequality of access to an international mobility experience.

There is no doubt that international mobility puts pressure on the quality and attractiveness of higher education institutions.

Portuguese polytechnic education has been following this trend, having established cooperation programs with 83 countries and regions. Polytechnic higher education exchange programs involve the mobility of students, teachers and staff across more than 60 countries. In 2016/2017 there were 11 734 foreign students in polytechnic education, 3211 were in credit mobility and 4809 in degree mobility.

Table 1. Number of students enrolled in polytechnic education of foreign nationality

Countries	2014/15	2015/6	2016/7
Brazil	1112	1541	2026
Cape Verde	1067	1239	1461
Spain	1042	1146	1195
Angola	744	806	799

Sao Tome and Principe	376	437	575
Poland	326	384	381
France	125	167	306
Italy	194	220	278
Turkey	205	199	238
Guinea Bissau	122	169	226
Ukraine	186	185	188
Romania	147	148	158
Lithuania	144	160	147
Czech Republic	117	126	139
Germany	116	118	137
Mozambique	107	133	128
Others	1144	1472	1676
TOTAL	8418	10122	11734

Fonte: [5]

Increasingly polytechnics are recruiting students under the international student statute. It is a clear bet by most institutions and is contributing to the internal change of the institutions themselves.

On the other hand, CCISP integrates several international networks representative of polytechnic higher education, namely:

- European Network of Applied Sciences Universities (UASNET).
- European Association of Institutions in Higher Education (EURASHE).

CCISP has signed a protocol with the Macao International Institute for scientific and technical collaboration, development of relations between Portugal and Asia, exchange of researchers and technicians, organization of conferences and exchange of publications.

It also established a Memorandum of Understanding with the Macao Polytechnic Institute to foster and develop teacher and student mobility between IPM and the CCISP institutions.

Also in Macao, CCISP signed a consultancy contract with the Portuguese School of Macao, with the support of the Government of Macao, to provide teachers in the areas of Portuguese, Mathematics and Science.

CCISP has signed a student mobility protocol under the Science Without Borders Program with CONIF (National Council of Institutions of the Federal Network of Professional, Scientific and Technological Education in Brazil). Protocols were signed within the scope of the recognition of degrees and graduations between the Brazilian Federal Institutes and the Portuguese Polytechnic Institutions.

The Declaration of Collaboration was also signed between the institutions of CCISP and the KRPUT (Conference of Rectors of Polish Technological Universities), in the context of student, faculty and non-teaching mobility, as well as sharing publications and organizing conferences. Several annual meetings were held, alternating the venue between Portugal and Poland.

These partnerships at CCISP level paved the way for numerous bilateral cooperation agreements, which the polytechnic institutions were signing.

Polytechnic institutions now have a joint strategy for internationalization, relying on part of their action in a European-funded project that is delivering its results.

This networking culture, which has been transversal to all areas, is a strength of the polytechnic system and that also in internationalization provides significant benefits.

There are still difficulties or “obstacles” to the development of the internationalization policy of higher education that need to be answered, namely through the adaptation of some legal

diplomas, the evaluation of joint courses, and a simplified process for obtaining visas for foreign students.

Hence, in 2015, CCISP considered it essential to create a true internationalization strategy for higher education that would address the following aspects:

- Promotion of the country as a destination for higher education strategically, in articulation with other entities, namely the Ministries of Foreign Affairs, Economy and Higher Education.
- Creation of a specific policy for Portuguese-speaking countries.
- Streamlined processes and legal framework for creating joint courses.
- Promoting greater involvement of embassies and consulates in the process of recruiting international students, notably through new processes aimed at streamlining and reducing visa issuance time for these students.

From the available data, the path taken by the polytechnic institutions in internationalization is already long! The results are already appreciable! Hope for the future is encouraging!

4. CONCLUSIONS AND BENEFITS

The results and benefits achieved with the internationalization of higher education institutions are many and diverse, going far beyond their specific mission.

We now enumerate only the most significant:

- Contribution to the spread of a global culture of tolerance and multiculturalism;
- Path of cooperation and peace;
- Contribution to European rapprochement and European integration (Erasmus Program);
- Building transnational networks of academic, cultural, scientific and business cooperation at European and world level;
- Enhanced student and teacher / researcher mobility;
- Expansion and recognition of production and scientific activity;
- Knowledge transfer in the context of international networks;
- Sharing good practices in the teaching and learning process;
- Development of an international environment in higher education institutions, particularly benefiting the resident community that does not make international mobility;
- Socio-economic benefit with impact on institutions and regions.

As mentioned, many other benefits could be mentioned. Given the above, it remains to be concluded that the internationalization of science and higher education is unavoidable and drives significant changes in global society.

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A VIEW TO COGNITIVE ENGINEERING

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Abstract. *Cognitive engineering is the application of artificial intelligence, cognitive psychology and many different disciplines to human-machine systems with various software hardware elements. Cognitive engineering is supported by engineering disciplines and health, medical, psychology, sociology and even philosophical sciences. In this sense, it can be accepted as an interdisciplinary new science. Cognitive engineering is the transformation of human thought and psychology, even philosophy, into systems by modelling with software programs. Thus, machines or systems can be provided with more humane thinking and decision making capabilities than artificial intelligence. In this study, general information about Cognitive Engineering discipline will be given and recent applications in this field will be discussed.*

Keywords: *cognitive engineering, human-machine systems, artificial intelligence.*

1. INTRODUCTION

Cognition generally arises from psychology and learning-based mental processes such as cognition, memory, thought. In the first half of the 19th century, these methods began to be used by astronomers as an approach to distinguishing stars [1]. Then seafarers and surveyors began to use these approaches to find their way through navigation [2,3]. Since 1950, although these concepts are known in general terms, they still have not completed their development. The graph of the development of cognitive systems is given in Figure 1. These development processes are due to the continuation of developments in neurology and neuroscience sciences. It can be said that science has been divided into different subfields in recent years. These fields develop as a result of multi-disciplinary studies of social sciences and engineering sciences. In this sense, although there are resources that call Machine-Human interactive systems, Machine-Human interaction systems are perhaps a sub-branch of Cognitive engineering discipline [4,5]. A cognitive system is intelligent systems capable of producing intelligent actions that include intuitive features such as the human mind. Their behaviour is aimed at generating behaviour or commands based on target-oriented symbols and manipulations [6]. Has the ability to make new inferences from previous experiences. In this sense, it can be said that Cognitive Engineering takes its model from Artificial Neural Networks and Expert Systems.

Moreover, a cognitive system is adaptive and can solve a problem by multiple methods. In other words, a cognitive system builds its actions by gathering all the data in the environment, statistical approaches and deriving from its previous experiences based on the information here. Therefore, the Cognitive System is not only data-oriented, but also concept-oriented. Human being, which is a biological perfect system, is clearly a cognitive system. It gains a new meaning by combining with machines and engineering systems [7].

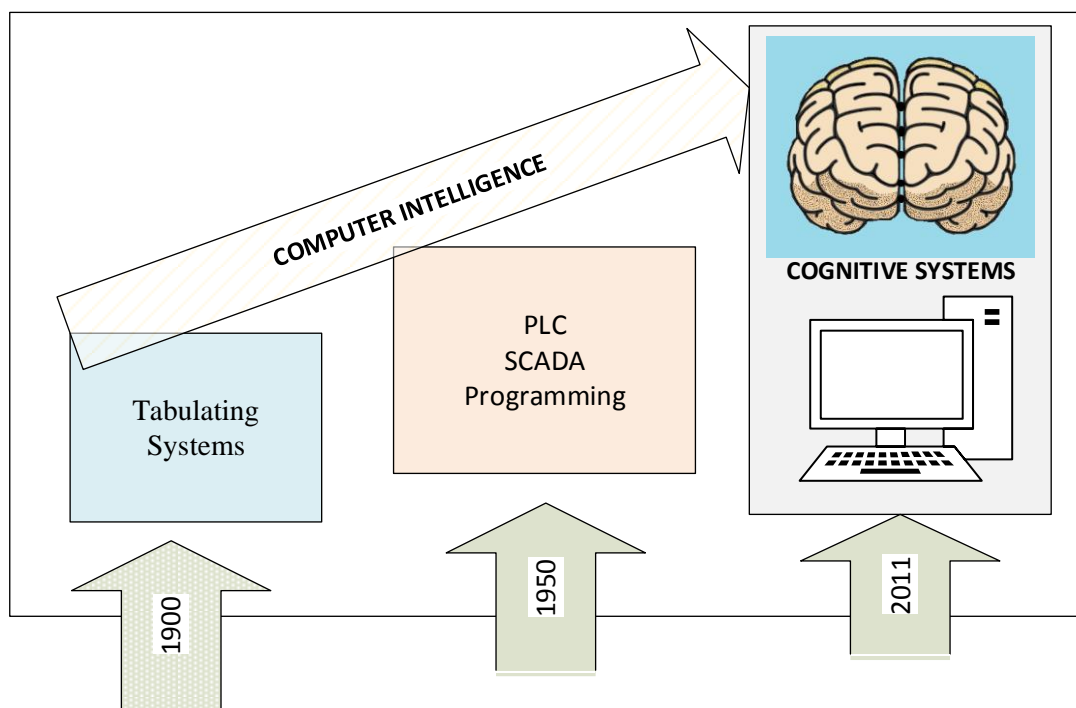


Figure1. Historical development of Cognitive Engineering [9]

The development of Neuroscience and Artificial Intelligence systems enables Cognitive Systems Engineering to develop and find applications every day. Human resources units in the industry have started to use cognitive functions frequently in improving economic performance, increasing employee motivation and increasing the appointment of employees [10,11]. In the field of engineering, applications where human emotions or feelings are taken as a parameter in managing systems are increasing. Here, Cognitive Engineering concept differs from Cognitive System Engineering. Cognitive system engineering is a special discipline in which social and technical systems are designed together. Decision making, planning, managerial concepts. It aims to design cognitive, social psychology and system design. Civil air traffic control, transportation control design, communication, process control, health care issues are found in the application area. The concept of cognitive engineering focuses on the design of industrial systems with human-machine interfaces [7,8,12,13].

In this study, Cognitive system engineering and cognitive engineering concepts are discussed and their application areas are discussed.

2. COGNITIVE COMPUTING

Cognitive Computing (CC) will be the only area to address problems that can solve the difficult problems of technology, including human beings, in the future. This area has not yet completed its development. It will gain new algorithmic capabilities to solve very difficult problems such as decision making and making meaning from the systems where too much data are collected. This field is closely related to Cognitive Science, psychology, neurology, computer science and other engineering disciplines. It consists of three main components: human cognition, perception, action and learning [14]. The brain can use information as a cognitive system, can extract new information from this information and make sense of it. It can also use its experience as knowledge [14]. Cognitive Engineering has many

applications in the fields of Civil Engineering, Industrial Engineering and engineering management.

2.1. Human Machine Systems (HMS)

In Human-Machine Systems it acts as an adaptive, optimal, decision-making controller like a human operator. It is a multi-disciplinary field covering control engineering and psychology and experimental psychology. Here, human adds bio-dynamic properties to the operator. These factors are often not mathematically modelled. The human; emotions, physiology, kinematics, perceptual behaviour, motivation, as well as performance of the system, environmental factors that affect the system [3-5]. The block diagram of Human Machine Systems is given in Figure 3. The diagram in Figure 2 changes as the relationships between the sub-disciplines are determined.

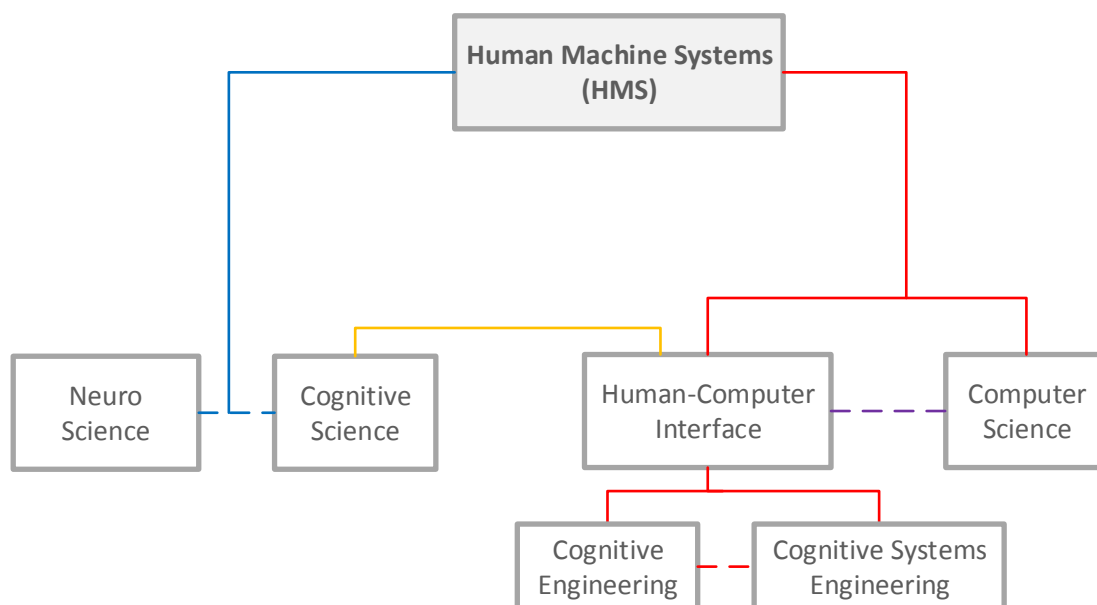


Figure 2. Human- Machine System [15]

3. COGNITIVE ENGINEERING

Cognitive Engineering is a multi-disciplinary field of research. Since it is an engineering field, it works together with many science or systems. It covers all elements from system design to analysis and evaluation at the end. It acts by combining human and technology elements. Old experiences in cognitive science include human-computer interaction and humanoid factors. The relationship between cognitive engineering and other disciplines is given in Figure 3.

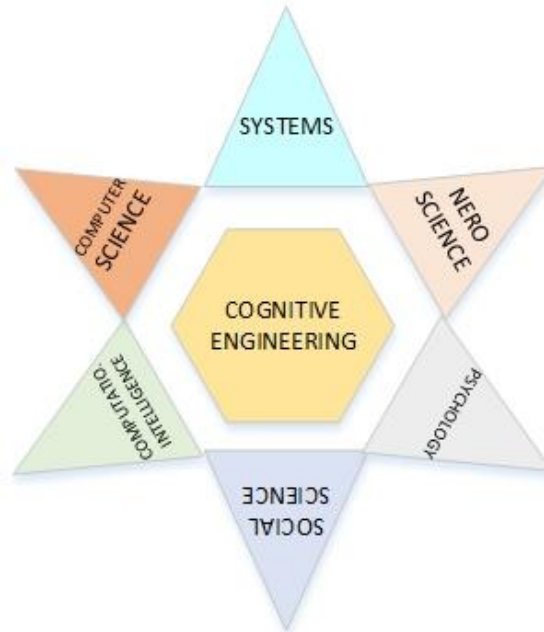


Figure 3. Relationship between cognitive engineering and other disciplines.

Cognitive engineering differs from other fields of Cognitive Science as it includes mechanical and computer sciences including complex socio-technical fields. Even though it was thought that there was a difference between Cognitive Systems and these two areas at the moment, these two areas are in each other. The most important feature of this field is that real-life engineering projects co-create neurology, psychology and computer science. Figure 4 shows the Cognitive Network Architecture.

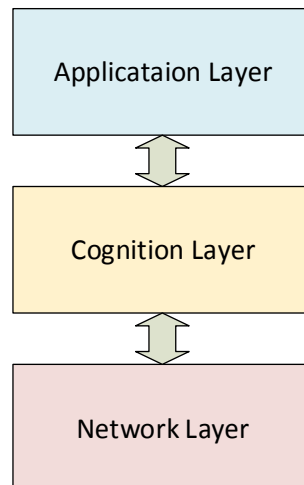


Figure 4. Cognitive Network Architecture [17-17]

3. REAL WORLD APPLICATION OF COGNITIVE ENGINEERING

Cognitive engineering contributes more to our lives day by day. A new one is added to wired and wireless communication networks and sensor networks. Smart buildings are widely used in many areas such as smart transportation, health services, agriculture, public health, food and similar applications. There is no doubt that Cognitive engineering will find

its place in an area of computer and decision making systems. Cognitive engineering has introduced new approaches in information and communication systems, radio radios and telephone systems. Dynamic spectrum access (DSA) has many applications in this area that make use of noise reduction and mobile communications more efficient. Cognitive Radio (CR) has emerged as a result of the development of adaptation techniques and software tools in communication. In the cognitive engineering cluster, CR has the most uses. It is used in the design of the transmitter and receiver in communication, adjustment of channel power estimation, adaptive modulation processes [5-17]. Cognitive communication method is a smarter, faster and more efficient method in mobile and internet communication. In this sense, this method is both fast, high in performance and more economical.

The other area that finds application in cognitive engineering is the cognitive camera. The Cognitive camera can understand and interact with the environment and extract meaning from images for users to understand. These cameras can be used for high performance work despite their low cost. For this reason, they are used in vehicles and safety areas. The development of Cognitive camera-related equipment and software has led to the development of cognitive robot and cognitive tool applications. Neuro automobiles were produced following the driver's biometric characteristics. In Japan, it is planned to reduce vehicle accidents by producing prototypes following the vital data of drivers. Intelligent applications such as vehicle oil change, tire air control and change are seen as standard features in our existing vehicles. We will be able to see self-driving vehicles on our roads very soon. Similarly, self-flying aircraft will be the products of cognitive vehicle technology.

4. CONCLUSION

Cognitive systems are structures capable of processing natural language, learning from experience, interacting with people, making decisions based on what they have learned and received from the environment. All Cognitive systems are capable of learning and many use cognitive features during detection with sensors. In this study, Cognitive Computing and Information concepts are examined based on Cognitive System Engineering. In addition, the engineering applications that have been made to date and future applications have been investigated in the literature.

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EDUCATION AND TECHNOLOGY: DESIGNING NEW HORIZONS WITH LITERACIES

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Abstract: *Modern society has created a profound and compelling need to (re)think the universes of Education and Pedagogy, namely with the incorporation of Literacies into the teaching-learning process. As a result of technological advances, societal mutations and new information skills, there is a need to harmonize Education and Technology in order to enhance teachers at all levels of education, including Higher Education, to respond appropriately to these technological challenges and to the deeply embedded students in this ocean of technology and permanent change. The great challenges of Education on the horizon for 2030 are clearly focused on acquiring the skills to understand and decode the world, launch ready-made layouts and activate critical thinking for more fruitful understanding of the contemporary ideas, spaces and times, values and key issues like citizenship, as referred to in the OECD report on the future of education and skills. This is the reason why UNESCO (2013) supports the essential contribution of teachers to ensuring that all citizens can access information, as literate citizens and contribute to sustainable development goals, better living conditions, employment, per capita income, industrialization and land infrastructure development. Thus, it is important to recognize Literacies as sources and strategies to understand our world through a pluralistic approach to multiliteracies, taking into account the context, level of education and area of scientific teaching and research, and always connecting Education and Technology.*

Keywords: *Education, Technologies, Higher Education, Pedagogical Innovation, Literacies*

1. INTRODUCTION

The connection between Education and Technology is no longer a dispute, but an everlasting challenge. A challenge focused on our students, higher education teachers, learning and teaching skills, curricula design and strategic planning for our universities as a whole. Moreover, Information and Communication Technologies are a key axis in this double look, reminding us of the Latin god Janus, so that Education and Technology belong together and strongly united, as UNESCO highlights:

The Qingdao Declaration (UNESCO, 2015) declares that to achieve the goals of inclusive, equitable and quality education and lifelong learning by 2030, ICT-based teaching and learning needs to be integrated into all sectors of education. However, it also observes that on their own, ICTs will not bring about the required transformation and that there is a need for well-informed, long-term policies and strategies, professional development and well-researched and innovative methodologies for educational technology to play a central role in building inclusive and sustainable knowledge societies. (UNESCO, 2017, p. 221)

The great challenges of contemporary society and Education for 2030 focus clearly on acquiring skills to understand and interpret the world, launching a prepared look and activating critical thinking for a more profound understanding of nowadays spaces of contemporaneity and citizenship, as mentioned in the OECD The Future of Education and Skills:



Education needs to aim to do more than prepare young people for the world of work; it needs to equip students with the skills they need to become active, responsible and engaged citizens (...) Students will need to apply their knowledge in unknown and evolving circumstances. For this, they will need a broad range of skills, including cognitive and meta-cognitive skills (e.g. critical thinking, creative thinking, learning to learn and self-regulation); social and emotional skills (e.g. empathy, self-efficacy and collaboration); and practical and physical skills (e.g. using new information and communication technology devices). (2018, p. 5)

This is an effort for governments, Higher Education and Teachers. Much has happened since the UNESCO first documents and recommendations. Technology became a usual presence in the classroom and in the teaching-learning process. In fact, the classroom of the future became a symbol of incorporating technology in the classroom and all over the world experiences and concepts began to overthrow the classic classrooms. Today, this common expression entered our vocabulary: "The Classroom of the Future". It's a complex issue, but we can underline several keywords to define it: Education, Technology and Pedagogical Innovation. As Tarabasz, Selakovic and Abraham wrote:

The concept of the classroom of the future should be capable of providing a new student experience. It seems to be a passport to success in the new business environment, as students are already grown up in the digital world (Buzzard, Crittenden, Crittenden, & McCarty, 2011). Clem and Junco (2015) define the classroom of the future as 'an engaging social space, bringing forth vigorous conversation and debate while using technologies to help students collaborate, communicate, and build a sense of classroom community'. Coates (2016) conclude that student outcomes should include discovery, achievement, connection and opportunity. (...) Beyond any doubt, the classroom of the future is equipped with the state-of-the-art solutions, devices and technologies (Marinagi, Skourlas, & Belsis, 2013). Immersion into interaction with AI (Timms, 2016), ubiquitous computing (Marinagi et al., 2013) and technology exposure prepare the students for future working environment, allowing at the same time going out of the classroom while sitting physically in the class-room. The future classroom is an enabler of being connected, being involved and integrated with different Internet of Things (IoT) elements (Chang, Chen, & Huang, 2015; Sourdout, Smith, Anderson, & Whitworth, 2017). (2018, p. 233)

2. DESIGNING NEW HORIZONS WITH LITERACIES

Our 21st century is defined by Santaella (2010) as the century of the Digital society, not only because the technological advancement is vertiginous, but also because children and young people are increasingly immersed in this environment, being nicknamed Digital natives from the inaugural work of Prensky (2001). These young people reveal new skills such as the realization of multiple tasks at the same time, a permanent exposure to ICT, and a capacity to live with very varied digital gadgets and platforms. These students, of course, make us (re) think the educational institutions and pedagogical innovation that encompasses the teacher, the space-time of teaching-learning and the profile of these new students, in a clear conjunction with technological innovation. The European Commission stresses that higher education institutions should be in tune with these transformations and think about how they can incorporate them:

Technology is driving major changes in people's professional and personal lives across Europe and the world, impacting every facet of society and is now an integral part of how most people interact, work, learn and access knowledge and information. New and emerging technologies are already starting to have a transformative effect on higher education provision. There is every reason to harness the potential of these developments to the service of high quality higher education. (2014. p. 14)

This new student profile implies a new teacher profile, both of which are framed in a new educational paradigm, with increasingly advanced and multiform technological challenges.



The digital natives, with their natural harmonization with the technologies, which function as true extensions to read and interpret the world, with an ever-increasing fusion between written, verbal, sound and image text constitute a huge challenge for the teacher. In the same way that this new student evidences the desire for these platforms and technologies, thus emerges a correlates the need to provide the literacies to encode and decode correctly the information that they receive and create. At the same time, the teacher must follow these challenges, seeking, firstly, the mastery of new literacies and his later teaching as a tool to understand this new world. As stated in the European Commission's report *The Changing Pedagogical Landscape: new ways of teaching and learning and their implications for higher education policy*, this is a joint work of higher education institutions and teachers, who are essential in this process of change and which should be supported in this appropriation of pedagogical innovation:

New modes of teaching and learning are a major area of innovation, affecting all areas of European higher education provision. Having generally established a strong technological base for e-learning provision, universities now need to be continuously encouraged to explore possible new pedagogies. Especially, they need to focus on blended and online course design, e-assessment, learning communities, online tutoring, virtual labs and seminars, transnational online delivery, etc. Quality assurance agencies should support institutions by supporting the development of progress. Governments should develop overall strategies for the acceleration of this innovation and organise diversified funding mechanisms to support frontrunner institutions as well as a broad implementation of new modes of teaching and learning in models differ significantly between blended bachelor's and master's degree programmes, online and flexible recommendation. Institutional development in higher education should approach, developing these areas in their own right, practice, where possible. (2015, p. 89).

UNESCO has been defending the essential contribution of teachers to ensure that all citizens are able to access, assess and share information, as citizens with skills in literacies contribute to the objectives of a sustainable development, better living conditions, employment, per capita income, gross domestic product, industrialisation and development of country's infrastructures.

First of all, we must understand that Literacy is a keyword in the 21 st century and that this concept implies the means and tools to deal with information:

Literacy is fundamental to human development. It enables people to live full and meaningful lives and to contribute towards the enrichment of the communities in which we live. By literacy, we mean the ability to read and write at a level whereby individuals can effectively understand and use written communication in all media (print or electronic), including digital literacy. Literacy is an essential prerequisite for all kinds of learning. In the knowledge-based societies of the 21st Century, the rapid spread of new technologies and a constantly changing work environment, literacy learning is no longer limited to childhood and adolescence but must be recognised as a lifelong need and requirement. (2016, p. 3)

For this, we must struggle so that teachers are prepared for teaching literacies in every subject and in all grades, being always up-to-date to evidence-based practices and strategies and in order to do that the European Literacy Policy Network (ELINET) stated the following recommendations:

- Provide evidence-based teacher training in language and literacy development, learning theory and motivation, instructional strategies at word and text levels, reading–writing connections, instructional approaches in remedial reading, writing, effective reading and writing materials and assessment techniques, and in teaching digital literacy skills.
- Create awareness among teachers, head teachers and educational authorities about the need for continuous professional development on literacy issues; and provide teachers with the

necessary resources and opportunities to take literacy-related courses, including knowledge of contemporary authors and their books.

- Develop specific teacher training programmes to meet the learning needs of adults.

In summary, the literacies increase the work capacity of people, because they develop their competences. For UNESCO, teachers are at the heart of this issue, namely the benefits of Media and Information Literacy:

Policy and decision-makers, planners and professional institutions in the fields of education, information and communication supplied with valid and reliable data on existing gaps (in terms of environment and competencies), can initiate special interventions targeting teachers in service and in training; After assessment, teachers in service and in training will be better informed about their own level of competencies, and will seek and participate in special training programmes on MIL, in order to improve their teaching and learning and other areas related to their profession; Become more aware of the importance and usefulness of MIL for quality teaching and learning and will apply MIL in their classrooms and the training they provide. (2013, p. 93)

Thus, this society and these students take the teacher to the discovery and innovation that Guerreiro (2006) defines as the ability to see in another way the object that has already been observed by many, generating the need to be creative and innovative, changing paradigms in teacher's training and work processes, connecting them with the profile of digital natives. In view of the vertigo of technological development, the consequences in society and in the course of growth of students, it is urgent to harmonize education and training, in order to empower teachers, of all levels of education, including higher education, to respond appropriately to these technological challenges and to a deeply immersed public in this ocean of technology, information and permanent mutation. In fact, to look at these challenges, we need new skills to know, understand, analyze, interpret and produce. It is not enough to incorporate the technologies of the classroom, it is now more important to form for pedagogical innovation. In this context, it is absolutely essential that literacies constitute a priority in this field.

It is important to know literacies as sources and strategies for the appropriation of the world and to understand it, from the very beginning, with a plural approach, to the multiliteracies, to each of the literacies, keeping in mind the context, the level of education, and the scientific area of teaching and research. In the present case, we intend to carry out a reflective course on the multiliteracies, since it has a transversal, multidisciplinary and multicultural dimension, constituting itself as an area of knowledge with its identity, autonomous, in its study and in their teaching, allowing the acquisition of interpretative skills, techniques, narratives, aesthetics, among others, appropriate to various levels of education. One of the most relevant aspects in this area is that multiliteracies are fundamental to the future of students, as evidenced by Anstey and Bull:

In July 2017, The Foundation for Young Australians published the *New Work Smarts* report which identified the skills that would be required of workers by 2030 and the implications for schooling. The report identified the following: workers will spend 100 per cent more of their time involved in problem solving; 41 per cent more time on making judgements and engaging in critical thinking; 77 per cent more time using science and maths skills; 17 per cent more time engaging in verbal communication and using interpersonal skills (*Future Skills Report*, 2017, p. 4) The report also indicated that workers will spend 30 per cent more time learning while working, indicating the need for an ability to cope with change and be oriented toward lifelong learning. Overall the conclusion of this report was that workers would need to be strategic, able to solve complex problems and think creatively. The indications of this report clearly indicate the need for a multiliterate pedagogy. (2018, p. 26)

Faced with the uncertainty that characterizes the professions and professional demands of the future, it becomes clearer that students should be prepared for scenarios that we have



not yet been able to predict with a certain degree of certainty. Fast technological development and permanent social change combine to raise awareness of higher education institutions to prepare students for professions that do not yet exist or are not fully defined and that are in permanent mutation and development. Universities face a challenge of permanent change and updating that should be reflected in curricula and training skills. To empower our students, multiliteracies are absolutely fundamental. As Anstey and Bull wrote:

The definition of multiliteracies states that they enable capacities to cope with change and effectively participate in and contribute to all aspects of society: workplace, leisure, social, cultural and civic environments. These capacities would, therefore, include understanding the potential power of social media and being able to evaluate the types of social media available and their potential for influencing and changing social behaviour, beliefs, values and attitudes. For example, a multiliterate individual would have the capacity to explore and critically evaluate the concept of friendship and whether friending someone on Facebook is the same. Critical thinking skills, problem-solving, evaluating information, comparing and contrasting would all be part of this type of exploration. (2018, pp. 33 – 34)

3. CONCLUSIONS

In summary, we conclude that Education, Technology and Literacies are truly connected. Within the literacies, a first approach instituted the approximation between teacher and digital literacy as an initial bridge to associate them with pedagogical innovation. However, nowadays, this proposal is insufficient to cope with the multiplicity of challenges of contemporary society, with a complex network functioning and a capacity to generate increasingly larger information and on more varied platforms. Moreira (Moreira, J. and Ferreira, V., 2016, p. 72) advocates a new paradigm that is characterized by the fusion between pedagogy and technology, promoting the development of multiliteracies, according to the basic principle of the multiplicity of channels of Communication and its different forms of communication, through a pedagogical methodology centered on the development of multiliteracies, enabling the individual to analyze capacities in multimodal texts and even find new textual approaches. In fact, technological change and the latest social changes have transformed education and training for the young, as mentioned in the OECD report:

Technology now allows us to give all children, regardless of their social background, where they live or the jobs their parents do, the same chance to meet people – if not in person, then via the Internet – who do all kinds of jobs, to help them understand the vast array of opportunities open to them. It is also essential that employers and educators work far more closely together to help broaden young people's horizons, raise their aspirations, and provide them with the vital work-related knowledge and skills that will help them as they make the transition from school to work. Not only will these kinds of efforts give young people the best possible start in life, but they will also reduce the mismatch between young people's aspirations and the demands of the labour market, thereby ensuring that we have a workforce that will secure our economic prosperity in the future. (2019, p. 16)

Thus we must highlight the recommendations 3 and 5 of the High-Level Group on the Modernisation of Higher Education to the European Commission:

Recommendation 3. The integration of digital technologies and pedagogies should form an integral element of higher education institutions strategies for teaching and learning. Clear goals and objectives should be defined and necessary organisational support structures (such as the European Academy of Teaching and Learning) established to drive implementation.

Recommendation 5. All staff teaching in higher education institutions should receive training in relevant digital technologies and pedagogies as part of initial training and continuous professional development. (2014, p. 54):

Moreover, Education, Technology and Literacies are now a trilogy for future success in Higher Education because we need to train professionals but also the citizens of the future:

Education has a vital role to play in developing the knowledge, skills, attitudes and values that enable people to contribute to and benefit from an inclusive and sustainable future. (...) Education needs to aim to do more than prepare young people for the world of work; it needs to equip students with the skills they need to become active, responsible and engaged citizens. (OECD, 2018, p.5)

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THE ROLE OF CLOUD TECHNOLOGIES IN EDUCATION: INCREASING STUDENT ENGAGEMENT AND SUCCESS

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Abstract: *This paper proposes the technology of using own mobile devices based on BYOD concept for interactive involvement of students in the educational process. The technology is based on Google cloud services, which provide a comprehensive support to the survey and testing system from the creation of appropriate forms and storage of results in cloud data storage to the processing of test results and management of the testing system through the use of Google-Calendar service. Components of the system of interactive involvement of students in the educational process based on Google cloud services using BYOD concept and steps of its creating are given. Schemes of lessons with such survey control are listed. The experience of using the system is described. Technology of the interactive involvement of students in the educational process based on Google cloud services was approbated within the discipline "The Integrity and Security of Information". The results of approbation showed the described technology has a number of positive effects such as increasing the involvement of students in the educational process; smartphones in the classroom turn from a factor of distraction of students into a factor of involvement there in the educational process; for conducting classes using the proposed technology no devices other than smartphones are needed.*

Keywords: *student engagement, interactive learning, cloud technologies, BYOD*

1. INTRODUCTION

In education, student engagement refers to the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education. Generally speaking, the concept of "student engagement" is predicated on the belief that learning improves when students are inquisitive, interested, or inspired, and that learning tends to suffer when students are bored, dispassionate, disaffected, or otherwise "disengaged." Stronger student engagement or improved student engagement are common instructional objectives expressed by educators. In this regard, an active search for new educational technologies is being carried out, which provide in the educational process both the development of the personality of each student and his activity.

Nazmi Al-Shalabi [10] argues that it is absurd to expect all of students to be motivated and engaged in the classroom. Despite this difficulty, it is necessary to keep students involved to help them with learning. The discussion demonstrates the necessity of keeping students engaged because this engagement is a prerequisite for learning. To achieve this objective, he suggests using a few traditional strategies that have been used for so many years, and that are at the center of the attention of educators and teachers alike. He adds that the teacher's job is to keep students involved in the discussion and eliminate dead time. If this involvement is lacking, there won't be any learning.

Laura Jonson consider increasing student engagement with technology, such as Submit assignments as blogs, Submit assignments as podcasts or videos, Gamify Problem Solving, Interactive attendance and other [5].

A review of literary sources shows that one of the most effective methods of engaging students in the learning process is interactive learning [3, 2, 16, etc.]. With interactive

learning, the learning process is organized in such a way that almost all learners become involved in the learning process. Interactive learning keeps students engaged which makes them more receptive to the new information. The peculiarity of interactive methods is a high level of mutually directed activity, both for teachers and students. This activity is achieved due to the obligatory presence of feedback. The presence of feedback allows you to maintain focus on fixed periods of time.

These periods cannot be too large. As practice shows, teachers find it increasingly difficult to keep students' attention throughout the entire class. For example, the international Coursera platform requires that each recorded fragment should not exceed 15 minutes as part of a massive online course. In this regard, it is necessary to use technology that will provide feedback to all students throughout the entire classes. We would like propose to use own mobile devices of the students as a solution to this problem.

Today's students grew up in the digital age. Instead of treating technology as a distraction, we must use it to increase student engagement. Today, cloud technologies allow students to use mobile devices in classrooms for educational purposes. Smartphones are a quick and easy way to get feedback from students during class. This is great for an instant survey that can quickly assess students' understanding and help teachers adjust tempo and content. The question is that for the inclusion of surveys and tests in the course of the lesson, it is necessary to develop a technology that will support the interactive interaction of the teacher and students with minimal time. We propose to develop such a technology using the concept BYOD.

The Open University of Great Britain [13] in its report singles out BYOD (Bring Your Own Device) concept among the major innovations that can cause global changes in education. The traditional educational environment becomes wider through social networks and open educational resources. There is a unique opportunity to combine full-time and extramural education in the educational practice. The teachers instead of their former role as a source of information and knowledge get a new one — administrator of students provided with access to network resources.

The author of the article [11] lists the additional advantages of this very simple concept:

- firstly, it increases the amount of devices in educational institution that can be used to enhance learning;
- secondly, it avoids unnecessary spending on hardware resources, and this finance can then be re-directed to other areas of ICT development within the educational institution;
- thirdly, it avoids the 'doubling' or sometimes 'tripling' up on devices, where a computer is redundant for much of the day because it is either at educational institution, at home or hidden in your pocket.

In the article [12] the features of the BYOD trend in engineering education are described. Research results on various aspects of BYOD in one of the largest technical university of Russia - Bauman Moscow State Technical University - are summarized, but the question of the using of this concept for increasing student engagement don't discussed.

Today, there are a number of software products based on cloud technologies that allow running BYOD concept to get feedback from students during class. They include mQlicker service [9], Mentimeter cloud services [7], SMART Response VE system [14], SurveyMonkey service [15], Anketolog system [1], Webanketa service [17], and Hearne Software Survey System [4].

Drawbacks of the above services are that they are designed primarily for compiling questionnaires and surveys. Moreover, the announced full package of options of these systems is implemented only in the paid version, and in the case of using free services, their opportunities are significantly limited.

Another possibility of implementing BYOD concept to test the students in the classes is built into the mobile versions of distance learning systems. For example, an official application

Moodle Mobile [8] supports Moodle websites, configured for operation with the app. After setting the Moodle website one can use this application to organize testing of students including using BYOD concept. However, the implementation of such projects requires considerable financial costs and human resources.

We think that one of the prerequisites for implementation of interactive learning in the educational process is to create systems adapted to different levels of tasks and scales of education institutions.

Objective of the study is to propose a budget version of the system of interactive involvement of students in the educational process based on Google cloud services, which provides comprehensive support for feedback from students throughout the entire classes.

2. METHODS

The study "Values and Interests of Students" [6] puts the Internet first among the priorities of young people. However, as the main interest of the youth, we would like to note their interest in everything new. In this regard, we would like to propose to use cloud technologies as an instrument of increasing student's engagement in education.

The use of BYOD-based mobile devices allows implementing the information-educational environment of mobile learning. It makes possible to ensure control over the educational process not only in but also outside the computer classrooms.

The system of interactive involvement of students in the educational process includes the following components:

- a subsystem for creation questionnaires and tests based on the Google Forms service;
- Google Drive cloud storage for storing test forms and their results in the result database;
- subsystem for survey processing in electronic Google Tables;
- subsystem of management of surveys and testing based on Google Calendar, necessary for planning and coordinating all activities related to surveys and testing.

Interactive involvement of students in the educational process based on Google cloud services using BYOD concept includes the following steps:

- questionnaires and tests preparation;
- questionnaires and tests development in Google forms;
- registration of students to get access to surveys;
- generation of Google Calendar with the events of surveys management and provision of access of students to such calendar;
- the connection of the mobile devices of the participants to the created Google Calendar;
- surveys and testing;
- processing of surveys and testing results in electronic Google tables.

Questionnaire forms are created in order to obtain information about the content of the discipline, its practical filling, etc. At any moment, the teacher can ask question and demand an answer from all students at once. All teachers know how difficult to get an answer for the simple at first glance question: "Do you understand everything?" There are many reasons for this: and the students' shyness, and not the desire to look worse than others, etc. When using the system based on BYOD concept, the teacher who asked such a question asks students to choose the answer "yes" or "no" on smartphones. Each student performs input the answer individually and independently of others. The teacher has an instant reaction of system that shows the percentage of students who understood the material outlined. If this percentage is low, he has the opportunity to explain the material in more detail. If the number of students who did not understand the material presented is insignificant, the teacher may find out the problem individually after engagement with each of the students who chose the answer no.

The development of tests in Google form is a simple process. Eight possible types of questions ensure check of the assimilation of almost all the material learnt. After the creation of a survey or a test, the created Google form is automatically stored on your Google Drive account. The created form can be pasted into a website or blog. To do this, save it first, and then at the top of the editing window click More actions button, select Paste in the open menu.

If there are a significant number of surveys and tests in subjects, use Google Calendar cloud service for their convenient administration. Google Calendar supports synchronization with mobile devices. Reminders are sent via email or SMS. Google Calendar can be used to schedule work related to solving the problem of survey or testing. For each survey or testing you create in Google Calendar two events with the presenting of alerts through SMS messages and/or emails and/or messages via social networks. One message contains a reminder of what happens at the appointed time of testing on a given topic, the second at the appointed time will be sent to users of the testing system with reference to the form of the survey or the test. In addition, one of the components of Google-Calendar is a "task list", which determines the future and current tasks, for which the user can set priority. This is especially useful for scheduling the preparation of tests. Calendar "Testing" with events of surveys is shown on figure 1.

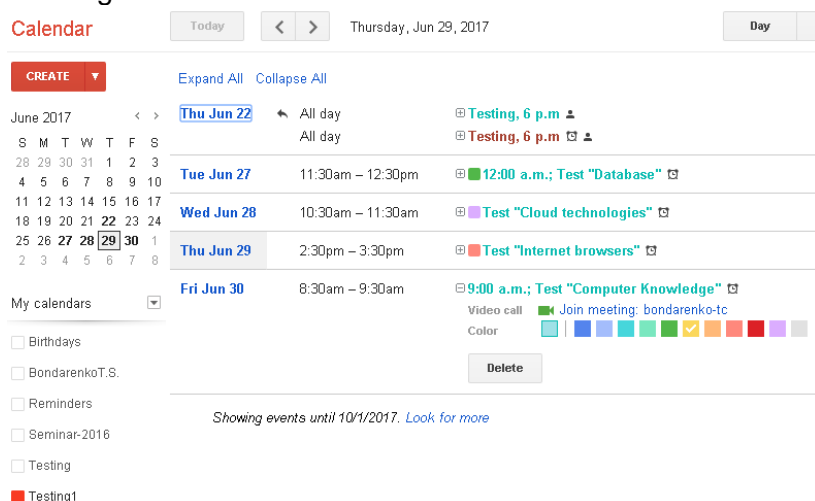


Figure 1. Calendar "Testing" with events of survey

You need to share the calendar "Testing" with the participants (specify a list of e-mail addresses of users in Share calendar menu) to send them the notifications of events. To receive SMS notification, each participant must independently connect his/her mobile phone to calendar "Testing".

After creating events related to survey in Google Calendar "Testing", send the messages to the participants (a reminder of the time of the survey and the forms with tests).

3. EXPERIMENTAL

Messages with a link to the form with the test come to the e-mail of the participants (figure 2). By clicking the received link, the mobile device opens the created form and the participant consistently answers the test questions contained in it (figure. 3).

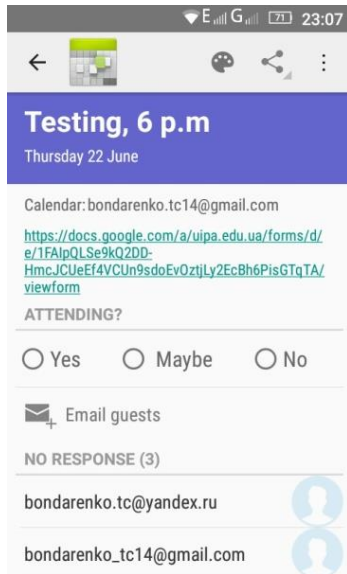


Figure 2. Message with a link to the form with the test

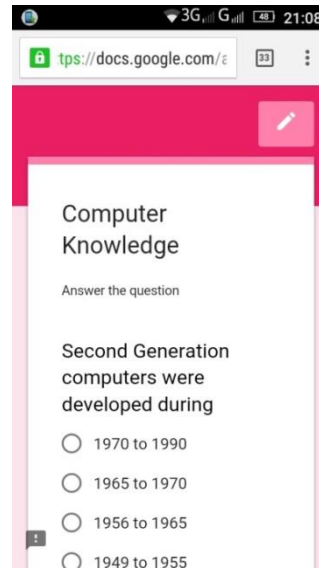


Figure 3. A survey form on smartphone

After filling the form press *Send* button. The test taker enters the survey result in the electronic Google table in the cloud storage. The table appears in Docs.Google file manager; its name is taken from the form name plus the word 'response'. Answers obtained through the form can be viewed in four ways:

- as a summary;
- as individual user's responses;
- as a table;
- as CSV file.

Using the tool *Summary*, a tab opens with a chart on every question of the form. In addition, next to the chart, the results will be presented in the form of numbers and percent (figure 4).

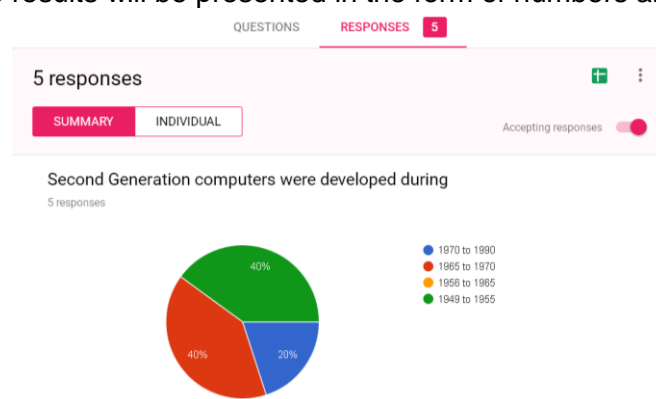


Figure 4. View of answers as a summary

Viewing responses of individual participants makes sense if there is a small number of both questions and test takers because in this case, a sufficiently large number of forms will have to be reviewed.

Test results in a table form contain information about the answers to test questions for each student. The table is attached to *Entry Timestamp* column that is also a data set "index". The

information is sorted in this field by default, so we get a chronological list of all entries. Despite the fact that to fill the test forms the participants need to login to their accounts, information about the person who filled the form is not reflected in the test results. Therefore, the form should include questions of Text type to fill in the name and surname of the student. During data processing, the electronic table allows easily re-sorting information by any column, not breaking the entries. Google table (as well as Excel table) has a set of options for statistical data processing. If desired, the table can be exported to MS Excel for processing.

In contrast, for example, to the Moodle-based distance learning system, which carries out processing of test results automatically by means of the system, in this case, the test developer has to individually perform the processing of test results.

Test results are sent using shared access of the users to the files stored on Google Drive.

4. RESULTS

We should have a closer look at possible options for the use of system of interactive involvement of students in the educational process based on Google cloud services. We can suggest the following schemes of lessons with such survey control:

- initial assessment on the subjects of the previous lesson;
- 2-3-step continuous assessment during the lesson to determine the level of mastering the material learnt;
- final assessment covering all the material learnt during the lesson.

The experience of using the system has shown that the time spent on interactive interaction in the course of surveys on lectures range from 10 to 20 minutes. During this time, the teacher can conduct from 3 to 5 surveys. Of course, we can say that this is a considerable loss of time from the total 90 minutes of the lecture. But if we remember the words of Nazmi Al-Shalabi about the dead time, then switching students' attention, activating their attention on the theoretical problems of the discipline, updating the received information during surveys, etc., of course, compensate for these costs.

Technology of the interactive involvement of students in the educational process based on Google cloud services was approbated within the discipline "The Integrity and Security of Information". Its Moodle-based distance learning course involves four test controls, held in the computer room during laboratory lessons.

The introduction the described system based on BYOD concept allows to add the number of up surveys to 2-3 on each lecture. By setting the option "Mix questions" we don't allow the students use the answers of other participants during survey. Thus, each student should carefully listen to a lecture, because the teacher at any time can conduct a brief testing of the mastery of the material presented.

During introducing this technology students still did not realize the need for constant perception of lecture material. But over time, they became more disciplined and attentive, since the estimates of the surveys that were conducted at the lectures not only show the degree of student involvement in the educational process, but also affect the final assessment of the discipline.

5. CONCLUSIONS

Too often, we allow ourselves to be dazzled by "technology for technology's sake." For example, a university might invite a 1:1 technology program and consider it successful when a laptop, netbook, or tablet is in the hands of every student. However, simply "having" or even using technology every day does not represent an end in and of itself. The role of

technology in education should be properly viewed as a means to the ultimate end objective of increased student engagement and learning.

The described technology has a number of positive effects:

- Firstly, we increase the involvement of students in the educational process;
- Secondly, using the BYOD concept, we do not require from the management of the educational institution additional funds for working with IT technologies;
- Thirdly, smartphones in the classroom turn from a factor of distraction of students into a factor of involvement there in the educational process.

Besides, the use of BYOD concept makes broader the survey procedure in space and in time, makes the survey procedure more flexible and systematic, adds elements of gamification to it. The ability to organize whenever and wherever a systematic control of educational outcomes on the basis of BYOD concept facilitates updating the knowledge of students.

Using the considered concept based on cloud services of Google search engine for survey has a number of advantages as compared to similar software services. First of all, this is a comprehensive support to the survey system from the creation of appropriate forms and storage of results in cloud data storage to the processing of test results and management of the testing system through the use of Google-Calendar service. Second, it provides the ability to create a cost-effective testing system through the free use of free Google services.

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STRATEGY OF INTERNATIONALIZATION OF IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE. MECHANISMS OF IMPLEMENTATION

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Abstract: *In the article, the current state of internationalization of higher education in Ukraine is outlined. The efforts of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" to promote the internationalization of university and the development of the university's international environment are described.*

Keywords: *internationalization, higher education, university rankings, academic mobility, students' exchange programs, international projects.*

1. INTRODUCTION

The process of transformation of the national economy from a command economy to the market one continues in Ukraine. Modern market mechanisms are being actively formed in the country and the education sector constitutes no exception to the above process. Competition in the realm of education is inherent to all market economies. What matters is the very high quality of education, which is the main competitive advantage for attracting those who want to get an education at a particular university.

In the modern world, the rankings of higher education institutions serve as the beacons that help young people choose judiciously their dream university. Getting into a major global ranking has considerable influence on the status of a university and its financial condition. Investors favor successful, promising universities by pumping funds into their best projects.

Every year the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (KPI) submits data to many international university rankings such as QS World University Rankings, THE World University Rankings, U-Multirank ranking, etc. Although each of these rankings has its own characteristics, almost all of them have indicators that can be related to the university's internationalization process. The analysis of these indicators showed that the key direction of the development of KPI lies in deepening of the university's internationalization and strengthening of the international component in all constituents of its activities. In particular, attracting more international students, inviting well-known international scientists and professors to participate in the educational process, as well as expanding the participation of the university staff in international projects.

Internationalization of higher education is one of the key world trends. Therefore, the exchange of experience and the study of best practices in this area are important for many universities.

2. REVIEW OF THE CURRENT STATE OF INTERNATIONALIZATION OF HIGHER EDUCATION IN UKRAINE

The internationalization of higher education institutions (HEIs) develops in the direction of establishing comprehensive international cooperation, becoming a strategic goal not only for universities, but also for the world community as a whole.

Unfortunately, the percentage of universities that are actively involved in international educational processes in Ukraine is too small. Thus, only seven out of 282 universities operating in Ukraine (less than 2.5%) are included in World University Rankings such as THE and QS. Since 2015, when Ukraine became an associate member of Horizon 2020, there have been 135 successfully won projects that brought about 26 million euros. On average, a private sector (51%), the universities (33%) and research institutions (33%) submit to Horizon 2020 initiatives in Ukraine [1]. Overall, only 21 Ukrainian universities (7% of the total) participate in Horizon 2020 projects. The development of academic mobility assumes the important aspect of the internationalization of universities. Owing to the active implementation of the EU Programme Erasmus+ in Ukraine, the significant part of Ukrainian universities can participate in it. In particular, 179 universities (63%) participate in Credit Mobility Projects, 101 universities (36%) take part in projects related to capacity building in higher education, 9 universities (3%) in joint master's degree programs and 36 (13%) in Jean Monnet Projects [2].

The Ukrainian HEIs, which provide training for international students, increase in number year after year: there were 185 such HEIs in 2015-2016, and their number reached 239 in the last academic year. As of January 01, 2018, 66,310 foreigners from 147 countries (almost the same number of Ukrainians receive education abroad) studied in Ukraine. Most entrants (16.4% and 11.3%) come from India and Azerbaijan respectively [3]. Over the course of a year the number of international students, who study in Ukraine, increased by 10,000 to 75,605 in March 2019. The relatively low prices of accommodations and tuition fees in Ukraine, as well as country's proximity to the European Union, attract International students.

The concept of the internationalization of higher education lacks elaboration within the Ukrainian legal framework. In fact, the Law of Ukraine "On Higher Education" does not contain the concept of the internationalization of higher education, but it includes the principles of "international integration and integration of the higher education system of Ukraine into the European Higher Education Area" among the principles that form the basis of state policy in this area [4]. At the same time, the Law stipulates that one of the main tasks of a higher education institution is "the establishment of international relations and implementation of international activities in the realm of education, science, sports, arts and culture". In addition, the Law promotes the development of international cooperation at universities by taking account of the level of integration into the global education and research area when granting research status to a university.

In general, the Law of Ukraine on Higher Education lays the foundation for the implementation of various forms of internationalization of the Ukrainian higher education system, particularly such parts as academic mobility, use of the European Credit Transfer System (ECTS), recognition of foreign qualifications.

In 2017 the Ministry of Education and Science of Ukraine put forward the initiative to work out and implement the comprehensive strategy of internationalization, as the direction of strategic development, by higher education institutions. The National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" was one of the first HEIs to apply this strategy.



3. STRATEGY OF INTERNATIONALIZATION OF IGOR SIKORSKY KYIV POLYTECHNIC INSTITUTE

A leading role in the practical implementation of the internationalization process of higher education belongs not only to the state institutions that work out the relevant national strategies of the internationalization of higher education. An important role in the effective implementation of international cooperation belongs to the universities, which are actively designing the strategies of the internationalization of their activities.

The Igor Sikorsky Kyiv Polytechnic Institute has drawn up and is carrying out the Internationalization Program [5]. In recent years KPI has put in place a strategically important system to improve its positions in the international rankings and adopt the world best practices in education, science and innovation. Thus, the International Collaboration Department, together with other departments of KPI, initiated the formation of a number of task-oriented working groups, in particular, to deepen internationalization, analyze international proposals in terms of their investment attractiveness, as well as to strengthen KPI positions in the international university rankings. These working groups are supposed to monitor and analyze the current situation in specific areas and recommend the university administration measures to rectify the situation. As the important step, the Board of Science and Innovation Studies adopted the practice of encouraging the KPI staff to publish in journals included in the bibliographic databases of SCOPUS and Web of Science.

Globally advanced research is international today. The tools to measure the results of research are their citations in international journals. Under the circumstances, investment in international partnerships and cooperation in research are vital to any university seeking to reach a world-class level. The main mechanism for the expansion of international cooperation in the scientific field is participation in the international programs of scientific and technical cooperation whose characteristic feature is keen competition. Winning such competitions, particularly calls within Horizon 2020, requires the knowledge and skills that KPI scientists sometimes lack. It is necessary to have a clear understanding about opportunities and requirements provided for in these programs, skills in submitting applications, the ability to protect intellectual property, figure out legal and financial aspects, have a good command of English. Overcoming these barriers is a necessary step in order to engage in breakthrough research conducted by leading international scientific institutions.

EU programs have been actively implemented in Ukraine since 2015, particularly those that have considerable impact on human development: Erasmus+ and Horizon 2020. Thanks to these programs, the KPI has seen a positive trend in international mobility in recent years: 209 students and 16 postgraduates studied at partner universities in 2018. According to the KPI Erasmus+ International Credit Mobility project database, the KPI in conjunction with various partners has been participating in 123 mobility projects from 2015 to July 2019.

The amount of international contacts made in 2018 testifies to the intense overall activity of the University in the international realm. Indeed, 243 international events were held last year, including 66 international conferences. Participation in international projects is up: 66 international scientific projects were implemented last year, totaling 185 together with educational ones. Among them are projects under the programs Horizon 2020, NATO, ERASMUS+, DAAD, and EURASIA.

Implementation of the international projects played a very important role in the development of KPI as a stable environment for interaction between science and business, scientists, engineers, and inventors. One of the fundamental principles of this environment is openness to adoption and use of the best international practices, the development of international cooperation and achievement of the world-class practical results.

For the first time in Ukraine, a delegation of international experts visited KPI in June 2019 to accredit one of the specialties pursued at the Institute of Mechanical Engineering. This

experience is unique not only for the University but also for Ukraine as a whole. Receiving international accreditation is the path that other specialties and universities will pursue in order to sustain competition both on a nation- and world-wide scale.

The University is expanding the practice of double diploma programs, when graduates receive diplomas from partner universities simultaneously with a KPI diploma. Currently, the KPI is already cooperating in 17 of them with universities from 10 countries. These programs are seen as international recognition for the quality of training specialists who pursue various specialties. Given that master's theses are defended before the examination committees of partner universities, the University undergoes the critical external international assessment of the educational process.

The University is pursuing marketing strategies in the international scientific and educational services market. One of them is aimed at seeking out directions in which departments can offer educational or scientific services and whereby put forward proposals to leading international companies.

The implementation of the strategy of internationalization produces tangible results for a university, which compare favorably with other Ukrainian higher education institutions, as well as ensures leading positions in the national and international university rankings.

4. CONCLUSIONS

The international activities of a modern university are multifaceted. The expansion of international cooperation influences all activities and the development of a university: the modern standards of higher education and educational techniques are applied, new training programs drawn up, the quality of training of specialists and the skills of research and educational personnel improved; the scientific potential of the teaching staff and students built up, joint research ensured, international conferences held, etc.; the material and technical base of a university improved; the positive image of a university formed in Ukraine and abroad, as well as its competitive advantages enhanced.

The National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" seeks long-term cooperation with universities, business entities, research institutions, investors and other stakeholders to form an alliance aimed at synergies that are mutually beneficial to all.

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INTERACTIVE STRATEGIES FOR STUDENTS LEARNING OPTIMIZATION

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Abstract: *In this article we intend to find intervention methods to optimize student learning strategies. There is more and more debate about a certain crisis in education and education specialists are trying to find solutions to overcome this situation by focusing on qualitative growth, on changing educational mind-sets and strategies. Change in thinking, attitude and manifestation is the key to success in education. In order to increase the quality of education and teaching, conventional barriers must be broken, educators should be urged to think creatively, find solutions, seek and explore beyond their own limits. Learning activities become more interesting and critical thinking is stimulated through the encouragement of free expression, interpretation from the personal perspective of the assimilated knowledge and connection with the practice. They all lead to the active participation of the educators in their own training. In our research, we have observed a change in attitude and thinking after applying certain strategies of critical thinking during courses.*

Keywords: *initial training, interactive strategies, optimization, competences, performance-learning*

1. INTRODUCTION

EDUCATION FOR THE 21ST CENTURY

The education reform must take into account the unprecedented transformations of the contemporary society, a knowledge society, globalized, technologized at the level of performance that requires the preparation of future professionals in order to satisfy the social demands (EACEA / Eurydice, 2011). Education is a force, an educated man has at his disposal the necessary levers for social integration and the chance for a better life. Quality education must be offered to children in order to provide them with opportunities for a successful life. Romania's educational policies aim at achieving an education at European standards, aligning it with Global Citizenship Education (GCED), (UNESCO, 2017), which implies first of all a complete reform of the educational system from the curriculum to the forms of implementation and certification. As part of the European Community, Romania has reconsidered educational policies regarding everything that the education process means (European Commission, 2010). These are materialized in guidelines at a higher quality level regarding the professional training of future professionals, in accordance with European standards (Biesta, 2011). The educational success of the educators in this context implies a higher level of preparation, according to European standards and high academic results, but also an adequate social integration (Gamble, 2010). Thus, the Romanian education proposes strategies that aim to assimilate the key competences by all young people, to optimize the quality of education, to increase everybody's chance to education, to promote lifelong learning and to eradicate illiteracy. (UNESCO, 2017) Permanent monitoring and awareness of each educator's preparation level will lead to the most appropriate methods of problem solving. The responsibility towards training for the social life remains an important point to follow in the initial and continuous training of the educable.

2. METHODS - LITERATURE REVIEW

Training –competence centred learning

Learning is an interactive, ongoing process that involves many processes of thinking and creativity (Freeman et al. 2014). Information technology, which is experiencing unprecedented development offers solutions to problems facing education, helping to provide viable and quality educational offers. Our faculty addresses the educational phenomenon from innovative perspectives, contributing to its graduated and complete implementation, with integrated and integrative approaches based on action-praxiological methodologies updated to modern European standards (Griffin, P., and Care, E. (eds.) 2015).

Effective training is achieved when focusing on the formative part of education, which aims at the activity of training-development-modelling of the personality of future professionals by combining theoretical training with practice (Nukpe, P. (2012). Our students are made aware of the deep action of the educational phenomenon which aims the functionality of the specific structure of the activity of formation and the development of human personality (Keengwe et al. 2014). The quality in education also implies a relation of trust and support between the educator and the educated. The modern teacher understands the uniqueness of each educator, using the most appropriate educational strategies, aims to implement a quality education at each educative level. The instructional-formative educational action aims to produce changes at cognitive, affective-motivational, attitudinal and behavioural level with all trainees. (Marcia 2015).

The shift towards competence centred learning is an important step towards training young people. Each learning activity aims to achieve certain cognitive, affective and psychomotor objectives with each educator, these being observed in their behaviours at the end of the learning sequence. The competences represent sets of knowledge, skills, aptitudes and attitudes that will mark the preparation of the educable to carry out an activity at high performance level (Abeysekera and Dawson, 2014). In order to achieve high level quality in education, it is necessary to implement both at the curriculum level and in practice a competence-based education, according to a pedagogical layout which is appropriate to the educators.

These transformations are the result of the educational action, carried out in and outside school. The action is carried out by the teacher by actively engaging the educator in the direction of confronting these changes. An efficient and effective didactic activity implies an optimal way of organizing the interaction of its variables, a report of functional interdependence in which the method plays an essential role (Kelemen, G., 2012). The didactic method is the way to be followed by the educator and the teacher to reach some objectives, it is the way to achieve them. It proposes, at the same time, an action plan (a series of operations in order to reach a goal) certain action ways (strategies, ways to proceed, etc.). In the broadest sense of the term, the teaching-learning method is a rationalized, scientifically validated practice that serves as a tool for transforming and improving human nature (Abeysekera, L., & Dawson, P. 2014).

It is an access point to knowledge and transformation of reality, to the acquisition of culture and civilization, to the formation and improvement of one`s personality. The method is part of all the external conditions of learning, conditions that influence the achievement of learning, its efficiency and sustainability. The assembly of the methods used in the instructive-formative educational activity constitutes the didactic methodology. Any teaching methodology includes a set of teaching methods, processes and techniques, subordinated to an instructional model, to a philosophy of educational achievement. The didactic methodology comprises traditional and modern methods differentiated according to their efficiency and usefulness in personality formation. Without maintaining an artificial,

unjustified dichotomy between classical/traditional and modern / current, it must be said that today the tendency is to transform and optimize the teaching methods in the sense of increasing educational efficiency. The efficiency of the educational action depends on several factors, of which the teaching-learning methods are detached as a defining factor.

3. EXPERIMENTAL- Proposed teaching method: description and delivery.

Among the techniques and methods specific to the constructivist model based on the formation of critical thinking, we selected a few that we considered more effective in learning and applied them to the experimental group during academic year 2018-2019. Brainstorming ("brain storm", "brainstorming") is an interactive method that results from discussions between several participants who come with a lot of suggestions. The result of these discussions is the best solution to solve the debated situation. It is the most widespread method of stimulating creativity in group activity.

Think/Work in pairs/ Communicate involves a collaborative learning activity that consists in stimulating the educators to reflect on a text (of an informational content) by collaborating with a colleague in formulating ideas, which they communicate to others, to the whole class. It is a relatively easy to use technique, which does not require much time and can be used several times during a teaching activity.

Initial keywords it is a technique meant to stimulate the educators to update some of their previous knowledge that has a certain connection with the topic/subject dealt with. By doing this, the interest of the educators is aroused and they are motivated for the activity, determined to set goals for the investigation to be carried out.

Know/Want to know/ Have learnt is mainly used in the evocation phase but also in creating meaning, being a way of making educators aware of what they know or think they know regarding a subject, a problem and at the same time, of what they do not know (or are not sure they know) and would like to know / learn.

Cluster technique is a teaching-learning technique that encourages educators to think freely and openly. Cluster is a necessary brainstorming, which stimulates the highlighting of connections between ideas: a way to build/make new associations of ideas or to reduce new meanings of ideas. Beyond these, clusters are a technique of searching the access paths to their own knowledge and beliefs by highlighting the individual's own way of understanding a certain topic, a certain content.

The Cube is a technique that highlights the activities and thinking operations involved in learning a content, which can be used in both the evocation and the reflection stage.

The Quadrant Method is another way of summarizing and synthesizing an informational content requesting the learners` participation and involvement in its proper understanding. The method of quadrants involves the drawing of two main axes, perpendicular to each other (one horizontal and one vertical), after which "four quadrants" appear as follows:

The learners hear a lecture, a story or read a text, then are asked to write down: a) in quadrant I: the characters; b) in quadrant II: the subject of the text; c) in quadrant III: beautiful expressions;d) in quadrant IV: "moral" or "lecture" that the text provides.

Quintet is a five-verse poem that summarizes and synthesizes the content of ideas of a text in a concise expression that highlights the reader's (educational) reflections on the subject in question. A quintet: - has a title (usually a noun); - presents a description (usually adjectives); - expresses certain actions (by means of verbs in gerund); - expresses certain learners` feelings; - synthesizes (in a word) the essential. The quintet is a quick and efficient reflection tool that summarizes and synthesizes information and knowledge about a topic. It is also a tool to evaluate understanding and express the learners` activity.

Setting the sequence of events is a method of engaging and involving learners in the intuition or discovery of a chronological relationship, i.e. succession in the development of the events presented in a text. The teacher presents 5-6 events, extracted from a text. Each event is written on a paper (a ticket). The tickets are mixed and one or more learners choose one. Their content is written on the board in the order of their extraction. The class is asked to establish the natural order of the events presented as they see it.

Synthesising and summarizing techniques for content and ideas. Making a summary or review based on a content of ideas are techniques that focus on learning and on carrying out appropriate exercises. A relatively simple technique for summarizing a content of ideas implies the learners' ability to acquire an algorithm or a "formula" for making a summary.

Double entry journal is a method used to teach learners how to correlate new information with their personal experience, to reflect on the significance of a text (informational content). We conducted a study with our students in which we looked at how interactive strategies influence students' conscious and active participation in courses and thus contribute to the acquisition of professional skills in their initial training (after a model of Voorhees, 2001). We selected a group of 150 students from the bachelor programs and 150 students from the master programs with whom we worked using the interactive methods. At the end of the experiment I applied a questionnaire to all 300 students from the bachelor and master's program. Through the answers given, I wanted to identify the perception regarding the level of preparation, but also the level of awareness of the importance of training the different skills for the future profession.

4. RESULTS-QUANTITATIVE COURSE ASSESSMENT- PERFORMANCE-LEARNING

Following the application of the experiment, we performed a qualitative evaluation of the learning outcomes. The students' performances were identified through different tests (e.g., exams, quizzes, etc.). In addition to the grades, the students also completed a questionnaire comparing their level of preparation from two perspectives, namely the way they see traditional learning based on lectures and interactive learning based on modern methods. The survey consisted of ten questions with answers rated between 1 and 5, one being the weakest, five being the strongest agreement. We wanted to know the students' opinion regarding the usefulness of these methods in the courses, but also their efficiency in assimilating the skills for the future profession.

Table 1. Matrix for review of the use of interactive methods

	1	2	3	4	5
1 st year students	20	24	33	40	45
2d year students	12	19	28	34	48
3d year students	18	17	34	46	47
1 st year master degree	21	18	29	32	49
2d year master degree	22	25	24	37	48
Total	93	103	148	189	227

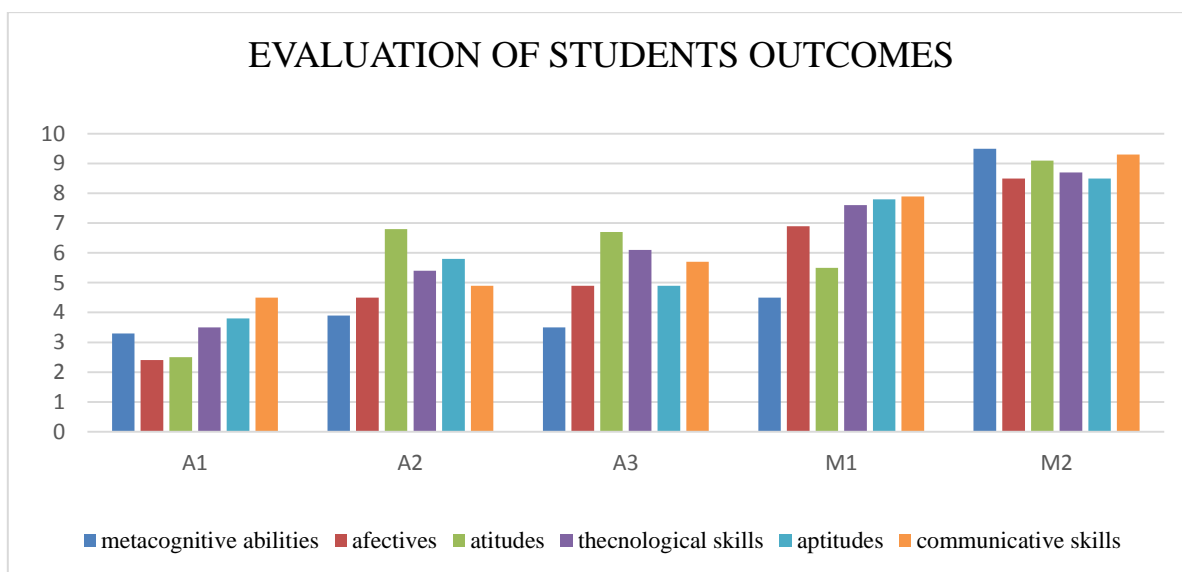


Fig. 1 Assessment of structural design course (after applying method)

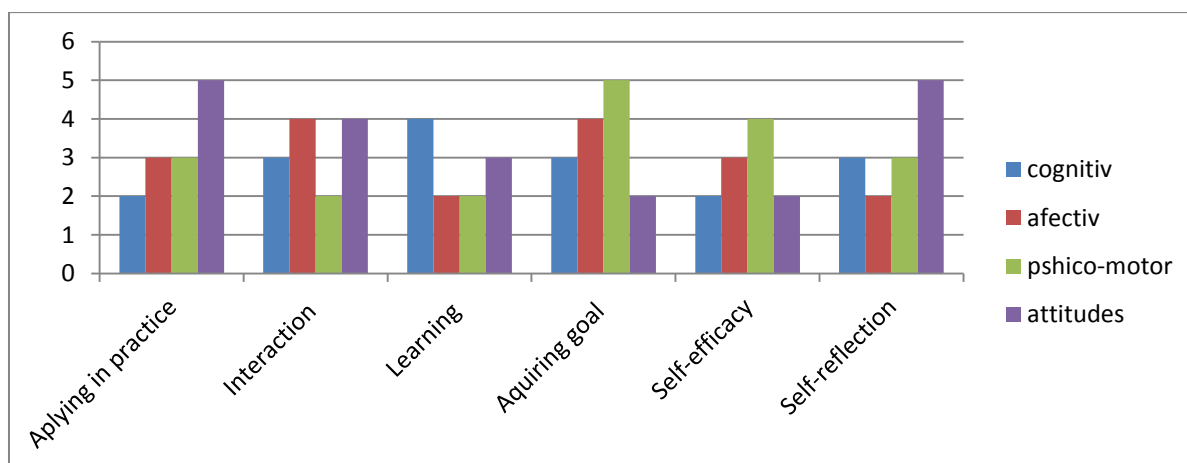


FIG.2. Distribution of quotations of the factors reflected in self-regulated learning

Despite its limitations, as the study is mostly a qualitative one, it identifies the way interactive methods affect positively both the knowledge acquired by our students and the attitude and behaviour developed through their active and conscientious involvement in certain activities. We observe from their answers some positive changes in behaviour, attitude and learning outcomes. We can state that students are more involved, more motivated, stimulated, participate more confidently in the activity, are more aware of their knowledge and the act of learning.

5. CONCLUSIONS

The study demonstrates the positive relationship between the use of interactive methods in the courses and the efficiency of the learning, the challenging and creative atmosphere supported by the constructivist theory which stresses out the idea that the human beings learn better by being actively involved. *These theories enhance the learning in a blended learning environment through the opportunities provided for students to interact with each other and with the professor on various learning activities* (Kelemen G., 2015).

Ever since 1997, Bandura points out that using interactive methods is a good way to create a stimulating learning atmosphere. Lectures should be replaced with activities in which students are involved in discovering new information (Gavrilă-Ardelean, M. ; Gavrilă-Ardelean L., 2017). By actively participating in the courses, handling the different materials, working in teams, restructuring the material learned through different methods, the students manage to understand better the concepts taught, to retain them and to apply them efficiently. Students prefer to work with other peers, with the teacher, to get involved in their own training, to communicate, to interact. Such approach and conduct lead to a better professional training.

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TRADITIONAL TEXTILE OF INDIA AND VALUE ADDITION

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Abstract: VALUE ADDITION is the process where we enhance the salability of the product by adding some incentives to it. A great deal of emphasis is given to the details of the designs and many new colours are introduced in the production of traditional textiles viz., dress materials and shirting's incorporating traditional motifs like- kantha, kasuti, worli etc during weaving by Jacquard and dobby mechanism. Thus this study is taken up to revive the traditional textiles. Polycot union woven sareese attained excellent Structural and physical properties viz dimensional stability, better cloth count, cloth stiffness, crease recovery, cloth weight, cloth thickness properties respectively. Polycot union sample had better Abrasion Resistance and fabric strength and elongation. Overall respondents opined that pallu designs with compactly woven traditional motifs can also be used to produce toppers, dupatta, stoles and other madeups. The total cost of poly cot pattern sarees was relatively less because of Jacquard shedding mechanism adopted for producing these patterns not only assisted in creating new designs but also saved time, money and labour

Keywords: kantha, kasuti, worli, Jacquard and dobby mechanism, GC Kala – 2008 and wilcom softwares

1. INTRODUCTION

Gone are the days when quality product was the only criterion to eye a product by a consumer. Earlier were the times when sheer competitiveness in the domestic market was very confined. But, during some past years with the emergence of globalization, competitive atmosphere and quality consciousness, has reached a new mark. With the steady improvement in technology & application standards, a gradual rise was observed in consumer demands. And to reach up to that mark, manufacturers have to add something to their products to get some added value for their product. A product must be able to encompass something more with it & therefore this has taken today's market to a platform where it seems very difficult for a manufacturer to market his product until he satiates consumer with something new which not only rewards him for his novel concept but also lures him with considerable increase in profit. This urge to come up with something novel to earn increased profit, have larger market share, satiate the fad could probably be termed as value addition to textiles. Value Addition is the process where we enhance the salability of the product by adding some incentives to it.

The world market place is continuously changing and so is demand of people changing. Every person desires for some change i.e. something new & unique. The successful effective implementation of change has to be done to in the market.

Past are the days of traditional and conventional fabrics, which are the super fed by fabrics with multi-functional weaving. Indeed, days are now of research and development of a huge spectrum of various advancements in fabric construction in order to project world class fabric in the world class market at the most competitive rates. A range of new fabrics need to be developed and manufactured which will give an innovative edge to the textile sector in various applications. In addition more emphasis should be laid on the derivation of various textile materials with numerous features and characteristics which should be merged for multifold applications to create variety of textiles. Today there is such an increasing demand for *traditional textiles* that despite of the thousands of workers involved in spinning and producing *traditional* fabric, the demand of the market does not get fulfilled. A great deal of

emphasis is given to the details of the designs and many new colours are introduced in the production of traditional textiles viz., dress materials and sarees incorporating traditional motifs of different states like kantha of Bengal, kasuti of Karnataka, worli of Maharashtra during weaving by Jacquard and dobby mechanism. Thus this study is taken up to revive the traditional textiles.

Objectives:

1. To develop variegated traditional textiles
2. To assess the physical characteristics of the traditional textiles and
3. To calculate the cost of production of these products

2. MATERIALS AND METHODS

Selection of raw material -

Raw materials – Cotton and Polyester yarns were procured from Hubli, Uppina betegeri, Khadhi Handloom Development Center, Gadag, Belgaum and local market

Pre-loom process

This section involved the Scouring and bleaching, Sizing, bobbin winding, warping and pirn winding and were carried out in the Department of Textile and Apparel Designing, College of Community Science, University of Agricultural Sciences, Dharwad, Karnataka, India

a. Scouring and bleaching

Scouring leaves the material in a more absorbent condition than the gray cloth. Scouring was done using sodium hydroxide (NaOH) which is a strong alkali. Cotton yarns were subjected for scouring where the hanks were boiled in alkaline media of sodium hydroxide for three hours to remove all the impurities and additives present in it. The hanks were squeezed, rinsed thoroughly once in hot water and twice in cold water to ensure the complete removal of chemical deposited superficially (IS: 1383-1977).

MLR ratio	- 1:20
Sodium hydroxide	- 1 per cent
Turkey red oil	- 0.5 per cent
Time	- 3 hours

Bleaching is whitening of the raw cotton material by removing the coloring matter.. The scoured yarn hanks were further subjected to bleaching. The scoured yarn hanks were boiled in a solution of hydrogen peroxide, sodium silicate and turkey red oil for 2 hours. Further bleached yarn hanks were thoroughly rinsed once with hot water and twice in cold water (IS: 10590-1983).

Water	- 1:20
Hydrogen peroxide	- 1.5 per cent
Sodium silicate	- 0.5 per cent
Time	- 2 hours

b. Sizing

cotton yarns were sized using maida starch wherein water was kept for heating and as the temperature raised to boiling maida was added with continuous stirring with a stirrer until a thin consistency was obtained. Thus once the required consistency of maida was obtained, it was applied to the warp yarns prior to warping (IS: 179-2009).

c. Warping

Polyester yarns were used as warp where required number of threads was laid in parallel form under uniform tension to make the required width of cloth.

d. Beaming

The process of winding the previously prepared warp yarns in the form of a sheet, on to a weavers beam is known as beaming. The beam is usually provided with discs on both the

ends of the beam in order to maintain required width of warp to keep the selvedge ends in control. While winding the warp on the beam the individual threads are laid parallel to each other and are kept under uniform tension.

e. Pirn winding

Sl, No	Woven Saree	Embroidered Saree
1	Warp-cotton 2/100	Warp-cotton 2/100
2	Weft-polyester 110 denier	Weft-polyester 110 denier
3	Coloured poly thread cone for border and motifs 2/64	Coloured poly thread cone for border, buttas and motifs 2/64
4	-	Coloured fancy thread spools for border, buttas and motifs

Pirns winding is the process of transferring the weft yarn from cone onto the pirn. Cotton yarns were wound on pirns with the help of hand driven charkha.

Table 1. Details of sarees woven and embroidered with motifs

Multifilament polyester of 110 d as warp and two ply (Table 1) mercerized cotton of 100s as weft and was selected to weave the ground cloth. The extra weft figuring was produced by using four folds of the ground polyester multi-filament yarn. The border warp constituted of two ply mercerize of 64s and extra warp figuring was produced with two ply rayon of 80d. Handloom with jacquard shedding mechanism (Figure 1a) of 172 needle capacity was employed to produce weft design patterns on polycot union saree with reed count 68. The extra warp figuring in the border on either sides of the saree was produced by dobby shedding mechanism. The *patterns* were woven in sarees by means of small swivel shuttles. These shuttles were inserted through a separate Jacquard shed operated manually. After the insertion of extra weft, the shed was closed and the ground weft was beaten to the fell of the cloth. In the sequential order of processing, the pattern was completed. The woven traditional textile material were fabricated into sarees

Post loom process and Design development

i. Cutting and doffing

After weaving a known length of fabric, extra one inch approximately was woven and separated from the cloth beam with the help of a knife which helped to prevent the slippage of yarns through dents. Further the fabrics were folded and pressed neatly.

a. Woven pattern motifs

A total of conventional motifs used in different states namely, traditional Kasuti of Karnataka, Kantha of Bengal and Worli of Maharashtra embroidery were selected. Motifs were grouped into three categories viz., main motifs, buttas and borders. The selected motifs were sealed according to the simulations and digitized using the software GC Kala – 2008. The output of digitized motifs was taken on point paper and accordingly punch cards were prepared and the pattern chain was developed.

b. Embroidery motifs

Embroidery pattern designs were developed on woven sarees using Wilcom embroidery software at Vadgaon digitized embroidery centre, Belgaum, Karnataka

Laboratory Assessment

Structural and physical properties viz., cloth count, thickness, stiffness, weight, dimensional stability, abrasion and drapability. The following tests were carried out in the testing laboratory to assess the physical parameters of the woven fabrics

A Structural properties

1 Dimensional stability

Cloth dimensional stability is measured in terms of shrinkage percentage. The fabric sample of 25 cm × 25 cm was taken and initial length of 20 cm was marked both in warp and weft direction. The test samples were soaked in the soap solution of 2gpl at room temperature for one hour rinsed thoroughly in cold water and dried under shade. The dried samples were pressed gently without stretching. The final distance was measured and change in dimensional stability was calculated using the below formula.

$$\text{Shrinkage} = \left[\frac{L_o - L_a}{L_o} \right] \times 100 \quad \text{Where,}$$

L_o = Initial length
 L_a = Final length

2 Cloth count

Cloth count in woven textile material is the number of ends and picks per unit area while the fabric is free from wrinkles and is affected by the yarn count and compactness of the weave. The number of warp and weft yarns in one square inch of the fabric is counted at five random selected places across the width and along the length of the test specimens. The region near the selvage should be avoided because the spacing of thread is often a little different than in the body of the cloth (Booth, 1996). Further, mean values of ends and picks per inch were calculated.

Number of specimen tested: 5 each warp and weft

Method: Direct counting of threads per unit area, 1 inch

Instrument: Magnifying counting device (Pick glass)

3 Cloth weight

Fabric weight is expressed as mass per unit area in g/sq.mt. A sample of 5 × 5 cm was cut and weighed on an electronic weighing balance to determine the weight per sq.mt (g) (Booth, 1996). Further, warp and weft threads were separated and weighed to calculate respective percentages. The per cent composition of warp and weft was calculated as follows.

Weight of 5 × 5 sample	: a (g)
Weight of warp yarns	: b (g)
Weight of weft yarns	: c (g)
% of warp	: $b/a \times 100$
% of weft	: $c/a \times 100$

4 Cloth thickness

Thickness is the distance between the upper and lower surface of the material measured under a specified pressure, expressed in mm. The specimens were tested as directed in BS test method 2544:1954 (Booth, 1996). The specimen chosen were free from folds, crushing or distortion, wrinkles, specimen were placed on the anvil of test apparatus and bring the pressure foot into the contact with the opposite side of the material and record the thickness in mm, the shape of the anvil and pressure foot was round. The thickness gauge instrument was used for measuring thickness. Five readings were recorded and mean was calculated.

5 Cloth Stiffness

Fabric stiffness is the resistance of the fabric to bending. Bending length is the length of the fabric that bends under its own weight to a definite extent. It equals half the length of rectangular stripe of fabric that bends under its own weight to an angle of 41.5°. The test samples were tested as directed in BS test method: 3356-1961. A rectangular strip of fabric, 6 inch × 1 inch was mounted on a horizontal platform in such a way that it hangs like a cantilever and bends downwards. Test specimen was cut with help of template and then both template and test specimen was placed on the platform with the fabric underneath. Both were pushed forward slowly. The strip of fabric was started to a droop over the edge of the platform and the movement of the templates and the fabric was continued until the tip of the

specimen viewed in the mirror cuts both index lines. The bending length was read off from the scale mark opposite a zero line engraved on the side of the platform. Readings were recorded by using Shirley's stiffness tester (Booth, 1996).

6 Cloth crease recovery

Crease recovery is nothing but allowance of the fabric to recover from the crease. The test samples were tested as directed in IS method: 4681-1968 by using Shirley's crease recovery tester. Samples were cut both warp and weft way from the fabric with a template, 2 inch long by 1 inch wide. It was creased by folding into half and placed under a weight of 2 kg for 5 minutes. The weight was removed and the specimen was transferred to the fabric clamp on the instrument using forceps and was allowed to recover from the crease for 5 minutes. As it recovered the dial of the instrument was rotated to keep the free edges of the specimen in line with the knife edge. At the end of the time period as it was allowed for recovery, usually 1 minute the recovery angle in degrees was read on the engraved scale. Readings were recorded for both warp and weft separately. (Booth, 1996)

B. Performance properties

1 Cloth Drape coefficient

Drape is the ability of the fabric to assume a graceful appearance in us. Fabric drape may be explained as the extent to which a fabric deforms when it is allowed to hung under its own weight. A circular specimen about 10 inch diameter was supported on a circular disc about 5 inch diameter and upper supported area drapes over the edge. On switching the lamp of the drape meter, it gave the shadow of the draped area, which was taken on a paper and was weighed. Similarly draped shadow area of the template and supporting disc was also taken. Drape coefficient is the ratio of the projected area of the draped specimen to its undraped area after deduction of the area of the supporting disc. Thus, drape coefficient was calculated using the formula.

$$F = \frac{\left(\frac{W}{w - a} \right)}{A - a} \times 100$$

Where;

F - Cloth drape coefficient

W – Weight of the draped pattern

w – weight/unit area of the print paper

a – Area of the specimen disk

A - Area of the specimen template

C. Durable properties

1 Cloth Tensile strength and elongation

Tensile strength is the ability of the material to resist or rupture induced by external force. It is expressed as force per unit cross sectional area of the specimen at the time of maximum load. The specimens were tested as directed in ASTM test method: 12616-1989. The method employed to determine the breaking load and elongation of the material by using the 'raveled strip test' in Unistretch 250 tensile tester. The specimen was gripped between two clamps of the tensile testing machine in such a manner that the same fabric was gripped by both the clamps and a continuous increasing load was applied longitudinally to the specimen by moving one of the clamps until the specimen ruptured. Values of breaking load of the test specimen were recorded from the indicator of the machine.

Elongation is the increase in length of the specimen from its initial length expressed in units of length. The distance that material will extend under a given force is proportional to its original length. Hence elongation is coated as percentage was assessed for the fabrics.

Size of the specimen	: 20 cm × 5 cm
Numbers of specimen tested	: 5
Test method	: Raveled strip test
Load range	: 250 kgf
Speed	: 300 mm/min

Abrasion is the rubbing away of component fibres and yarns of the fabric (Booth, 1996). Abrasion resistance was carried out using the instrument 'Martindale abrasion tester'. Fabric specimens were cut according to the size of template. The specimens were abraded until a hole was formed and number of cycles to create a hole and readings are recorded.

Size of the specimen	: 13.5 cm
Number of specimen tested	: 5
Type of abradent	: Zero emery paper
Type of abrasion	: Multidirectional
Determination of end point	: Formation of hole
Name of the instrument	: Martindale's abrasion tester
Test method	: IS 12673-1989

Visual evaluation of the polyester and cotton union sarees

Visual assessment of the developed fabric samples was carried out by a panel of 30 textile experts comprising of faculty members and PG students of Department of Textile and Apparel Designing, University of Agricultural Sciences, Dharwad. Fabric structure, fabric handle, fabric texture, overall acceptability of the developed fabrics based on their end uses were expressed in terms of frequency, percentages and weighted average ranking (WAR) was done in order to study the preference of developed union fabrics based on rankings (5-Excellent, 4- Very good, 3-Good, 2- Fair and 1-Poor).

Cost of production of developed sarees

The cost of the yarns and developed bamboo and tencel union fabrics per meter were calculated for comparison of polyester × cotton union sarees

3. RESULTS AND DISCUSSION

It is seen from Table 2 that, Polycot union sample attained excellent dimensional stability (warp and weft-20), better cloth count (warp-44 weft-55), cloth stiffness (warp -2.19 cms and weft-1.89cms), crease recovery (warp – 80^o weft-87.50^o), cloth weight (114.9 gsm) cloth thickness (0.35 mm) properties respectively. Polycot union sample had better Abrasion Resistance (112cycles) and fabric strength of warp-73 and Weft-57 (Kgf) with elongation (warp 25.46% and weft 16.19%).

Table 2. Structural and Physical properties of Polycot union fabric sample

Sample	Mean values	
	Polyester- Warp	Cotton – Weft
Dimensional stability	20	20
Cloth count	44	55
Cloth stiffness	2.19	1.89
Crease recovery (degrees)	80	87.5
Tensile strength (Kgf)	73	57
Elongation (%)	25.46	16.19
Cloth thickness (mm)	0.35	
Cloth weight (gsm)	114.9	
Abrasion Resistance (cycles)	112	
Drapability (%)	110.06	

Drapability is an important property regarding aesthetic and drape ability of textile materials. This may also be attributed to the larger diameter of polyester fiber which increases diameter of the yarn and decreases the cloth stiffness of polyester rich fabric.



a)

b)

Figure 1. Sarees woven with pattern designs

Visual analysis of woven sarees:

Table 3: Visual analysis of woven sarees with respect to traditional motifs

n=30

Motifs	Clarity	Colour combination	Texture	Alignment	Overall appearance	Preference WMS
Parrot	18.0	18.0	18.0	9.6	9.6	9.6
Leaf	27.6	27.6	27.6	20.4	20.4	27.6
Flower	24.0	15.6	24.0	20.4	20.4	20.4
Mango	24.0	24.0	27.6	24.0	24.0	28.8

From Table 3 and Figure 1b it is revealed that, among the different woven motifs and mango motif (28.8) secured the highest scores with respect to overall preference, followed by leaf (27.6) with respect to clarity, colour combination, texture and preference. While, the least score was obtained for parrot (9.6) motif with respect to alignment, overall appearance and preference.

Table 4: Visual analysis of embroidered sarees with respect to traditional motifs

n=30

Sarees	Clarity	Colour combination	Texture	Alignment	Overall appearance	Preference WMS
White Worli	27.6	26.4	28.8	27.6	27.6	26.4
White Kasuti	30.0	30.0	28.8	22.8	30.0	28.8
Coloured Worli	27.6	27.6	27.6	27.6	27.6	27.6
Coloured Kasuti	28.8	26.4	28.8	27.6	27.6	28.8

From Table 4 and Figure 2 it is concluded that, based on the ranks given to motifs of embroidered sarees percent score was given to white coloured embroidered sarees (30.0) with respect to its clarity, colour combination and overall appearance when compared to white coloured Worli embroidered sarees. Comparing white coloured Worli and kasuti embroidered sarees highest score was given to white colour Kasuti embroidered saree (28.8)

with respect to its clarity, texture and overall preference. While among all the four sarees lowest score (22.8) was given to white coloured kasuti saree with respect to alignment. Table 5 explains about the preference of borders with different motif combinations with respect to their clarity of motifs, their colour combinations and overall appearance, therefore the results indicated that among the five motifs highest preference was given for Elephant & flower Motif 3 (5.0) with respect to its colour combination followed by motif 3 (4.1) with respect to motif clarity and colour combination. Whereas, among the five motifs the least preference was given to Kantha parrot & leaf Motif 5 (3.0) with respect to the clarity of motifs followed by motif 1 & 4 with respect to its overall appearance. Overall respondents opined that pallu designs with compactly woven traditional motifs can also be used to produce toppers, dupatta, stoles and other madeups.

Table 5. Preference of border with motif combination n=30

Sl.No	Motifs	Parameters		
		Motif clarity	Colour combination	Overall appearance
1	Temple & kasuti	3.5	3.8	3.7
2	Khairi & leaf	3.8	3.7	3.7
3	Elephant & flower	4.1	5.0	4.0
4	Temple & worli	3.5	3.2	3.0
5	Kantha parrot & leaf	3.0	4.1	3.5

Various factors like fixed cost (depreciation) and variable costs (repairs and maintenance, cost of yarns, preparatory processes, punch cards, embroidery thread; wages for weaving and embroidering) were taken into account while determining the cost of production. It is clear from Similarly, the cost of raw materials and preparatory processes also remained same. The variation existed mainly with the wages paid towards embroidering and weaving, resulting into difference in the cost of production.



Figure 2. Woven Sarees with digitized embroidery designs

Looking into the total cost of the hand embroidered saree that accounted to Rs. 705.79 where greater amount paid was towards wages for embroidering (Rs. 300.00), since hand embroidery is very elaborate, time consuming, intricate and not only labour intensive but also expresses skill and creativity of an individual. Further, the embroidery threads were also relatively expensive that added to the production cost. On the other hand, the total cost of woven pattern sarees was relatively lower than that of embroidered saree. Actual cost of woven saree with traditional motif was Rs 775/saree and woven and embroidered with traditional motif was Rs 1075/saree. Though the amount spent on fixed and variable costs of

these sarees were same, a slight variation was observed with respect to the amount spent on punch cards. Further, it is assumed that the weavers earned 25 per cent of net profit per saree on total production cost

4. CONCLUSION

As a natural fiber, 100% cotton garments also tend to be a bit more expensive than the synthetic counterparts. A fabric made from a poly cotton combines the strengths of the two fibers. *Poly cotton sarees* are breathable, tear-resistant, and durable and can be fashioned into abrasion-resistant fabrics, like canvas. While not as inexpensive as pure polyester, poly cotton blends do tend to cost less than comparable garments made of 100% cotton and they provide much more comfort.

The total cost of poly cot pattern sarees was relatively less because of Jacquard shedding mechanism adopted for producing these patterns not only assisted in creating new designs but also saved time, money and labour. Thus, the handloom weavers can take up the production of these sarees, madeups, dupattas, stoles and toppers to earn better wages and in turn improve their livelihood. The weavers can even design and produce exquisite home textiles.

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INTERCULTURAL COMMUNICATION CHALLENGES IN MODERN HIGHER EDUCATION INSTITUTIONS

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Abstract. *Multicultural and multilingual classrooms have become the norm in many education institutions throughout the world due to changing immigration patterns caused by globalization. Subsequently, understanding the role that culture plays in the classroom is essential to effective teaching, learning and communicative interaction in general.*

Culture is an intricate concept, with many different classifications. The word "culture" refers to a group or community with which we share common experiences that shape the way we understand the world. Each of us is shaped by many factors, and culture is one of the powerful forces that influence our lives.

This paper offers a critique of problems experienced in multicultural learning environments and explores factors that inhibit intercultural communication. In addition, this paper highlights current cultural issues which are relevant to contemporary life in Moldova.

Keywords: *multilingualism, multicultural education, higher education, internationalization, globalization, intercultural communication*

In many educational institutions around the world, multicultural and multilingual classrooms have become the standard norm due to changing immigration patterns caused by globalization. Therefore, the comprehension of the cultural factor in the classroom is essential for teaching, learning and overall communication.

Culture is a complex and perplexing concept, with a wide range of characterizations and classifications. "Culture" broadly speaking, means a group, community or simply a gathering or network of people within which we share common experiences that shape the way we comprehend the world around us. Every one of us is moulded by numerous elements, and culture is one of the incredible powers that influence our lives.

This paper offers a scrutiny of issues experienced in multicultural learning conditions and investigates factors that hinder intercultural interaction. Moreover, this paper features current social issues, which are important to the contemporary life in Moldova.

1. INTRODUCTION

Thirty years ago, many Europeans saw multiculturalism - the embrace of an inclusive and diverse society - in response to Europe's social problems. Today, an increasing number consider it a cause of theirs [1]. Internationalization is a part of the process of globalization,



with an increasing mobility worldwide [2]. In the United Nations it is estimated that resources of Global Migration in 2015 are approximately 248 million international migrants in the world. In this regard, internationalization in higher education has been a goal of many governments. Intercultural communication, which has become a subject of study in universities around the world, has reopened the file of perennial themes of social thinking, such as the unity and diversity of cultures, the relationship between us and others, the crisis of identities and their redefinition under the combined pressure of several factors. [3]. Intercultural experiences enrich us spiritually, open up new horizons for understanding the world and oblige us to an implicit comparative evaluation, which helps us to know better our own identity.

Interculturality is required in modern education as a necessity to respond to the educational demands of the contemporary society, by developing the students' interest in intercultural aspects, by developing the attitude of cultural and intercultural empathy.

Intercultural education promotes tolerant, open attitudes, acceptance and natural understanding of the "self-other" relationship and of the notion of foreigner, the recognition and respect of cultural differences through the positive valorization of the relations of equality between people and not by applying the superior-inferior polarity.

This article will focus on the scientific literature to show the challenges of intercultural communication, that is, a basic approach to the multicultural learning environment. Therefore, my goal for this paper is to explore some issues in a multicultural class that can be confronted by teachers and students; most specific: low academic achievement, adaptation to a new cultural environment and problems of self-confidence, as well as with the new culture. Figure 1 shows a visual overview of the basics of this study.

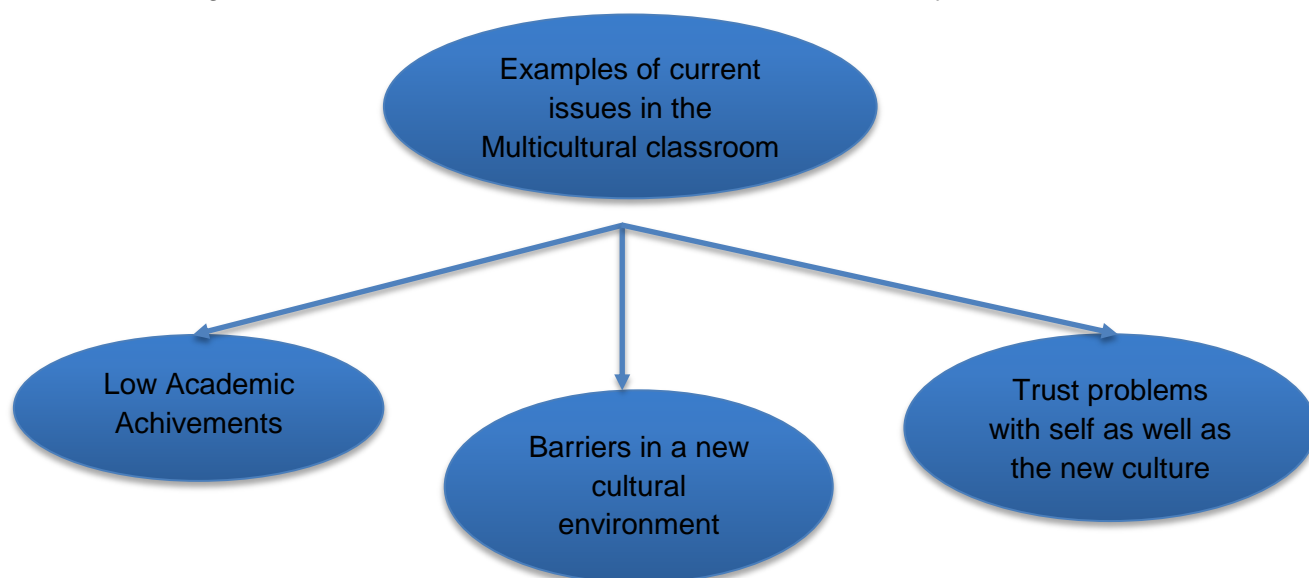


Figure 1. Example of current issues in the multicultural classroom

2. LITERATURE REVIEW

Based on the learning concepts introduced above it is the subject of learning with students from different cultures. Song stated that the term "multicultural" is used as a descriptive term to characterize the presence of diversity in a society, but in what follows, the focus is on its prescriptive use in the context of liberal-western democratic societies [4].

Learning in multicultural classes can be described as multicultural learning. Alexander Chomsky [5] define multicultural learning as learning that integrates and explores the rich tapestry of perspectives reflected in our diverse world. It occurs when the differences between the learners are both appreciated and explored. Multicultural learning recognizes and reaches the limits of capacity, age, class, gender, nationality, race, religion, sexual orientation and other personal, social and cultural identities, so that students can understand in more detail the multifaceted dimensions of knowledge to reflect and explore the implications of diversity and power. Multicultural learning is life education in our multicultural world [5].

Cantatore & Quappe [6] stated that cultural awareness is the foundation of communication and implies the ability to move away from ourselves and to raise awareness of our cultural values, beliefs and perceptions. Cultural awareness becomes central when we have to interact with people from other cultures.

There is an important relationship between culture and education, as the culture of teachers and students affects the education processes in the classroom. Thus, culture includes everything that makes one group or community within a society distinct from another: language, values, literature, worldview, food, religion, clothing, vacations, beliefs and behavior that builds lifestyle of a specific group [12]. Multicultural education encompasses practices and theories that support equitable opportunities and academic achievements for all students [13].

According to the Association (ASHE) for the Study of the Higher Education Report [7], in order to engage diversity in a classroom, the faculty must rely on a number of factors such as intentions, awareness, knowledge and development of additional skills. Also, the faculty should be willing to include teaching that supports the development of intercultural competences [8]. Therefore, theoretician Krutky stated in this regard: *"Education in the 21st century must prepare students for an increasingly interconnected, interdependent and diverse world."* *Teaching in a diverse classroom is a challenge for educators* [9].

3. METHODS

An overview of the methodology used in the article is represented by the following types:

1. Research approach (deductive)
2. Research method (qualitative)
3. Data collection (primary: Interviews, observations and secondary: books, journals, articles, previous studies in the literature and electronic sources)

4. EXPERIMENTAL

Given the geographical position of the Republic of Moldova, the development of cultural and intercultural competences is a constant concern of the universities of the Republic of Moldova. Thus, more than four thousand of the students who study in higher education institutions in the Republic of Moldova are foreign citizens. 2.1 thousand of them are studying medicine, according to data from the National Bureau of Statistics on the Activity of Higher Education Institutions in the 2018/19 study year. In figure 2 we can see the evolution of the number of foreign students in the higher education institutions.

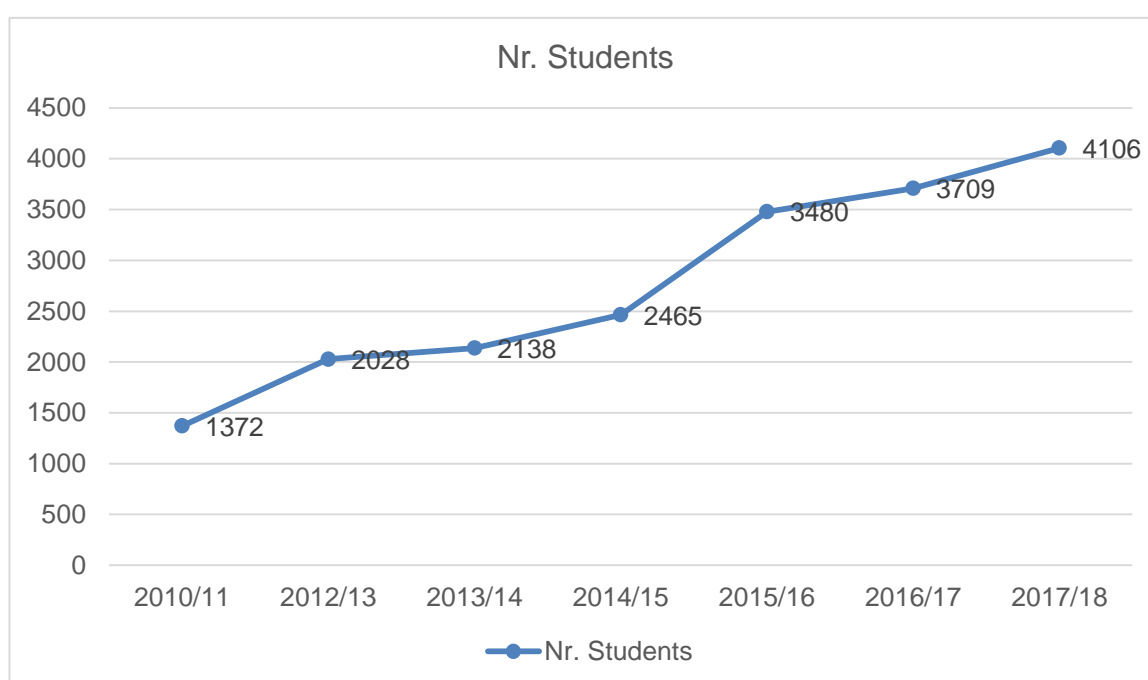


Figure 2. Evolution of foreign students in higher education institutions in the Republic of Moldova [10]

The majority of foreign students come from Israel - 41.8%, Romania - 39.2%, India - 6.3%, Ukraine 2.8% and Turkey - 2%.

For a few years now, Moldovan universities offer Romanian language courses for foreign citizens. In this context, the development of socio-linguistic, cultural and intercultural competences has become a necessity. The development of the above mentioned skills would be necessary for both Moldovans and foreign citizens, in order to avoid the possible situations of cultural differences.

In order to analyze the students' perception regarding the cultural and intercultural aspects, the need for skills development and how this would be possible, we conducted a quantitative research on a sample of 50 students enrolled in the bachelor programs of the American University of Moldova. The students had to complete a questionnaire with dual choice items



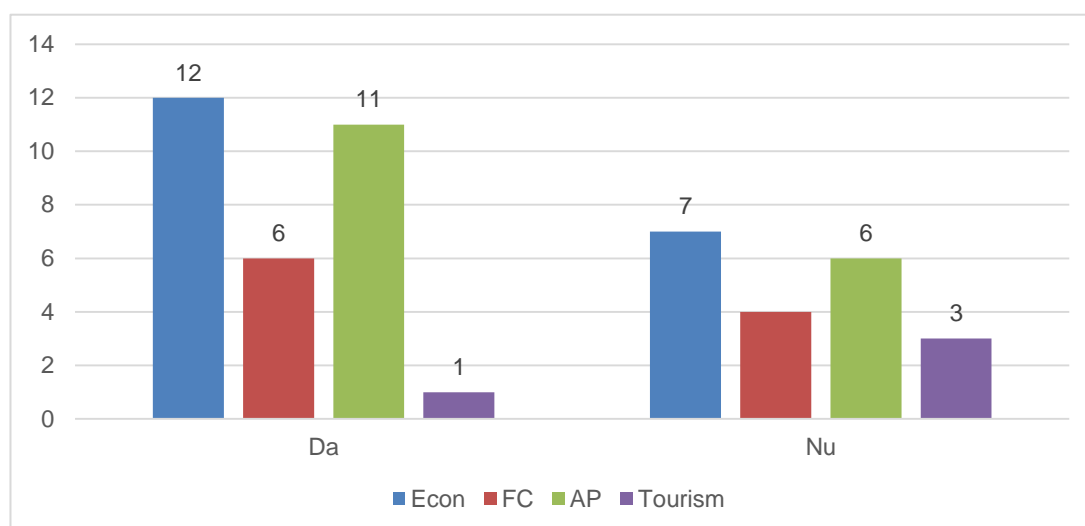
but also some open items. The students in the sample are enrolled in the Bachelor of Economics (19), Finance and Accounting (10), Public Administration (17) and Tourism (4). We will present their answers to questions in determining the need to develop intercultural competences within our study programs.

5. RESULTS

Question No 1. Do you consider the introduction of interculturality aspects in the course hours as positive?

The students' answers are divided into study programs to allow an analysis of them from the perspective of the specific of each specialization.

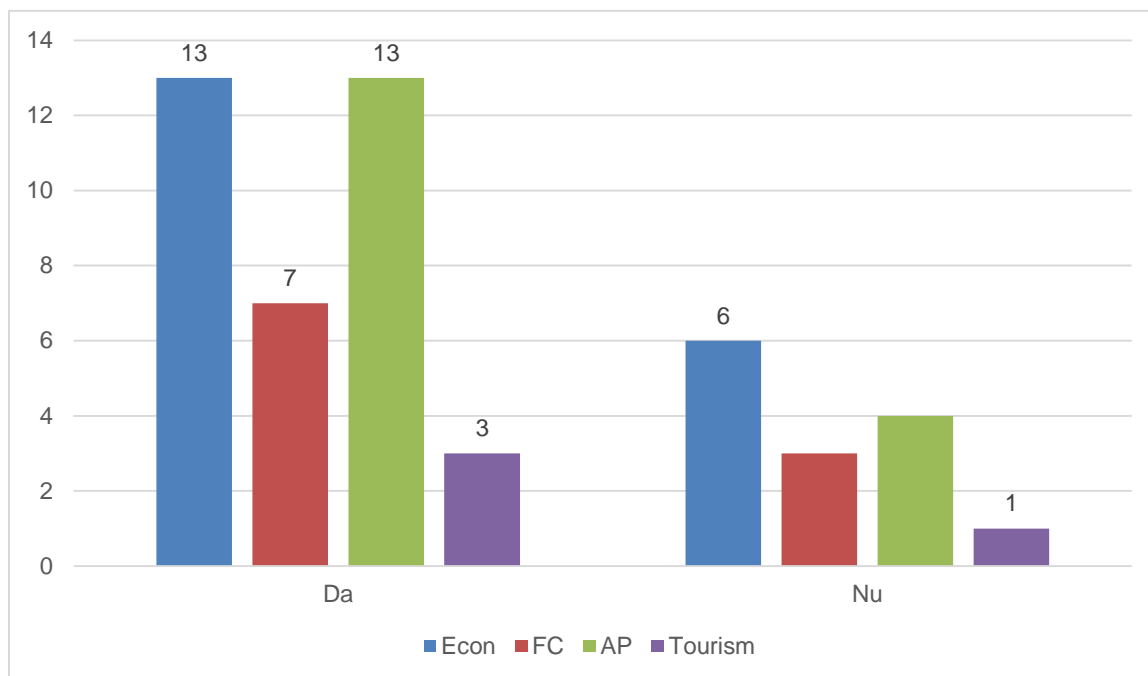
Therefore, we find that the students of Economics, Fin and Con and AP are for introducing the intercultural aspects in the courses. Tourism students, however, feel that these issues are not important to them, that foreign nationals should adapt to the culture of the host country.



Question no. 2 Could the development of cultural and intercultural competences help to avoid conflict situations?

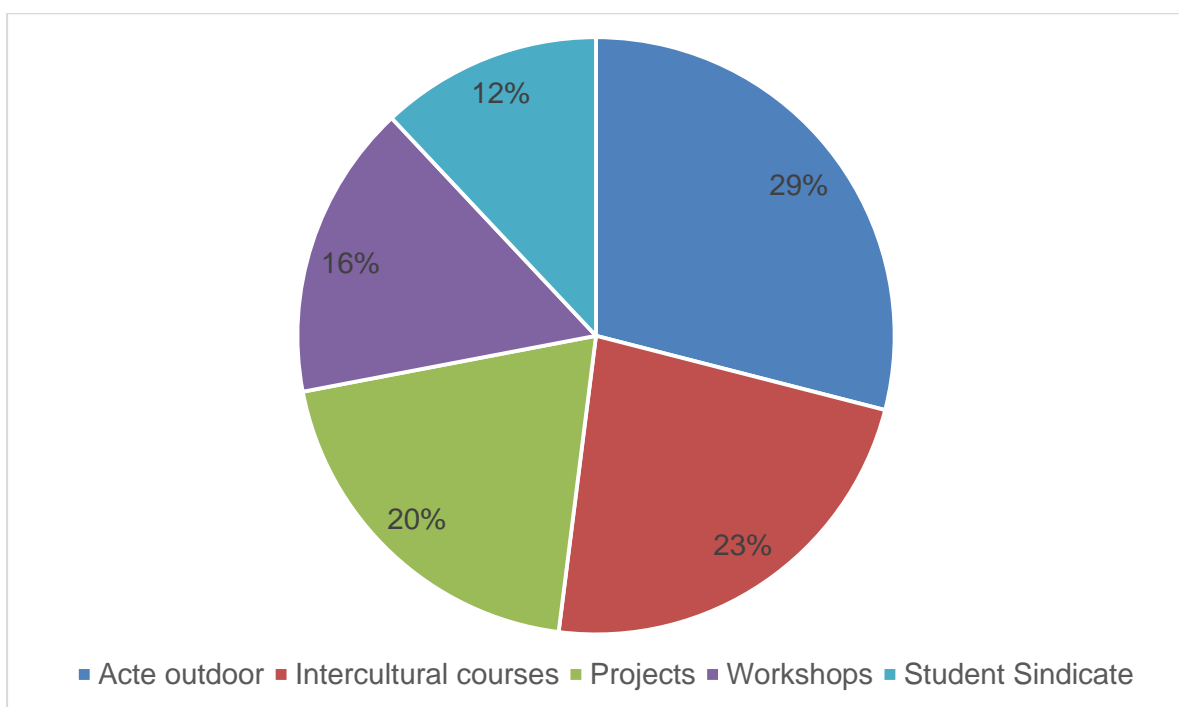


The figure below shows the students' answers to question number 2.



As we can see from the students' answers, the majority considers that the acquisition of cultural and intercultural competences would be useful in avoiding conflicting or embarrassing situations. Young people believe that most conflict situations between people from different cultural backgrounds originate from the lack of intercultural competences and not from hostile or conflicting attitudes. The students said that they often had a wrong approach towards the students who came with Erasmus mobility, because they did not have information about their culture, customs, traditions and holidays. In their turn, foreign students were offended by certain questions and attitudes, not understanding that they are in fact the result of cultural barriers and discrepancies.

One of the open item questions was question no. 3, which asked the students to list some activities that in their opinion would contribute to the development of intercultural communication. The graph below presents their options.



Finally, I believe that the trust between teachers and their students in the multicultural classroom plays an important role in motivating the class to learn in a challenging environment where language and culture differences can be barriers to learning. Thus, students should work hard to hone their language skills to help them understand and communicate better and integrate into a multicultural classroom.

6. CONCLUSIONS

In conclusion, teachers who learn more about the environments, cultures and experiences of their students will feel more capable and efficient in their work as teachers. Teachers should work continuously to improve the lives of foreign students. Also, teachers can reduce problems in the multicultural classroom by improving their teaching and learning approaches [11]. Flexibility is more important than knowledge in addressing multicultural issues. Therefore, teachers should explore the issues in the multicultural classroom as they arise and deal with these issues. Also, teachers should try to find, create or design ways that elevate and improve students' academic performance and build an effective or strong relationship with students.

In conclusion, the necessary and compulsory direction in our modern education, but also in the extracurricular activity organized in specialized educational institutions, must ensure to the young generations a solid preparation for life, in the spirit of modern European values, to the extent that the teacher has the training and the endowment. necessary as both moderator and trainer of intercultural communication, thus becoming the promoter of intercultural education.

I would conclude by using the words of Pierre Dasen, who I find very eloquent in relation to the topic addressed: "The educator practicing an intercultural pedagogy will actually benefit from the presence of children from different backgrounds in order to (re) enhance their culture of origin and to raise awareness, at the same time, others to cultural diversity, but will avoid imposing some identification, will avoid stereotypes, the presentation of cultures in a static way. "

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BEHAVIOR OF THE PHARMACOKINETICS OF ENROFLOXACIN IN THE PHASE SPACE

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Abstract. *Phase space is an approach for analysis of nonlinear differential equations. The graphical solutions that are obtained are convenient for qualitative assessment of the behavior of systems and processes. A comparative analysis of the pharmacokinetics of the antibiotic enrofloxacin administered intravenously in dogs and cats has been performed in the present study. The mathematical models that represent the change in blood plasma concentration of the two groups of animals are described by second-order differential equations. For the graphical representation of phase trajectories using the fluoroquinolone, the Mathcad program tools are used. The properties of the peculiar points are determined based on the received images.*

Keywords: *phase plane, mathematical models, differential equations, Mathcad, pharmacokinetics.*

ПОВЕДЕНИЕ НА ФАРМАКОКИНЕТИКАТА НА ЕНРОФЛОКСАЦИН ВЪВ ФАЗОВОТО ПРОСТРАНСТВО

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1. ВЪВЕДЕНИЕ

Фазовото пространство е подход за анализ на линейни и нелинейни диференциални уравнения. Графоаналитичните решения, които предлага метода са удобни за качествена оценка на поведението на системи и процеси.

Всяка система независимо от реда на описващото я диференциално уравнение може да се изрази в многомерно пространство, като нейното състояние се дава с положението на изобразяващата я точка. Тя служи за качествена характеристика на преходните процеси в системите.

Въпреки че геометричната интерпретация на метода на пространството на състоянието се простира до системи от всякакъв ред, важното му предимство - видимост - е най-силно изразено в случая на системи от втори ред, когато състоянията на системата са представени с точки на фазовата равнина. Трябва да се добави, че нелинейните модели от втори ред позволяват да се разкрият много основни характеристики на поведението на динамичните системи; това определя методологичната, теоретичната и практическата значимост на метода на фазовата равнина.

Целта на настоящото проучване е сравнителен анализ на фармакокинетиката на препарата енрофлоксацин в кръвната плазма при котки и кучета по метода на фазовата равнина.

2. МАТЕРИАЛ И МЕТОДИ

Експерименталният дизайн и методиката на получаване на данните са представени в [1]. При идентификацията са използвани тяхната средна стойност и стандартно отклонение.

2.1. Използван софтуер

Обработката и анализът на данните са осъществени със специализиран софтуер от фамилията KORELIA. Потребителски ориентираният интерфейс и модулът за разпознаване на изследвания процес [5] улесняват въвеждането на данните и подпомагат избора на математически модел. Идентифицираните уравнения [8] могат да бъдат анализирани и сравнявани по редица параметри [4] и по този начин да бъде намерено най-подходящото за конкретното множество [7].

Анализът по метода на фазовата равнина е реализиран с програмата Mathcad. Използвана е векторната функция Rkadapt за решаване на ОДУ по метода на Рунге – Кута от IV ред с адаптивна стъпка, а за пресмятане на собствените стойности на матрицата на състоянието функцията eigenvals.

2.2. Математически модел от втори ред

Математическите модели на процеса за изследваните животни са представени в [2, 3]. За идентификация на процесите е избрано диференциално уравнение от втори ред:

$$\left\{ \begin{array}{l} \frac{d^2 y(t)}{dt^2} + 2 \cdot \zeta \cdot \omega \cdot \frac{dy(t)}{dt} + \omega^2 y = K \cdot \omega^2 \cdot U(t) \\ y(0) = C_0 \\ \frac{dy(0)}{dt} = 0 \end{array} \right. \quad \begin{array}{l} (1) \\ \text{начални условия} \end{array}$$

където: $U(t)$ – приложена доза енрофлоксацин

Параметрите за идентификация са:

ζ – коефициент на потискане

ω – собствена честота на системата

K – коефициент на чувствителност

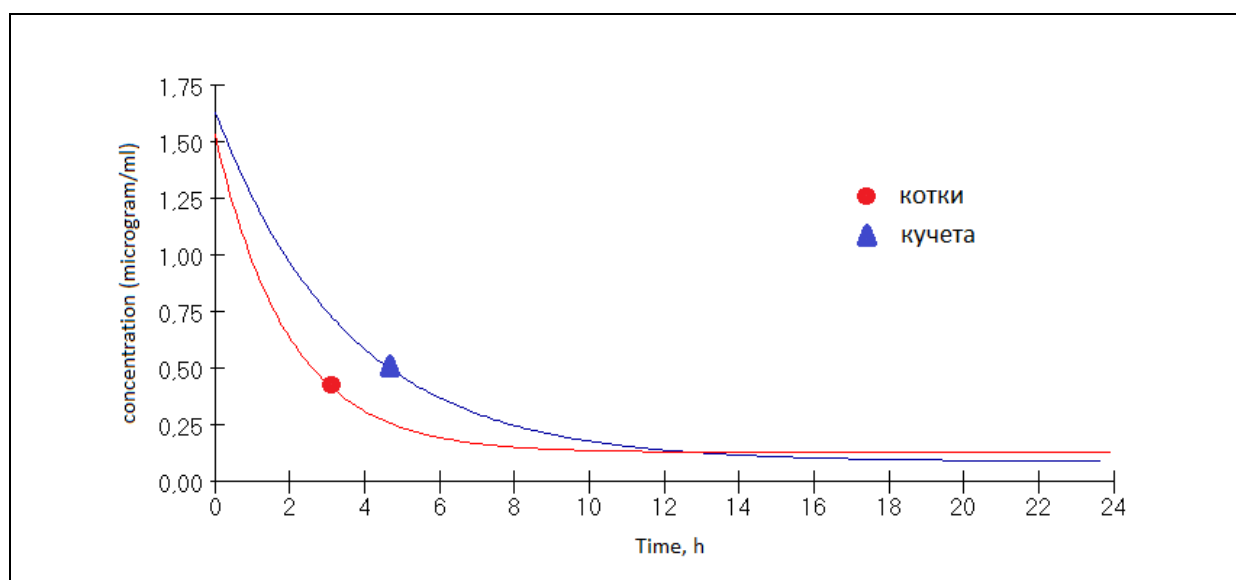
3. РЕЗУЛТАТИ

Изчисляването на идентификационните параметри за двата вида животни е осъществено с програма KORELIA-Ident като получените стойности са представени в Таблица 1.

Таблица 1. Параметри на модела за двата вида животни

параметър		животни	
в уравнението	Mathcad	кучета	котки
ζ	z	6.00	6.83
ω	w	3.40	6.86
K	K	-0.09	-0.12

На Фигура 1 е представен диференциален модел от втори ред на процеса



Фигура 1. Изменение на концентрацията на енрофлоксацин при кучета и котки

Представените в таблица 1 параметри са използвани за сравнение на процесите на промяна в концентрацията на енрофлоксацин в кръвната плазма при кучета и котки след еднократно венозно инжектиране на субстанцията, като е приложен алгоритъм за анализ по метода на фазовата равнина [6].

3.1. Модел в среда на Mathcad

Със следното полагане:

$$y_1 = y(t)$$

$$y_2 = \frac{dy_1(t)}{dt} \quad (2)$$

Уравнение (1) се свежда до система от две диференциални уравнения от първи ред:

$$\left\| \begin{array}{c} \frac{dy_1}{dt} \\ \frac{dy_2}{dt} \end{array} \right\| = \left\| \begin{array}{cc} 0 & 1 \\ -\omega^2 & -2\zeta \cdot \omega \end{array} \right\| \cdot \left\| \begin{array}{c} y_1 \\ y_2 \end{array} \right\| \quad (3)$$

Началните условия се задават в матрица:

$$\text{за котки} \rightarrow Y_0 = \begin{pmatrix} 1.53 \\ 0 \end{pmatrix}$$

$$\text{за кучета} \rightarrow Y_0 = \begin{pmatrix} 1.63 \\ 0 \end{pmatrix}$$

Други начални стойности, необходими за моделирането са:

$$\left\{ \begin{array}{ll} t_0=0 & // \text{начален момент} \\ t_1=24 & // \text{краен момент} \\ N1=2000 & // \text{брой точки в интервала} \end{array} \right.$$

Векторната функция, необходима за програмата за решаване на ОДУ е:

$$D(t, Y) = \begin{pmatrix} Y_1 \\ -\omega^2 \cdot Y_0 - 2 \cdot \zeta \cdot \omega \cdot Y_1 \end{pmatrix} \quad (4)$$

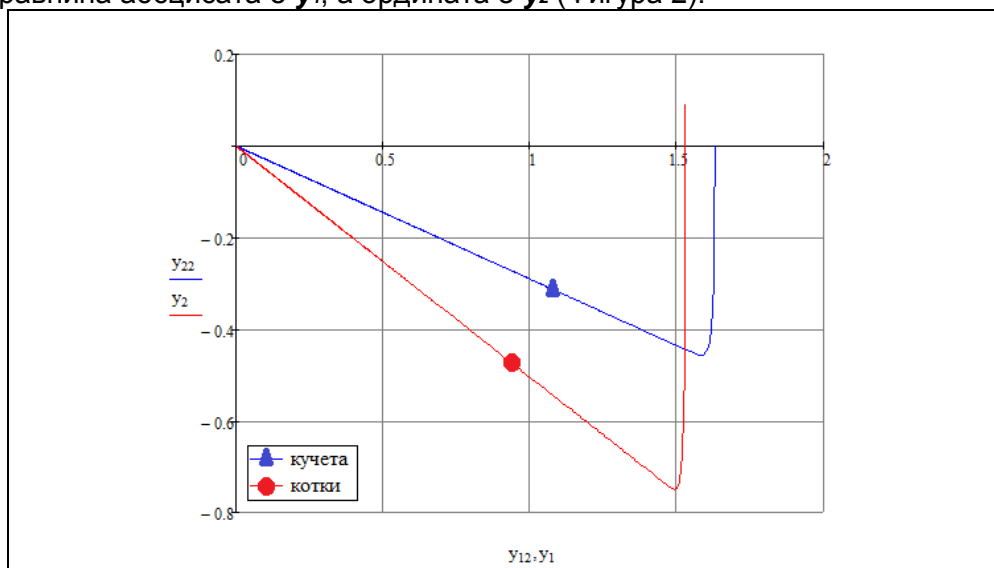
Числовото решаване е с оператора:

$$S := Rkadapt(Y_0, t_0, t_1, N1, D)$$

3.2. Фазова равнина

Променливите на състоянието на пространството y_1 и y_2 определят фазовата равнина.

В тази равнина абсцисата е y_1 , а ордината е y_2 (Фигура 2).



Фигура 2. Фазови траектории

3.3. Нулклинни на процеса

Нулклинните на процеса се строят в координатна система $y_1 O y_2$. От системата

$$\left\| \begin{array}{cc} 0 & 1 \\ -\omega^2 & -2\zeta \cdot \omega \end{array} \right\| \cdot \left\| \begin{array}{c} y_1 \\ y_2 \end{array} \right\| = 0 \quad (5)$$

$$M := A * Y + B \rightarrow \left\| \begin{matrix} y_2 \\ -\omega^2 - 2\zeta \cdot \omega \end{matrix} \right\| = 0 \quad (6)$$

се получават две решения спрямо y_2 :

$$M_0 \text{ solve, } y_2 \rightarrow 0$$

$$M_1 \text{ solve, } y_2 \rightarrow -\frac{w}{2 \cdot z} \cdot y_1$$

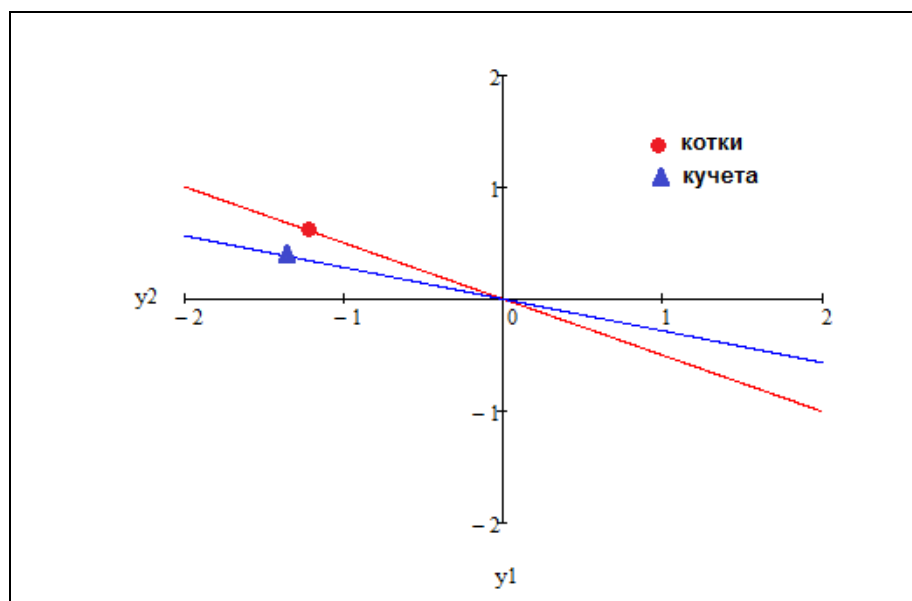
Първото решение определя нулклина, съвпадаща с абсцисната ос. Второто решение определя нулклина, която представлява права, минаваща през началото на координатната система и пресичаща нулклина в особената точка.

Последната зависимост дава координатата y_1 за различния вид животни:

$$-\frac{w}{2 \cdot z} \cdot y_1 \text{ solve, } y_1 \rightarrow 0$$

Наклонът е мярка за стръмността на една права. Колкото е по-голям (в абсолютна стойност) толкова наклонът е по-стръмен. При разглеждания модел неговата стойност се изчислява по формулата:

$$a = -\frac{w}{2z} \quad (7)$$



Фигура 3. Нулклини на процеса

Има една особена точка. Тя се получава като пресечна на двете нулклини и за изследвания процес и при двата вида животни е една и съща и е с координати (0, 0).

3.4. Собствени стойности на матрицата на състоянието.

В случая собствените стойности на матрицата на състоянието при кучетата и котките са различни. Те се получават от функцията `eigenvals` и в общ вид са следните:

$$ev(w, z) := \text{eigenvals}(A(w, z)) \rightarrow \begin{bmatrix} -w \cdot z - w \cdot \sqrt{z^2 - 1} \\ -w \cdot z + w \cdot \sqrt{z^2 - 1} \end{bmatrix} \quad (8)$$

При разглеждания модел и за двата вида животни реалните части са отрицателни и $z > 1$, което означава че особените точки са от тип устойчив възел – в случая точката с координати (0,0). Това е доказателство за устойчив процес и при кучетата и котките.

4. ДИСКУСИЯ

Стойностите на параметрите за идентификация, представени в Таблица 1 отразяват разликите в протичането на процеса при двата вида животни.

При кучетата коефициентът на потискане е по-малък, което означава по-бързо намаляване на концентрацията.

При котките собствената честота е по-висока, което поражда необходимост от подаване на лекарството през по-малки интервали от време.

Процесът при котките се характеризира с по-нисък коефициент на чувствителност, което означава по-малка чувствителност към препарата и затова е препоръчително да се прилагат по-големи дози.

Коефициентът на потискане при двата вида животни е по-голям от единица, поради което не е възможен колебателен процес, следователно няма опасност организмите им да реагират с циклична промяна на реакцията.

При котките процесът се характеризира с ъглов коефициент -0.50, а при кучетата с -0.28. По абсолютна стойност по-голям е коефициентът при котките. На графиката правата, която го определя е по-стръмна, което е признак за по-висока скорост на протичане на процеса при този вид животни. Това означава че лекарството се задържа в организма им за по-кратко време и поради тази причина следва да се приема през по-малки интервали от време.

По-голям коефициент на потискане се компенсира с по-голяма собствена честота и рефлектира в по-висока скорост на промяна на концентрацията (Фигура 3).

5. ЗАКЛЮЧЕНИЕ

Направен е сравнителен анализ на фармакокинетиката на енрофлоксацин в кръвната плазма при котки и кучета след еднократно венозно инжектиране по метода на фазовата равнина като промяната в концентрацията е описана в пространството на състоянията. Построени са фазовите траектории. Аналитично и графично са получени нулклините на процеса. Определени са особените точки и от собствените стойности на матрицата на състоянието техния тип - устойчив възел.

Препаратът енрофлоксацин се разгражда по-бързо в организма на котките, което поражда необходимост от подаване на лекарството през по-малки интервали от време. Поради по-ниския коефициент на чувствителност е препоръчително да се прилагат и по-големи дози.

БЛАГОДАРНОСТИ

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DOSE-DEPENDENT BIFURCATION ANALYSIS OF PLASMA RENIN ACTIVITY AFTER NICARDIPINE TREATMENT

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That which is static and repetitive is boring.

That which is dynamic and random is confusing.

In between lies art.

John A. Locke (1632–1704),

British philosopher and medical researcher.

Abstract: Renin-angiotensin system is one of the general regulatory mechanisms of blood pressure. The activity of the system depends on the rate of renin secretion, therefore, plasma renin activity (PRA) is one of the main variables that mediates the effect of a number of factors on blood pressure. Consequently, the impact of a particular drug on blood pressure disorders can be evaluated by the PRA changes. In clinical practice, the administered therapeutic dose is of critical nature, and a number of methods are known for its calculation. In the present study, applying bifurcation analysis the range of the administered doses of the nicardipine (antihypertensive drug) are determined. The bifurcation diagrams show how the stability of the renin-angiotensin system depends on the administered dose.

Keywords: Bifurcation, Phase Plane, Plasma renin activity, Stability analysis, Modeling

1. INTRODUCTION

The regulation of blood pressure in the body is carried out by the renin-angiotensin system. The criterion for its action is plasma renin activity (PRA). The effect of a particular drug on blood pressure abnormalities can be evaluated by monitoring the change in PRA. Therefore, one of the approaches to drug regulation of blood pressure is the impact on PRA. This can be done by administering various drugs: calmodulin inhibitors [2], prostaglandin synthase blockers [4], angiotensin-converting enzyme inhibitors [5] and calcium channel blockers [8]. In all cases, the dosage of the drug is important [9,10]. A significant problem with medication administration is to investigate how the stability of the physiological system is affected by the drug. When the reaction depends on a parameter, in this case, the dose administered, it is advisable to determine critical values for that parameter at which the system would dramatically change its behavior. Bifurcation analysis shows the behavior of a system as a function of a selected parameter [1].

In the present work with the means of bifurcation analysis, the critical limits of the administered doses of the preparation nicardipine are determined. The bifurcation diagrams show how the stability of the renin-angiotensin system depends on a given parameter, in this case, the dose administered. Predicting the required dose of the drug makes it possible to avoid the side effects of the body.

2. MATHEMATICAL MODEL

The subject of analysis is a change in the activity of plasma renin activity after treatment with nicardipine in experimental animals [3,6]. The mathematical model of the process in function of the drug dose is presented in [7]. The dose-dependent model of the regulation kinetics in the state space is:

$$\left\| \begin{array}{c} \frac{dx_1(t,d)}{dt} \\ \frac{dx_2(t,d)}{dt} \end{array} \right\| = \left\| \begin{array}{cc} 0 & 1 \\ -\omega_0^2 & -2\zeta(d)\omega_0 \end{array} \right\| \left\| \begin{array}{c} x_1(t,d) - x_{01} \\ x_2(t,d) - x_{02} \end{array} \right\| + \left\| \begin{array}{c} 0 \\ -K_0(d) \end{array} \right\| \quad (1)$$

The initial conditions are:

$$x_{01} = 7.58$$

$$x_{02} = 0$$

where:

$x_1(t,d), x_2(t,d)$ - the state of the system ;

d - the applied dose [mg/kg];

$\zeta(d) = 4 - e^{-\frac{d+73,9}{123,4}}$ - the damping ratio;

$\omega_0 = 0,64$ - the natural frequency of the process;

$K_0(d) = 3,64 \cdot \ln(d) - 14,47$ - the base level

3. STABILITY ANALYSIS

The stability of the system is determined by the state space matrix **A**:

$$A = \left\| \begin{array}{cc} 0 & 1 \\ -\omega_0^2 & -2\zeta(d)\omega_0 \end{array} \right\| \quad (2)$$

From the characteristic equation:

$$\det(A - \lambda I) = \left\| \begin{array}{cc} -\lambda & 1 \\ -\omega_0^2 & -2\zeta(d)\omega_0 - \lambda \end{array} \right\| \quad (3)$$

the eigenvalues of λ are determined. The solutions are:

$$\lambda_{1,2} = -\zeta(d)\omega_0 \pm \omega_0 \sqrt{\zeta^2(d) - 1} \quad (4)$$

The eigenvalues depend on the applied dose d by the damping ratio ζ . Substituting ζ by its equivalent expression yields:

$$\lambda_{1,2} = - \left(4 - e^{-\frac{d+73,9}{123,4}} \right) \omega_0 \pm \omega_0 \sqrt{3 - e^{-\frac{d+73,9}{123,4}}} = r(d) \pm i.m(d) \quad (5)$$

Real part:

$$r(d) = -\left(4 - e^{-\frac{d+73.9}{123.4}}\right) \quad (6)$$

Potentially imaginary part:

$$m(d) = \sqrt{3 - e^{-\frac{d+73.9}{123.4}}}$$

3.1. Appreciation of the discriminant.

The presence of an imaginary ingredient in the root determines the occurrence of oscillations in the process. The discriminant is:

$$D(d) = 3 - e^{-\frac{d+73.9}{123.4}} \quad (7)$$

The graphical dependence of the discriminant on the dose is in Figure 1. In order to be negative, the dose d must fulfill the inequality:

$$d < 123.43 \cdot \ln\left(\frac{1}{3}\right) - 73.9 = -209.469 \quad (8)$$

Presumably, the dose is a positive number, and therefore the discriminant is always positive, which precludes obtaining complex solutions regardless of the dose.

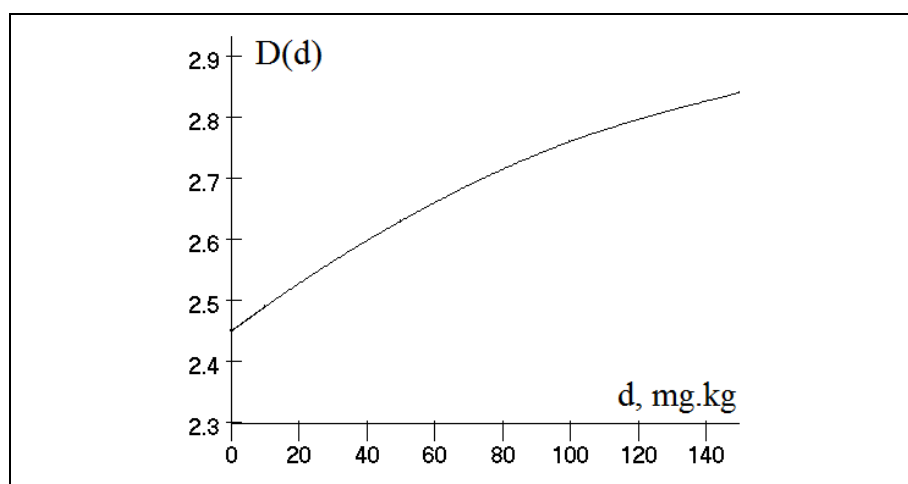


Figure 1. Dependence of the discriminant on the administered dose

3.2. Appreciation of the real roots

The absence of an imaginary part in the solutions determines the following two real values:

$$\left\{ \begin{aligned} \lambda_1 &= -\left(4 - e^{\frac{d+73,9}{123,4}}\right) \cdot 0,64 + 0,64 \cdot \sqrt{3 - e^{\frac{d+73,9}{123,4}}} \\ \lambda_2 &= -\left(4 - e^{\frac{d+73,9}{123,4}}\right) \cdot 0,64 - 0,64 \cdot \sqrt{3 - e^{\frac{d+73,9}{123,4}}} \end{aligned} \right. \quad (9)$$

Figure 2 shows their variation in dose function.

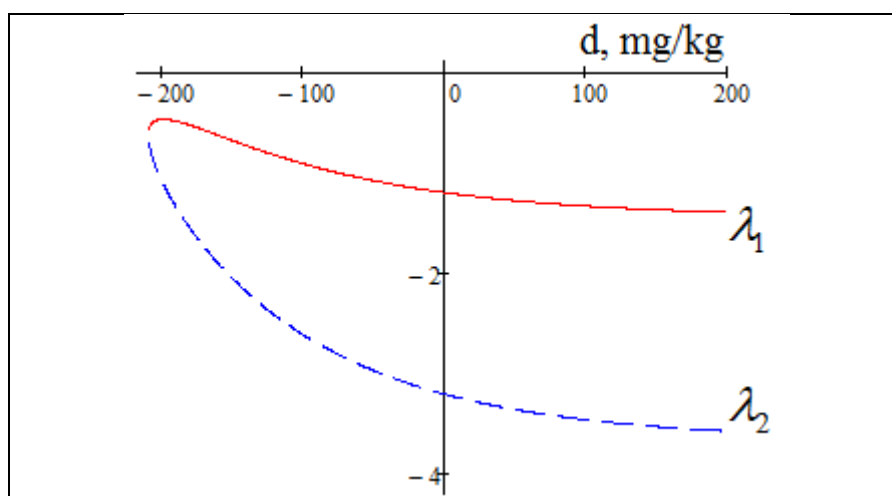


Figure 2. Dependence of the eigenvalues on the administered dose.

The limit to an infinitely large dose again leads to negative values:

$$\left\{ \begin{aligned} \lim_{d \rightarrow \infty} (\lambda_1(d)) &= -1.45 \\ \lim_{d \rightarrow \infty} (\lambda_2(d)) &= -3.67 \end{aligned} \right. \quad (10)$$

The results show that the process is stable regardless of the dose administered. The conclusion obtained by the phase plane method [11] is confirmed.

3. CONCLUSION

In the present work, the stability of the renin-angiotensin system to different doses of nicardipine was investigated. The analysis is made on the mathematical model of PRA change, which is an indicator of PAC behavior. Using bifurcation analysis, critical doses that would influence the sustainable behavior of PAC are sought. Analytical expressions and graphs show that such points do not exist.

The final conclusion of the study is that administration of nicardipine at random doses cannot induce instability reactions on the system.

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MOODLE PLUGINS CODERUNNER FOR ASSESSMENT CODE IN TRAINING PROGRAMMING

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Abstract: *The report presents Moodle's capabilities in teaching programming through the implementation of the CodeRunner and connect with him Adaptive adapter for CodeRunner plugins. In the beginning, Moodle's virtual learning environment is briefly introduced, its characteristics that make it so popular and preferred. Plug-ins are also given as an opportunity to evolve according to user needs. The specifics of the installation in the Moodle environment of CodeRunner is described. The use of executed servers, their role, setup and functions are explained. CodeRunner plugin is discussed as a question type with options for evaluating programming code in different programming languages. In conclusion, it was stated that the implementation of CodeRunner in the Faculty of Engineering and Technology - Yambol have to be analyzed..*

Keywords: *E-learning, Moodle, Teaching Programming, CodeRunner.*

1. INTRODUCTION

Moodle is a very well-developed, flexible, constantly evolving platform that provides a virtual learning environment suitable for all types of learners. It has functionality and features that make it possible to create and maintain a bespoke content management system through dynamic courses in each discipline that encourages scheduled learning appropriate for every learner. Moodle is a training platform that has a wide range of standard and innovative features, making it the leading and most used training platform for both universities and business organizations. It can be successfully used not only to provide content that was available since the early versions of Moodle, but also to collaborate and work with many users with different roles, supported by many resources.

The purpose of this paper is to show what CodeRunner plugin is used in teaching programming; its specific options have been considered; how it is applied in programming training; what is its benefits - for students and teachers; which can be used for automatic assessment.

2. MATERIAL AND METHODS

There are many different types of activities and resources in the standard Moodle that can be found when the editing is turned on Moodle. Most used in programming training are Assignment, Feedback, Glossary, Lesson, Quiz and Workshop. Resources include: forums, wikis, communication resources They can be expanded by using additional plugins or by integrating external tools. The integration can take place because Moodle supports standards for information sharing (eg SCORM 1.2) and protocols for communication with other systems.



There are many different types of activities and resources in Moodle that can be used in programming training, such as Assignment, Glossary, Lesson, Quiz, Workshop. Forums, wikis, blogs, communication resources can be useful and helpful to students. Available resources and activities can be expanded by additional plugins or by integrating external tools. The integration can take place because Moodle supports standards for information sharing (eg SCORM 1.2) and protocols for communication with other systems.

Moodle is developed by Martin Dougiamas to help teachers create online courses with options for interaction and collaborations between students and content. The first version of Moodle was released in 2002. (In Faculty of Technics and Technology - Former Technical College – Yambol, it is using from 2005.) Nowadays the Moodle Project is led and coordinated by Moodle HQ, an Australian company which is financially supported by a network of Moodle Partner service companies worldwide. The development of the system has been assisted by open-source programmers [4].

Moodle has 68 million users worldwide and is one of most widely used Learning Management System that is used not only by schools and universities but also by commercial organizations. The system is user-friendly, highly-configurable, and feature-rich [10]. Moodle is one of the best open source LMS because of its rich features [9,11]:

- Open source system - users can expand system by developing different plugins.
- Social Constructionism pedagogy based system - Moodle offers different learner-centric and collaborative tools.
- Intuitive interface - The system is easy to use with user-friendly simple interface with drag-and-drop features.
- Documentation and support - Moodle has a community of developers and users who work collaboratively to improve the system.
- Flexible and customized system - the modular structure of the system allows the creation of additional plugins and integration of external applications to enhance its functionality.
- Multi-language support - Over 100 language packs are available.
- Standards compliance and interoperability - Moodle is compliant with the international standards, such as Open Source Initiative, IMS LTI™ Certified, SCORM-ADL, Open Badges.

New functionalities can be added to Moodle by developing different plugins. The most useful development for Moodle is the involvement of users and third parties who use Moodle and develop those features and functionalities that are necessary for their users. Sharing them with open source is another value they bring to the public of Moodle users. Many of the plugins are designed by universities and are implemented in student education.

This report examines plugins that are suitable for application in programming training. The specificity of programming training and difficulties, both in conducting tests and exams, and in knowledge testing, are at the heart of the development of new plugins to be applied in this field. This report looks at one of the most used and useful programming learning plugins of the last 3 years: CodeRunner, Adaptive Adapter for CodeRunner and Virtual Programming Lab. CodeRunner and VPL require two steps during their installation: first install the plugin and then install sandbox servers.

CodeRunner is applicable in programming disciplines. CodeRunner is a type of Moodle question that allows teachers to use program codes to evaluate students' response. Students have to write a program code and then teachers have to evaluate that code. Students can run series of tests with their code [6].

CodeRunner currently supports Python2 (considered obsolescent), Python3, C, C++, Java, PHP, JavaScript (NodeJS), Octave and Matlab. The architecture allows easy extension to other languages [2].

CodeRunner is usually configured on a separate machine called a "Jobe server" or "Jobe sandbox machine", which guarantees a greater degree of security when student submit their assignments for testing [7].

The components of CodeRunner are shown on the Figure 1.

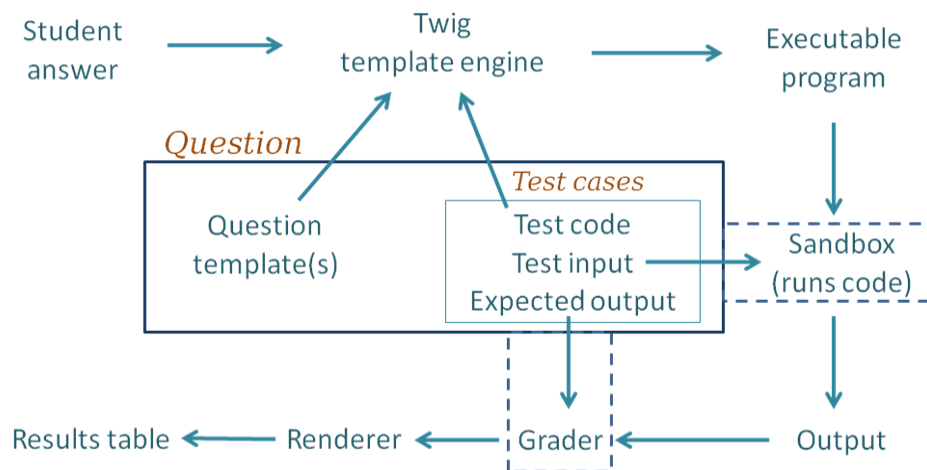


Figure 1. Architecture of CodeRunner [3].

The logic behind checking the submissions is as follows [3]. The student sends his code. For each of the pre-defined test cases, the Twig template engine integrates the student's answer with the pre-set question template and creates an executable program. The executable program is compiled and executed by Jobe sandbox. The output from the execution goes through the Grader component to evaluate the degree of coincidence with the expected results. The result of the comparison is a "test object" that contains the "Expected" and "Received" attributes. All test results are presented to the student by Renderer in a form of a result table, which is colored green (correct results) or red (errors).

3. DISCUSSION AND RESULTS

Programming training is practical and aims at acquiring specific skills. The use of quizzes to test knowledge and skills is rare. The opportunities for their use enrich and diversify the exam forms, facilitate the teachers and assist in the process of refining programming skills.

CodeRunner is a plugin developed for the Moodle system that adds new types of questions and allows quizzes to include items whose answer is code written in Python2, Python3, C, C++, Java, PHP, JavaScript (NodeJS), Octave and Matlab.

The teacher creates questions with CodeRunner, which are stored in the question bank. Creating questions with CodeRunner involves choosing the type of question - the programming code in which programming language will be created, whether it will be a function, class, method, or an entire program. The usual elements of each question - the name of the question, content, number of points, note, and correct answer - should be determined. Teachers can set test cases to automatically check and evaluate the code generated (Figure 2).

▼ Test cases




Figure 2. Test cases.

Part of the process of creating questions is the setup of “mandatory punishment regime” that applies to consistent responses by students after the wrong ones. Teachers can adjust the assessment method and determine the format and degree of “punishment” for incorrectly created code, depending on the number of student attempts or the number of test cases passed.

When students run a quiz with questions created with CodeRunner, they have to create a program code and submit it. If the code is wrong, they can correct it as needed, but any subsequent editing may be accompanied by points deduction as a type of punishment for errors. These opportunities are available because CodeRunner questions are always in adaptive mode no matter what behaviour of the test as a whole is selected [7]. Frequently, teachers choose the delayed feedback as behaviour of the test. Adaptive mode means that after answering the question, students receive immediate feedback on the correctness of the answer. If the code is wrong, errors are displayed and students have the opportunity to make corrections and submit a new answer, but their points are deducted as a penalty (Figure 3).

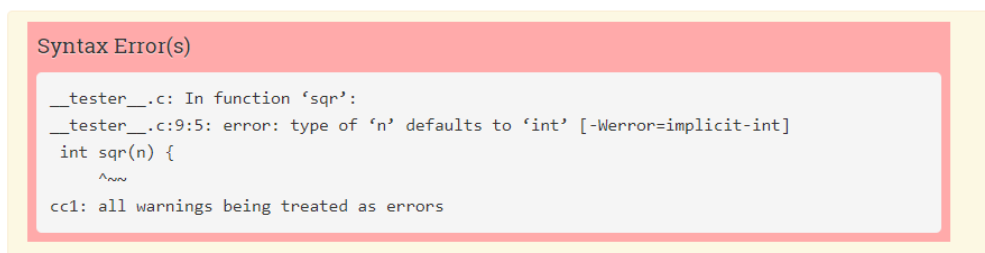


Figure 3. Feedback on wrong answer.

Code validation is based on whether the submitted code passes the pre-defined tests in “All or Nothing mode”. The questions created with CodeRunner use a template to construct a test program from the program code sent by the student and all tests that the teacher has set [5].

Figure 4 shows the successfully passed tests.

	Test	Expected	Got	
✓	<code>printf("%d\n", sqr(-5))</code>	25	25	✓
✓	<code>printf("%d\n", sqr(4))</code>	16	16	✓

Passed all tests! ✓

Figure 4. Feedback on correct answer.

The final automatic evaluation of the questions takes into account the number of answers the student has sent - if the code is correct on the first attempt - 100% of the points, if correct corrections are made upon resubmission - 80% of the points, etc. (Figure 5).

Question author's solution:

```
int sqr(int n) {
    return n * n;
}
```

Правилно

Точки за този отговор: 1,00/1,00. Отчитайки предишните опити за даване на отговор, крайният резултат е 0,90/1,00.

Figure 5. Evaluation with the opportunity to repeatedly send a response.

The benefits of CodeRunner are mainly expressed in the ability to evaluate programming skills through a test form [8].

- CodeRunner is integrated into the Moodle environment, allowing assessment activities to be conducted in a familiar environment for both students and faculty, and the questions created through it can be combined with standard types of multiple choice, free answer questions, drop-down list and more.
 - The plug-in supports a wide range of programming languages and is suitable for assessing students' skills in various programming disciplines.
 - There is an automatic verification and evaluation of the created codes, which allows the assessment of many students in a short period of time without the intervention of the teachers.
 - Immediate detailed feedback, which includes information about the tests performed with the student-created codes, which assists them in independently detecting the errors made and reaching the correct solution of the task.
 - There are opportunities to send the generated codes repeatedly, which allow students to come up with the right solution on their own, which stimulates and motivates them.
- CodeRunner is an opportunity to diversify assessment activities and to some extent automate them. The Moodle add-on has its drawbacks, which are:
- Applicability to not very complex programming tasks, i.e. suitable for initial programming and basic levels in some programme language.
 - Adhering to a specific programming style (setting templates).

By weighing the positives and negatives, it can be concluded that the CodeRunner has significant advantages that automate and diversify forms of testing students' programming skills.

4. CONCLUSION

In this paper, Moodle CodeRunner plugin is presented. According to the purpose of the report, the purpose and features of the installation processes have been clarified. The possibilities of application of the plugins in programming training, their advantages in different types of tasks are discussed. The report outlines the advantages and capabilities of this plugin with a view to its implementation at the Faculty of Technics and Technologies - Yambol.

It is envisaged to analyze their application in the learning process of students in the disciplines related to the study of CPP, Java, JavaScript, HTML.

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AUTOMATIC WATER LEVEL MONITORING WITH IOT AND LPWAN

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АВТОМАТИЗИРАН МОНИТОРИНГ НА ВОДНОТО НИВО ЧРЕЗ IOT И LPWAN

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Abstract: *Monitoring water levels of lakes, streams, rivers and other water basins is of essential importance and is a popular measurement for a number of different industries and organisations. Remote water level monitoring helps to provide an early warning feature by sending advance alerts when the water level is increased (reaches a certain threshold). The purpose of this report is to present an affordable solution for measuring water levels in water sources using IoT and LPWAN.*

The assembled system enables recording of water level fluctuations in real time and storing the collected data on a remote database through LoRaWAN for further processing and analysis.

Keywords: *water level, ultrasonic waves, sensors, measurement station, LoRaWAN, Arduino, Internet of Things (IoT), automation.*

1. ВЪВЕДЕНИЕ

Грижете за доброто състояние на водохранилища, езера, потоци, реки и др., е отговорност на жителите в даден регион, на местните власти и държава. Акцентът попада все по-често върху усилията за запазване качеството на водата, равнището на съответния воден басейн, предотвратяване на наводнения, чрез своевременно предупреждаване [3].

Потоците и реките дават поглед върху състоянието и хидрологията на водоизточниците и функционират като жизненоважен ресурс за човешката дейност, както и местообитание на множество животински и растителни видове. Водните запаси на потоците и реките хранят различни потребления, категоризирани като търговски, битови, промишлени, напояване, животновъдство, минно дело, обществено снабдяване, производство на термоелектрическа енергия и др. Именно затова е важно да бъдат защитени водните басейни и е необходимо при реализацията на всеки бизнес проект в близост до поток, река или друг воден басейн, да се изгражда и подходяща система за мониторинг, за да се гарантира, че хидрологията и качеството на водата са защитени и всяко вредно въздействие може да бъде ограничено или предотвратено, още в момента на неговото възникване. От съществено значение е да се осъществява непрекъснат мониторинг на водните басейни и данните за нивото и качеството на водата в реално време да се съхраняват, обработват и анализират като се използват възможностите на съвременната компютърна и комуникационна техника и технологии.

Целта на настоящия доклад е да представи едно достъпно решение за измерване нивото на водата във водоизточници, чрез използване на IoT и LPWAN. Разработената система, създава възможност за регистриране колебания на нивото на водата в реално време и съхраняване на събраната информация в отдалечена база данни за по-нататъшна обработка и анализ.

2. НЕОБХОДИМОСТ ОТ ИЗГРАЖДАНЕ НА СИСТЕМИ ЗА МОНИТОРИНГ НА ВОДНОТО НИВО

В повечето случаи, оборудването за наблюдаване нивото на реки, язовири, потоци е скъпо и сложно за инсталиране и поддръжка. Това е водеща причина, много водни обекти да не се наблюдават, а последиците от това в много случаи може да са фатални. Метеорологичните аномалии, които водят до резки промени в нивото на водоизточниците стават все по-чести и интензивни. Наводненията са сред най-честите природни бедствия, водещи до скъпи за възстановяване щети, прекъсвания на електрозахранването, финансови загуби, представляват заплаха за живота и здравето на хората, повреждат инфраструктурата. Последното налага технологията за мониторинг на водното ниво и получените данни да са достъпни до институциите, отговарящи за водните басейни, до местните власти и до гражданите, за да ги предупреждава своевременно за предстоящи критични повишавания на нивата на реките и язовирите.

За жителите на районите в близост до водоизточници, съществува повишена опасност от наводнения, причинени от изненадващи, внезапни флуктуации на водното ниво. Събирането на информация за подобни изменения в нивото е важно и при планиране на различни дейности, напр. при аварийно затваряне на шлюзове с цел предотвратяване на обратния поток към ниско разположени зони; пътувания по реките (напр. по р. Тунджа с лодка, водно колело, каяк и др.), риболов, гмуркания и др. Водохранилищата за напояване също трябва да бъдат регулярно наблюдавани, да не се допуска пресъхването им. Предвижда се разгледаната в доклада разработка да намери приложение при водоснабдителната мрежа на гр. Ямбол и по-конкретно за контрол на водното ниво. Охраната на водохранилищата (трите резервоара), които захранват града, е недостатъчна [2] като не е осигурен и непрекъснат мониторинг на нивото. Последното предполага проектиране и изграждане на система, която да изпълнява такива контролни функции, с възможности за своевременно осведомяване при критични ситуации.

3. ПРОЕКТИРАНЕ НА СИСТЕМА ЗА МОНИТОРИНГ НА ВОДНОТО НИВО

В наши дни необходимостта от вода е много висока. Населението нараства с всеки изминал ден и нуждите му не могат да бъдат задоволявани своевременно. Наводненията, недостигът на вода и др. са основни проблеми, които трябва да бъдат разрешавани по най-бързия начин, без да се отлагат [5]. Инженерни организации препоръчват и изготвянето на цялостен план за мониторинг, който да включва оборудване и техники за използване, протоколи за вземане на проби, местоположение на устройства за получаване на пробите и подробности за това как да се интерпретират данните от мониторинга. Предвижда се и разработване на план за управление, описващ конкретните действия, които трябва да бъдат предприети въз основа на резултатите от мониторинга. Но своевременните и ефективни управленски решения и действия са постижими единствено с данни, получени в реално време и обработени и анализирани в изключително кратки срокове.

3.1. Съоръжения и системи за измерване на водно ниво

Разработени са и се прилагат различни системи за измерване на нивото на водните басейни. Съществува система, работеща с множество на брой проводници с различна дължина като всеки отговаря за определена дълбочина [1]. Когато водата докосне съответния кабел, индикатор отчита какво е нивото в този момент. Ако например водата докосва само най-дългия кабел, значи наличното количество е на своя минимум. Всеки проводник може да бъде свързан към диод за визуална индикация [4]. Подготовката на такъв тип система изисква много време от една страна, а от друга при докосването на проводниците от водата, те може да се повредят.

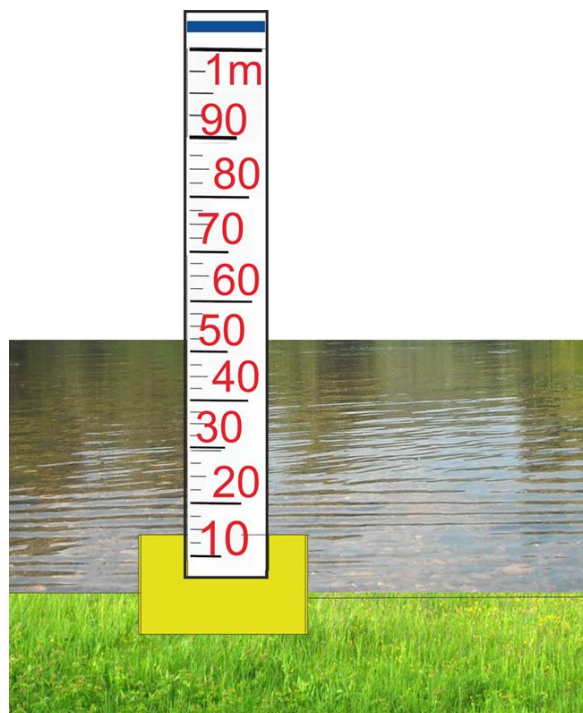
Използват се и ултразвукови методи, които имат редица недостатъци: скоростта на звука през въздуха варира в зависимост от температурата на въздуха; максималното разстояние до повърхността на водата обикновено е 9 метра или по-малко; висока концентрация на фина утайка може да разпръсне и абсорбира звуковия пулс, възпрепятствайки отражението на откриваемо ехо. Дори обикновена кондензация, е в състояние да доведе до проблеми с работата на сензора.

Друга технология за следене на ниво е Position Analog Transmitter (PAT), при която се прилага електромеханично устройство, използвано за преобразуване на ъгловото положение на вал или ос в аналогов или цифров електрически сигнал. Част от механичния аспект на това устройство за измерване на нивото се състои от поплавък и противотежест, прикрепени към връв, увита около ролка, свързана за вала на енодера. Когато нивото се променя, поплавъкът се движи нагоре, надолу и по този начин измества ролката и прикрепения вал, генерирайки електронен сигнал както за посоката на движение, така и за степента. Недостатъци на тази технология са високата цена (над 1500 лева); колебанията в показанията при силна турбулентност или вълнение на водата; ограничената употреба в бързотечащи потоци и необходимостта от по-голямо електрическо захранване от други датчици за ниво.

За измерване на нивото на течност се използват и преобразуватели на налягане - сензорите за налягане (наричани още датчици за налягане или пневматични сензори за налягане), при които сензорът е потопен на фиксирана дълбочина под водната повърхност. Измерва се еквивалентното хидростатично налягане на водата над сензора, като това се използва за изчисляване на общата дълбочина на течността. Тази функция на сензора за налягане може да се сравни с „претегляне на водата“ и се са подходящи за измервания при подземни води. Могат да се отбележат следните недостатъци: в дългосрочен план са податливи на отклонения и вариации според околните температури (препоръчва се калибриране на всеки 6 месеца); задръстване или корозия на частите, пряко изложени на водата, може да повлияе на показанията; прилагат се при широк диапазон за налягането, който трябва да се знае по време на покупките; някои модели изискват вентилиране с атмосферен въздух в тръбичка, за да сравнят с атмосферното налягане за най-добра точност (изисква допълнителна поддръжка); имат сензорна глава, която може лесно да се повреди при допир на хора или други обекти.

Нивомер с балончета е също подходящ за измерване на ниво. Функционира чрез изтласкване на газ (сгъстен въздух или азот) при почти постоянен дебит на дъното на отворена тръба (потопяема тръба), потопена в течност. Измерва се обратното налягане в тази тръба. Типичните системи включват източник на налягане (резервоар за азот или компресор) и регулатор на налягането. Недостатъците на тази система са: устройството трябва периодично да бъде почиствано; ако има промени в плътността на измерваната течност, уреда трябва да се калибрира отново; изисква резервоар под налягане или друг външен източник на налягане.

Старомодна система за следене нивото на река Тунджа в периодите, когато тя излиза от коритото си съществува и се използва в близост до Ямбол, в района на земеделските площи на село Окоп. Създадена през 50-те години на 20-ти век, изградена е от бетонни съоръжения и нивомерна стоманена сонда (стълб) - фиг. 2.



Фигура 2. Стълб за измерване нивото на водата

3.2. Свързване на Dragino Lora Shield (върху Arduino Mega) с The Things Network (TTN)

Dragino Lora Shield е приемо-предавател на дълги разстояния, за монтаж върху Arduino, функционира чрез библиотека с отворен код. Характеристики на Dragino Lora Shield: съвместим с 3.3V или 5v I / O захранване от Arduino; честотен обхват: 915 MHz / 868 MHz / 433 MHz (Предварително фабрично конфигуриран); ниска консумация на енергия; съвместим с Arduino Leonardo, Uno, Mega, DUE; външна антена чрез стандартен I-Pex конектор. Ролята на Dragino Lora Shield в този проект е да осигури безжично свързването по LoRaWAN мрежа на измерващото сензорно устройство с TheThingsNetwork (TTN) IoT сървър. Предаващото устройство (Node), състоящо се от Arduino Mega с монтиран върху него Dragino Lora Shield и свързан към тях сензор, първо трябва да бъде регистрирано правилно в The Things Network (TTN). Възловата точка (Node) събира данните от сензора и ги изпраща по LoRa мрежата [7]. Регистрирането в TTN става като в <https://console.thethingsnetwork.org/> се посочи линк „Application“, след което последователно „Add Application -> Register Device“. На следващата отворена страница, настройващият оператор попълва полето „Device ID“ с уникално име за клиентското устройство. Поискава се произволно генериране на „Device EUI“ и „AppKey“. След това се клика върху „Регистрация“. В меню „Настройки“ (Settings) се разрешава „ABP“ като „Активиращ режим“ с искане за произволно генериране на „App Session Key“ и „Network Session Key“. За да взаимодейства с LoRa

предавателя, е използвана библиотека Arduino-LMIC на matthijskooijman (съдържа модифициран вариант на библиотеката IBM LMIC (LoraMAC-in-C) за работа в Arduino среда, позволяваща използването на предаватели SX1272, SX1276 и др. съвместими с тях модули). Инсталира се с помощта на Arduino Library мениджъра ("Sketch" -> "Include Library" -> "Manage Libraries..."), или като се изтегли архивен файл от Github (с помощта на бутона "Download ZIP"), който операторът трябва да инсталира ръчно чрез IDE ("Sketch" -> "Include Library" -> "Add .ZIP Library ...") [6]. Arduino-LMIC библиотеката е предварително модифицирана за работа с 868MHZ Dragino LoRa платки.

Кодът на фиг. 3 е част от изпълнявания изпращанията, при условие че операторът е заменил правилно променливите "NWSKEY", "APPSKEY" и "DEVADDR" с уникалните стойности Network Session Key, Application Session Key и Device Address, предоставени от конзолата на TTN:

```

1 #include <lmic.h>
2 #include <hal/hal.h>
3 #include <SPI.h>
4 // LoRaWAN NwkSKey, network session key
5 static const PROGMEM u1_t NWSKEY[16] = { 0x1B, 0x2E, 0x15, 0x16, 0x28, 0xAE, 0xD2,
6 // LoRaWAN AppSKey, application session key
7 static const u1_t PROGMEM APPSKEY[16] = { 0x1B, 0x2E, 0x15, 0x16, 0x28, 0xAE, 0xD2,
8 // LoRaWAN end-device address (DevAddr)
9 static const u4_t DEVADDR = 0x01234507 ; // <-- Change this address for every node!
10 static uint8_t mydata[] = "Hello, ICTTE 2019!";
11 static osjob_t sendjob;
12 const unsigned TX_INTERVAL = 60;
13 const lmic_pinmap lmic_pins = {
14     .nss = 10,
15     .rxtx = LMIC_UNUSED_PIN,
16     .rst = 9,
17     .dio = {2, 6, 7}

```

Фигура 3. Псевдокод за изпращане на данни до TTN

3.3. Следене на водното ниво с ултразвуков сензор за разстояние HC-SR04

Модулът HC-SR04 най-често намира приложение в проекти, където е необходимо отчитане на разстояние, избягване или откриване на обект и др. Захранва се с напрежение 5V и консумира приблизително ток 6mA. В настоящия проект, приложението му е да засича нивото на водата в речното корито. В колаборация с Arduino, Lora Shield, Sentrius Gateway ще има възможност да изпраща данните през LoRaWAN и Интернет до TTN сървъра. Веднъж достигнали TheThingsNetwork (TTN), данните могат да бъдат публикувани онлайн. HC-SR04 е ултразвуков сензор с ниска цена, осигуряващ безконтактна функционалност от 2 cm до 400 cm с точност на измерване, която може да достигне до 3 mm. Всеки модул HC-SR04 включва ултразвуков предавател, приемник и контролна верига. Има само четири пина: VCC (Power), Trig (Тригер), Echo (Receive) и GND (Ground). Лесен за настройка и измерва нивото на водата, без да се използва сонда или допир с течности. Засича разстоянието до водната повърхност. При всяко измерване, HC-SR04 се намира на една и съща позиция, може да се прикрепи към стабилна основа по брега (бетонна дига, мост, дърво и др.). Компонентите са свързани към Arduino shield и платката се захранва от 9V батерия или 4бр. 1.5V батерии. За подобряване продължителността на живот на тези батерии, може да се добави TPL5110 платка с таймер, която да активира Arduino на всеки 1 час. Заедно с Arduino се получава измервателен уред за засичане на разстоянието до водната повърхност без употреба на метър, с ултразвуков модул.

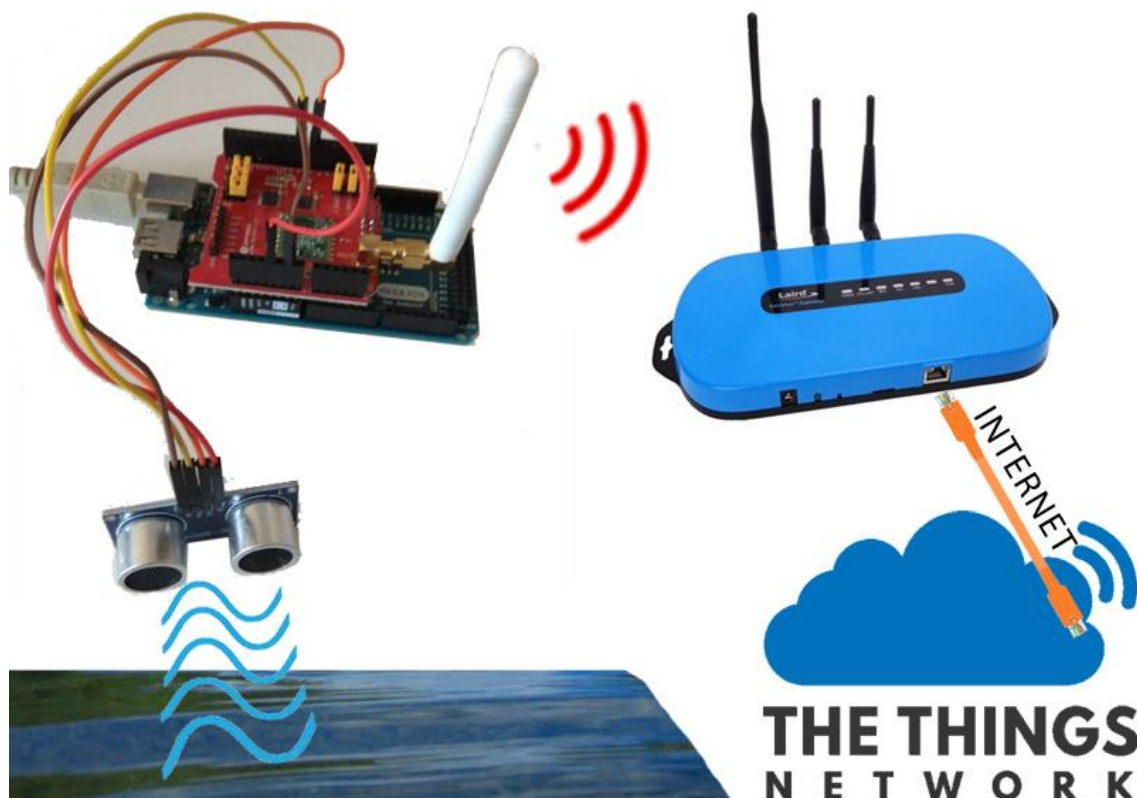
Разстоянието се определя чрез изчисляване на времето, необходимо на ултразвуковите вълни да рикошират в препятствие и да се върнат обратно. Това е подобно на принципа, използван от прилепи и круизни кораби (сонарни системи, ехолокация). Характеристики на използвания HC-SR04: размери: 43 mm x 20 mm x 15 mm; захранване: 5V; консумация на ток: 6mA; честота: 40kHz; обхват: ~ 2 cm – 400 cm; работно напрежение: 5V; ъгъл на отчитане: ~ 15°; интерфейс: цифров. Последователността на работа е следната:

- Предавателят (чрез Trig pin) изпраща сигнал: високочестотен звук.
- Когато сигналът достигне до обект, той се отразява.
- Предавателят (чрез Echo pin) получава отразения сигнал.

Времето между предаването и приемането на сигнала позволява да бъде изчислено разстоянието до обекта. Това е възможно, защото е известна скоростта на звука във въздушна среда. Пинове на сензора: VCC: +5VDC; Trig: Trigger (INPUT); Echo: Echo (OUTPUT); GND: GND. Начин на свързване към Ардуино платката:

- VCC пин се свързва с Arduino +5VDC пин (по червен проводник, към порт 5V).
- Trig: Trigger (INPUT) пин се свързва с Arduino цифров пин 7 (по оранжев проводник, към порт 7 Digital).
- Echo: Echo (OUTPUT) пин се свързва с Arduino цифров пин 8 (по жълт проводник, към порт 8 Digital).
- GND: GND пин се свързва с Arduino GND пин (по кафяв проводник, към порт GND).

HC-SR04 модулът се състои от два барабана, единият от които е излъчвателя, който излъчва ултразвук, а другия - приемник, който получава отразения ултразвук от обекта (Фигура 4). Емитерният барабан изпраща звуковите вълни (извън обхвата на човешкия слух), когато бъде задействан с помощта на пина TRIG_PIN. Веднага след като ултразвукът се изпрати през излъчвателя, модулът задейства пина ECHO_PIN в режим high. Емитираният звук се придвижва напред, докато не се отрази от обекта и след това се връща обратно, така бива засечен от приемника. Когато отразеният звук бъде получен от приемника, ECHO_PIN преминава в режим low. По този начин се установява времето, нужно на ултразвука, за да достигне до обекта и отново да се върне при източника, което също е равно на продължителността, за която ехопинът е бил в режим high. Това време се съхранява в микроконтролера. Следователно времето за пътуване на сигнала между източник и обект е половината от времето, необходимо за пропътуване разстоянието източник-обект-източник.



Фигура 4. Схема на свързване

Примерен код, използван при измервания с HC-SR04 за нивото на водата

На фиг. 5 е представен псевдокод, който работи по следния начин: първо се създават променливи за тригер и ехо пиновете, наречени съответно `trig_Pin` и `echo_Pin`. `Trig_Pin` е свързан с цифров пин 7, а `Echo_Pin` е свързан с цифров пин 8: `const int TRIG_PIN = 7;` `const int ECHO_PIN = 8;` Всичко, отдалечено на над 400см (23200 пулсации) се класифицира като "out of range": `const unsigned int MAX_DIST = 23200.` В `setup()` се задават `TRIG_PIN` като изход, а `ECHO_PIN` като вход; инициализира се серийния порт със скорост на предаване 9600: `pinMode(TRIG_PIN, OUTPUT); digitalWrite(TRIG_PIN, LOW); pinMode(ECHO_PIN, INPUT); Serial.begin(9600).` В частта `loop()` се задейства сензора, като изпраща HIGH импулс от 10 микросекунди. Задава се и кратък нисък (LOW) импулс, за да се подsigури получаването на чист ВИСОК (HIGH) пулс: `digitalWrite(TRIG_PIN, HIGH); delayMicroseconds(10); digitalWrite(TRIG_PIN, LOW).` Операторът `delay(60)` - изчаква поне 60 ms преди следващото замерване. Подготовката на кода изисква да се стартира Arduino IDE, импортират се нужните библиотеки (от падащо меню Sketch), написва се кода, за да бъде ъплоуднат в Arduino платката. Резултатите могат да се следят чрез Serial Monitor.

```

1  const int TRIG_PIN = 7; const int ECHO_PIN = 8; const unsigned int MAX_DIST = 23200;
2  void setup() {
3    pinMode(TRIG_PIN, OUTPUT);
4    digitalWrite(TRIG_PIN, LOW);    pinMode(ECHO_PIN, INPUT);    Serial.begin(9600);
5  }
6  void loop() {
7    unsigned long t1;
8    unsigned long t2;
9    unsigned long pulse_width;
10   float cm;
11   float inches;
12   digitalWrite(TRIG_PIN, HIGH);
13   delayMicroseconds(10);
14   digitalWrite(TRIG_PIN, LOW);
15   while ( digitalRead(ECHO_PIN) == 0 );
16   t1 = micros();
17   while ( digitalRead(ECHO_PIN) == 1);
18   t2 = micros();
19   pulse_width = t2 - t1;
20   cm = pulse_width / 58.0;
21   inches = pulse_width / 148.0;
22   if ( pulse_width > MAX_DIST ) {
23     Serial.println("Out of range");
24   } else {
25     Serial.print(cm);    Serial.print(" cm \t");    Serial.print(inches);
26     Serial.println(" in");
27   }
28   delay(60);

```

Фигура 5. Псевдокод за измервания с HC-SR04 и Arduino

3.4. Предимства на предложената система

Ултразвуковият сензор работи безконтактно, съвместим е с Arduino, Raspberry Pi, Pinguino, Esquilo, NodeMCU, Bolt и др. платформи. Предимства: лесен монтаж под мостове или други конструкции над водата; ограничен е проблема със замърсяването или корозията на сензора. Отличава се с: ниска цена, простота и лесна инсталация, устойчивост, възможност да известява какво е нивото на водата в реално време. Ултразвуковият сензор предлага добро съотношение между прецизност и отдалеченост на измерванията. В комбинация с технологията за дълги разстояния LoRaWan (~5 km до 15 km), дава възможност за сензорно наблюдение в много голяма зона при ниски инфраструктурни разходи, отдалечено управление, дълъг живот на батерията. Системата е създадена, за да предоставя незабавни известявания, оставайки лесна за употреба. В сравнение с контактните технологии за наблюдение, някои, от които не позволяват дистанционно отчитане и достъпа до всяка от станциите е много по-трудоемък, поради необходимостта ѝ да бъде в контакт с водата, HC-SR04 и LoRaWAN спестяват много време. Отличното безжично покритие на LoRaWAN осигурява възможност сензорите и платките да бъдат прибрани в IP67 водоустойчиви кутии.

4. ЗАКЛЮЧЕНИЕ

Основен причинител за наводненията и недостига на вода, е слабият контрол или липсата на такъв от страна на отговорните институции и гражданите. При разработването на стратегия за мониторинг, трябва да се търси осигуряване на бърза обратна връзка, позволяваща да се реагира на потенциалните проблеми своевременно.

Неправилната поддръжка води до занижаване възможностите и претоварване на водохранилища, речни корита и др. водни басейни. Монтирането на автоматизирана система за наблюдението им, е в състояние да се справи с тези и с други, впоследствие възникнали проблеми. Представеният проект може да бъде начало на икономически изгоден, автоматизиран мониторинг в реално време на водното ниво и своевременно получаване на известия, когато реката или водохранилището достигне критична точка. Съчетаването на IoT и LPWAN при автоматизираното наблюдение над водите на река Тунджа, ще даде възможност за: комуникации на дълги разстояния при ниско потребление на енергия; събиране на информация от различни точки, чрез поставяне на множество сензори; мониторинг на труднодостъпни локации. Сравнително лесният за монтиране и евтин ултразвуков сензор предлага добро съотношение между прецизност и отдалеченост на измерванията, безконтактно следи водното ниво и е устойчив на замърсявания. Системата е съставена от отделни модули, което я прави адаптивна към всякакви работни среди. Достъпността на решението дава възможност да бъде инсталирано преди и след притоци, при реки, язовири и други водни басейни; на местоположения, където магистралите и пътищата се наводняват; до малки потоци, които текат през населените места, включително и да служи за резервно наблюдение на критични и труднодостъпни точки.

5. ЛИТЕРАТУРА

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SELECTION OF THE MATHEMATICAL MODEL FOR THE USE OF ENROFLOXACIN IN CATS

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Abstract: *The process of changing the concentration of enrofloxacin in blood plasma in cats after single intravenous injection was identified by three mathematical models - algebraic and two models represented respectively by a first order differential equation and a second order differential equation. In order to select the best model of the three, the Akaike information criterion corrected is used. With the most identification parameters differs the model based on a second-order differential equation. The lowest value of the Akaike information criterion corrected was also obtained with it. This fact gives reason to choose it for the best model for describing the research process.*

Keywords: *mathematical model, identification, enrofloxacin, Akaike's information criterion, Korelia.*

ИЗБОР НА МАТЕМАТИЧЕСКИ МОДЕЛ ПРИ ПРИЛОЖЕНИЕ НА ЕНРОФЛОКСАЦИН ПРИ КОТКИ

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1. ВЪВЕДЕНИЕ

Енрофлоксацинът е широкоспектърно антибактериално лекарство, официално регистрирано и разрешено за употреба във ветеринарномедицинската практика. Спада към така нареченото „второ поколение“ от флуорираните хинолони [1,4]. В [2] е проследена промяната на концентрацията на енрофлоксацина в кръвната плазма на котки, като са сравнени динамичните параметри на фармакокинетиката на препарата при три метода на прилагането му. За всеки от начините на третиране с лекарството: еднократно венозно и подкожно инжектиране на субстанция от енрофлоксацин хидрохлорид и вътрешно прилагане във вид на таблетки, са съставени алгебрични уравнения. Те представляват решения на диференциални уравнения от първи ред. Целта на настоящото проучване е избор на математически модел за описание на процеса на промяна на концентрацията на енрофлоксацин в кръвната плазма при котки след еднократно венозно инжектиране. За реализирането ѝ е използвана идентификация чрез три математически модела – алгебричен [2], диференциален от първи ред и диференциален от втори ред. Изборът е направен с използването на коригирания информационен критерий на Акайке, като е анализиран и броя на идентификационните параметри.

2. МАТЕРИАЛ И МЕТОДИ

Експерименталният дизайн и методиката на получаване на данните са представени в [1]. При идентификацията са използвани тяхната средна стойност и стандартно отклонение.

2.1. Използван софтуер

Обработката и анализът на данните са осъществени със специализиран софтуер от фамилията KORELIA. Потребителски ориентираният интерфейс [13] и модулът за разпознаване на изследвания процес [9,12] улесняват въвеждането на данните и подпомагат избора на математически модел. Идентифицираните уравнения [8] могат да бъдат анализирани и сравнявани по редица параметри [10] и по този начин да бъде намерено най-подходящото за конкретното множество [11].

За оптимизация е приложен критерия за минимизиране на квадратичната грешка. За оценка на близостта на идентифицираните параметри до експерименталните данни за всеки от моделите е използван коефициентът на детерминираност R^2 .

Поради наличието на три модела, описвани с различни уравнения не е допустимо тяхната близост до данните да бъде оценявана с коефициента на детерминираност. Подходящ за случая е информационния критерий на Акайке (Akaike information criterion, AIC) [3,6,11].

Когато броят на информационните точки N е малък в сравнение с броя на идентификационните параметри K ($\frac{N}{K} < 40$), е необходимо използването на коригираната версия на информационния критерий на Акайке от втори ред (Akaike information criterion corrected, AICc) [5,7]. Ако $N \rightarrow \infty$ стойностите на двата критерия се доближават.

В случаите, когато резултатите от AICc са много близки се налага да се използват допълнителни критерии за оценка на моделите. От AICc може да се изчисли достоверност на модела (Probability of the model - $P_{I,J}$).

$$P_{I,J} = \frac{1}{1 + e^{0.5\Delta_{I,J}}} \quad (1)$$

където: $\Delta_{I,J} = AICc_I - AICc_J$

I, J – номера на сравняваните модели

При сравняването може да се използва и доказателствения коефициент (Evidence ratio - $ER_{I,J}$), представляващ отношение на достоверностите на два сравнявани модела във вида:

$$ER_{I,J} = \frac{P_{I,J}}{P_{J,I}} = e^{-0.5\Delta_{I,J}} \quad (2)$$

2.2. Математически модели

Идентифицирани са три математически модела.

2.2.1. Алгебричен модел (Модел 1)

В [2] подробно е описан използваният алгебричен модел, който представлява решение на диференциално уравнение от първи ред

$$\left| \begin{array}{l} y(t) = (C_0 - C_\infty)e^{-rt} + C_\infty \\ C_\infty = \lim_{t \rightarrow \infty} y(t) = \frac{K \cdot U}{r} \end{array} \right. \quad (3)$$

където: $U(t)$ – приложена доза енрофлоксацин
 C_0 – начална стойност

Параметрите, които са идентифицирани са:

r – скоростна константа на процеса
 K – коефициент на чувствителност

2.2.2. Диференциален модел от първи ред (Модел 2)

$$\left| \begin{array}{l} \frac{dy(t)}{dt} + r \cdot y(t) = K \cdot U(t) \\ y(0) = C_0 - \text{начално условие} \end{array} \right. \quad (4)$$

където: $U(t)$ – приложена доза енрофлоксацин

Параметрите за идентификация са:

r – скоростна константа на процеса
 K – коефициент на чувствителност

2.3. Диференциален модел от втори ред (Модел 3)

Той се представя с уравнението:

$$\left| \begin{array}{l} \frac{d^2y(t)}{dt^2} + 2 \cdot \zeta \cdot \omega \cdot \frac{dy(t)}{dt} + \omega^2 y = K \cdot \omega^2 \cdot U(t) \\ y(0) = C_0 \\ \frac{dy(0)}{dt} = 0 \end{array} \right. \quad (5)$$

начални условия

където: $U(t)$ – приложена доза енрофлоксацин

Параметрите за идентификация са:

ζ – коефициент на потискане
 ω – собствена честота на системата
 K – коефициент на чувствителност

3. РЕЗУЛТАТИ И ДИСКУСИЯ

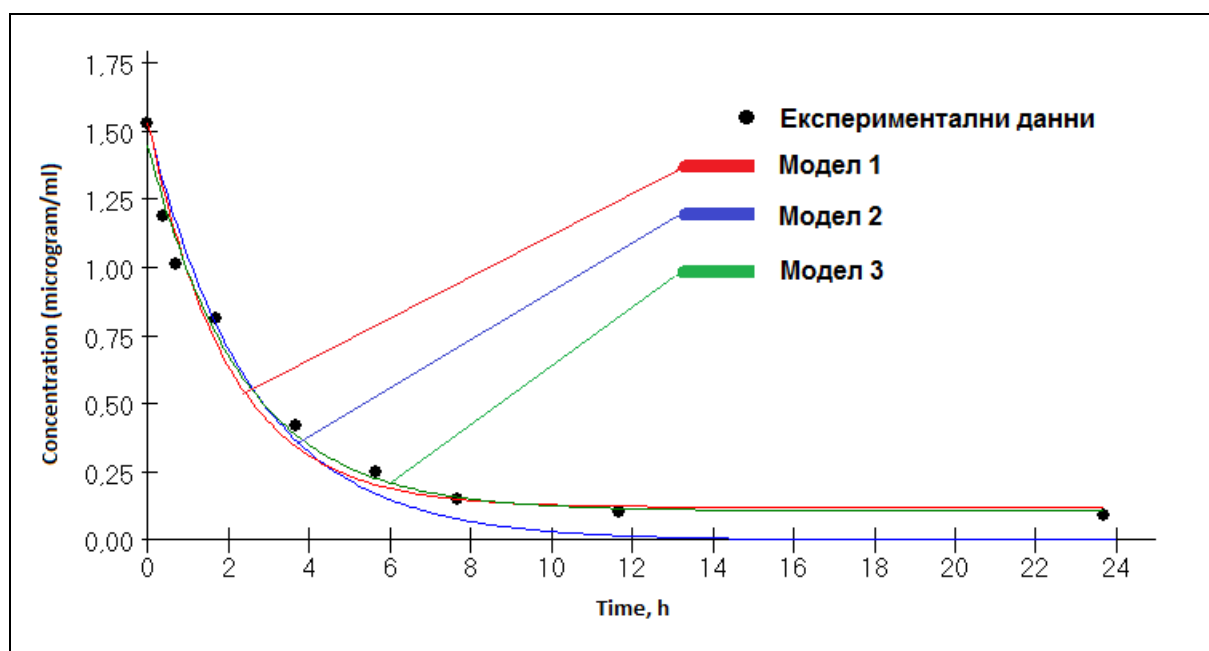
Изчисляването на идентификационните параметри за всеки от трите модела е осъществено с програма KORELIA-Ident. На тяхна база са получени следните уравнения:

$$\text{Модел 1} \quad y(t) = 1.34 \cdot e^{-0.42t} + 0.10 \quad (6)$$

$$\text{Модел 2} \quad \frac{dy(t)}{dt} - 0.39 \cdot y(t) = 0 \quad (7)$$

$$\text{Модел 3} \quad \frac{d^2y(t)}{dt^2} + 93.71 \frac{dy(t)}{dt} + 47.06y = -28.24 \quad (8)$$

На Фигура 1 са представени графиките на моделите.



Фигура 1. Изменение на концентрацията на енрофлоксацин при трите модела

Параметрите, използвани за сравнение на трите математически модела са представени в Таблица 1.

За пресмятане на достоверността на модела и доказателствения коефициент са използвани формули (1) и (2). Изчисленията са направени с Excel. Стойностите за R^2 , квадратична грешка и AICs са получени при идентификацията с програма KORELIA-Ident. Използвана е коригираната версия на AIC за избор на модел от трите поради сравнително близките стойности на N и K в изследвания процес.

Таблица 1. Сравнение на моделите след идентификация

Модел	Брой параметри за идентификация	R ²	Квадратична грешка	AICc	ΔAICc	P _{i,j}	ER _{i,j}
Модел 3	3	0,980	0,045	-2304			
Модел 1	2	0,987	0,030	-2192	112	6,7917E-25	1,47239E+24
Модел 2	2	0,964	0,082	-2151	153	5,53578E-34	1,80643E+33

За най-добър модел съгласно критерия AICc се избира този, който е с най-малка стойност. Изпълняващият това условие е диференциалния модел от втори ред – Модел 3. Стойностите на P_{i,j} и ER_{i,j} показват, че трите модела се различават помежду си.

4. ЗАКЛЮЧЕНИЕ

Процесът на промяна в концентрацията на препарата енрофлоксацин в кръвната плазма при котки след еднократно венозно инжектиране е идентифициран чрез три математически модели - алгебричен, диференциален от първи ред и диференциален от втори ред. За избор на „оптимален“ модел е използван коригираният информационен критерий на Акайке. Най-ниската му стойност е получена при математическия модел, базиран на диференциално уравнение от втори ред и отличаващ се от другите два с по-голям брой параметри за идентификация – три на брой.

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STEGANOGRAPHIC METHODS FOR EMBEDDING INFORMATION IN DIGITAL OBJECTS TO PROVIDE INFORMATION SECURITY IN THE CONCEPT OF "INTERNET OF THINGS"

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Abstract: *Internet of Things is a new world for connecting object space in the real world with virtual space in a computer environment. To build IoT as an effective service platform, end users need to trust the system. With the growing quantity of information and communication technologies, the need to ensure information security and improve data security is increasing. One of the potential solutions for this are steganographic methods. Steganography based on the least significant bit (LSB) is a popular and widely used method in the spatial domain.*

Keywords: *information security, Internet of Things, IOT, information embedding, digital images, steganography, steganalysis, steganalysis methods, cover object, security.*

СТЕГАНОГРАФСКИ МЕТОДИ ЗА ВГРАЖДАНЕ НА ИНФОРМАЦИЯ В ЦИФРОВИ ОБЕКТИ ЗА ОСИГУРЯВАНЕ НА ИНФОРМАЦИОННА СИГУРНОСТ В КОНЦЕПЦИЯТА ЗА „ИНТЕРНЕТ НА НЕЩАТА”

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1. ВЪВЕДЕНИЕ

Изследователите на безжични технологии обръщат все повече внимание на концепцията за Интернет на нещата (Internet of Things, IoT), която съчетава голямо разнообразие от електронни устройства, комуникационни технологии и протоколи за взаимодействие [5]. При Интернет на нещата уникални и идентифицируеми крайни точки (физически обекти, неща), осъществяват безжична комуникация в една глобална мрежа, като самостоятелно получават и изпращат информация чрез IP свързаност. Тези данни могат да бъдат споделяни пряко с управляващи устройства, със софтуерна програма или с хора, за да предизвикат незабавно действие или, за да се генерират варианти за бъдещи действия. Идеята е като цяло да се повиши производителността и условията на работа в ежедневието.

Благодарение на мащабното развитие на Интернет, на технологичните иновации и комуникации, IoT се развива с невероятна скорост, включват се все по-голям брой устройства и все повече данни [10]. В същото време редица експерти в областта на информационната сигурност отбелязват, че разпространението на взаимодействието на техническите системи без човешка намеса представлява доста сериозни заплахи за

сигурността. От една страна, дистанционното управление на умните неща осигурява по голям комфорт, но повечето от тях са в начална фаза на своето внедряване и развитие и попаднали в ръцете на зложелател, значително увеличават рисковете в областта на информационната сигурност.

Според резултатите от тримесечно проучване на глобалните заплахи за киберсигурността Global Threat Landscape Report на Fortinet през март 2019 г. шест от дванадесетте най-често срещани уязвимости са свързани с Интернет на нещата. Ниската сигурност на IoT устройства дава възможности за атаки за киберпрестъпниците. Обикновено стеганографските методи не се използват в най-често срещаните атаки, но след постиженията в областта на стеганографията, вече е налице увеличаване на интереса на атакуващите към този тип атаки, отбелязва Fortinet.

По време на проучването изследователите са открили образци на зловреден софтуер, които използват стеганография, за да скрият злонамерен код директно в мемовете, разпространени в социалните мрежи. Опитвайки да се свърже с командния сървър, кодът търси изображения в съответната емисия в Twitter, качва ги и след това търси скрити команди в тях за по-нататъшно разпространение. Този скрит подход показва, че киберпрестъпниците продължават да експериментират различни възможности за инжектиране на злонамерен код с помощта на цифрова стеганография.

Съвременните стеганографски методи, които се обобщават в направлението цифрова стеганография и изучават възможностите за скриване на информация в друга, анализирайки особеностите в цифровото представяне на данни, са предназначени основно за защита на мултимедийни данни. Въпреки това, някои изследователи се опитват да използват тези методи за решаване на проблеми със сигурността в концепцията за Интернет на нещата.

В настоящия доклад са разгледани такива подходи в научни изследвания, които могат да бъдат използвани в IoT, когато в електронен вид се съхранява и употребява цифрово представена информация.

2. СТЕГНАЛИЗ В ИЗОБРАЖЕНИЯ

Поради изключително бързото развитие на съвременните технологии, употребата на цифрови мултимедийни файлове - представляващи огромна разновидност и разнообразие от различни файлови формати, се засилва със всеки изминат ден. Глобалната употреба и разпространение на голям брой различни цифрови файлови формати предоставя неограничени възможности за скриване на поверителна информация, с цел нейното предпазване от всякакви нерегламентирани посегателства, запазвайки конфиденциалността на информацията.

Стеганографската система (стегосистема) е набор от различни методи и инструменти, използвани за създаване на скрит канал за предаване на информация [2,8]. Контейнер за скриване на информация се отнася до всеки файл, чиято структура и размер позволяват да се скрият необходимите данни. Сигурността в една стеганографска система зависи от стеганографския метод и алгоритъм, използван за скриване на съобщението.

Стеганализът (steganalysis) е наука за идентифициране на фактите за прехвърлянето на скрита информация в цифровите обекти и обединява методи и технологии за откриване на секретни стеганографски комуникации [14]. Тези методи позволяват да се определи количеството скрита информация, както и да се определи кой стеганографски метод е бил използван за вграждане. По този начин се унищожава целта на стеганографията – секретната комуникация. Стеганализът е

противодействието на стеганографията. Оценката и идентификацията на слабостите на стего средствата чрез стеганализ, помагат за усъвършенстване сигурността им.

Стегоаналитичен метод (steganalytic technique) е съвкупността от атаките и методите за изследване на получения стегофайл (сумарният файл, който съдържа скритото съобщение). Повечето от известните методи за стеганализ се базират на откриване на следи от използвани стегопродукти, тъй като е доказано, че при самия процес на скриване на съобщението във файла носител, стеганографската система оставя характерни цифрови отпечатъци вътре в неговите характеристики. Тези доловими следи в стегофайловете, наричани сигнатури, се сравняват с такива, събрани в специални бази от данни, подобно на антивирусните приложения и системите за откриване на нахлуване и позволяват на подслушвача да засича променената среда, разкриваща че съществува секретно послание. Въпреки, че самото съобщение все още не е компрометирано, с разкриването на скрития стегоканал за комуникация главното предимство и основна цел на стеганографията е провалено.

Ключов подход при стеганализа за стеганалитика е да започне първо с проучване на свойствата на стегофайла. Правилно отчетените свойства могат да доведат до много точна класификация, затова е важно познаването на основните стеганографски методи и алгоритми, техните основни характеристики, предимства и недостатъци.

Алгоритмите за стеганализ в зависимост от работните сценарии и ресурсите, с които разполага стеганалитика, както и от ефекта, който се търси, биват основно три – пасивен (passive), активен (active) и злонамерен (malicious). При използването им се създават различни стегозаплахи (stego-threats), които решават три проблема – намиране на неуспоримо доказателство на факта за наличие на скрито съобщение, определяне на неговия размер (дължина) и разкриване на тайното послание [7].

Цифровата стеганография изучава възможностите за скриване на информация в друга, анализирайки особеностите в цифровото представяне на данни, както и слабостите на човешките възприятия. Един от най популярните съвременни методи за стеганографска защита е LSB (Least Significant Bit), основаващ се на използването на най-младшия бит за представяне на скрити данни. Вграждането е действие на стегосистемата по поставяне на съобщението в контейнера.

Стегосистемата е нестабилна, ако съществуват методи, които позволяват да се идентифицира фактът на работа на системата. Нивото на шума, създаден при вграждане на контейнера се оценява с абсолютна оценка [6]:

$$Nrms = \sqrt{\frac{\sum_{i=0}^{k-1} (B_i - A_i)^2}{k}}, \quad (1)$$

където $Nrms$ е стандартното отклонение на реалния сигнал, описващ изображението от полезния; B_i е стойността на i -тия елемент на запълнения контейнер; A_i е стойността на i -тия елемент на празен контейнер; k е броят на елементите в контейнера.

Въз основа на абсолютната оценка може да се изчисли оценката на пиковото съотношение сигнал-шум $PSNR$ [3], измерено в децибели:

$$PSNR = 20 \log_{10} \left(\frac{A_{max}}{Nrms} \right), \quad (2)$$

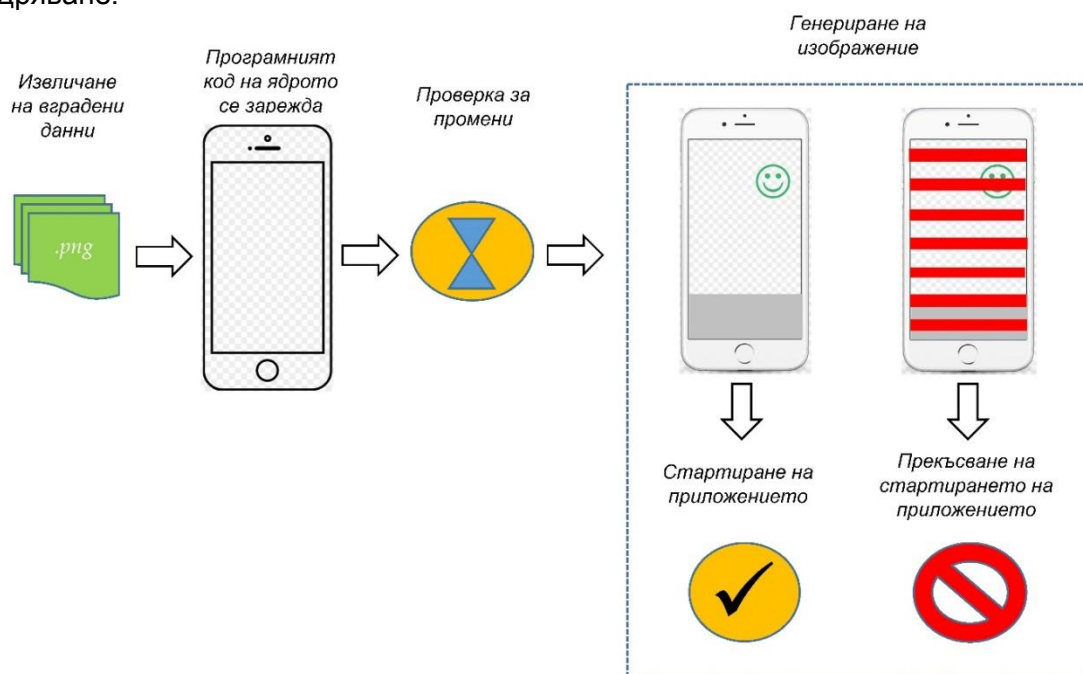
където $PSNR$ е пиковото съотношение на полезния сигнал към шума; A_{max} - максимална стойност на сигнала; $Nrms$ е абсолютна оценка.

3. ПРИЛОЖЕНИЕ НА СТЕГАНОГРАФСКИ МЕТОДИ ЗА ВГРАЖДАНЕ НА ИНФОРМАЦИЯ В ЦИФРОВИ ОБЕКТИ ЗА ОСИГУРЯВАНЕ НА ИНФОРМАЦИОННА СИГУРНОСТ В КОНЦЕПЦИЯТА ЗА „ИНТЕРНЕТ НА НЕЩАТА”

Тъй като в концепцията за Интернет на нещата взаимодействието на потребителите с различни „умни“ устройства най-често се осъществява чрез мобилни приложения, на първо място е важно е да се гарантира тяхната безопасност. Авторите изучаващи този проблем [11] предлагат метод за защита на мобилни приложения за операционната система Android с помощта на LSB стеганография, чиято идея се основава на факта, че мобилните приложения съдържат голям брой изображения във формат PNG, в които могат да се скрият компонентите на основния код на приложението, като се вградят в стеганографски изображения. Капацитетът, който е наличен е равен на средно 3,05 бит/пиксел.

Схемата е проектирана така, че един зложелател не може да получи основния код и да заобиколи процедурата за откриване на неотризиран промени, просто заобикаляйки синтаксиса на сравнението. Според нея изображенията в приложението (графичните интерфейсни елементи) се показват в оригиналния си вид само при успешно стартиране. Ако в приложението се въведат злонамерени кодове, изображенията ще се показват неправилно или изобщо няма да се показват, което ще позволи на потребителя визуално да открие фалшивите. Схемата на предложението метод е илюстрирана на фиг.1.

Описаният метод успешно предотвратява статичен и динамичен анализ на програмния код. Според авторите, предложената схема е подходяща за почти всяко приложение за Android и е по-надеждна от маскиране на кода на приложението. Въпреки това, при прилагането на този подход може да се наложи модификация на операционната система на мобилните устройства, което ще доведе до значителни разходи за внедряване.



Фиг. 1. Защита на мобилно приложение за Android, чрез скриване на код в PNG изображения [11]

Три алгоритъма за защита на данните в концепцията за Интернет на нещата, при които чрез стеганография RGB изображения се използват като носители на информация, предлагат авторите на [10]. При растерната графика графичното изображение се представя като правоъгълна мрежа (растер) от пиксели. За представяне на цветовете при растера се използват различни цветови модели. Сред най-разпространените модели е RGB системата (Red червен, Green - зелен, Blue - син). На базата на два принципа в растерните изображения е възможно да бъде скривана и друга информация - тъй като дигитални изображения могат да бъдат променени без да се нарушава функциите им и неспособността на човека да различи минимални разлики в цвета на едно изображение. Това позволява използването и модифицирането на излишната информация в тези файлове. В трите алгоритъма подходящите за вграждане позиции на пикселите се намират с помощта на секретен ключ.

Първият алгоритъм намира три подходящи позиции на три пиксела във всеки един от трите цветни канала R, G и B и променя всяка една от стойностите на най-младшите битове на съответния пиксел, така че впоследствие наличието или отсъствието на скрито съобщение да бъде еднозначно определено. Най-младшият бит в едно изображение носи в себе си най малко информация. Известно е, че човек не би могъл да усети промяна в този бит. За да извлече информация, алгоритъмът първо проверява всички най-младши битове на трите канала и след това изчислява позицията на скритите битове, при които стойността на най-младшият бит съответства на наличието на вграждане. Капацитетът при този алгоритъм е 1,24 бит / пиксел, а стойността на пиковото съотношение сигнал-шум PSNR между оригиналното изображение и кодираното изображение е 60 - 61 dB. По-високата стойност на PSNR означава по-добро качество на изображението.

Вторият алгоритъм използва само цветните канали G и B, за скриване на информация. Той намира две подходящи позиции на два пиксела в двата канала и като сравнява битовете необходими за скритото съобщение и битовете на избраните позиции, избира тази с най-голям капацитет. При този алгоритъм капацитетът също е 1,24 бит / пиксел, но стойността на пиковото съотношение сигнал-шум PSNR е 53 - 53,5 dB.

Третият алгоритъм използва трите цветни канала, за да скрие информация. Той намира две подходящи позиции в тях, като същевременно също проверява за позиция с максимален капацитет. Капацитетът и при този алгоритъм се запазва, но стойността на пиковото съотношение сигнал-шум PSNR е между 50,5 - 51 dB.

И трите алгоритъма осигуряват висок капацитет и незабележимост на вграждане, а резултатите от представените експерименти демонстрират стабилност на към RS-стеганализа.

Отново за повишаване на сигурността на предаване на данни в „Интернет на нещата“ използват популярния и широко използван в пространствената област метод LSB авторите на [4]. Отчитат че конвенционалните методи, базирани на LSB стеганография, са фокусирани главно върху увеличаване на капацитета на вградената информация и осигуряване на невидимост, докато проблемът със сигурността все още се нуждае от решение, тъй като вграждането чрез LSB е уязвимо за няколко често срещани атаки на данни.

Представената разработка осигурява иновативен подход за увеличаване на скрития трансфер на данни в една система. Тайната информация се обработва предварително, като се използва модифициран генетичен алгоритъм. Цифрово изображение се кодира с класически LSB метод, като позициите на вграждане на пикселите се определят с генетичен алгоритъм. Този процес повишава сигурността на информацията, тъй като получените данни не могат да бъдат дешифрирани без правилен секретен ключ.

Предложеният метод е тестван на различни изображения, заедно с класически LSB методи. Посочва се, че предлаганият метод повишава устойчивостта на стего изображения към атаки от недоброжелатели. Също към предимствата на иновативния метод е увеличеното пиковото съотношение сигнал-шум (PSNR) в стего изображенията. По този начин, предлаганият метод повишава стабилността на стего изображенията.

Авторите на [13] предлагат стеганографски метод за защита на медицинска информация, подходящ за предаване на данни в реално време в концепцията за „Интернет на нещата“, например за системи за мониторинг на здравето. Контейнерът за изображения в цветовия модел RGB е разделен на отделни равнини. Защитените данни, представени като двоичен вектор, също са разделени на три вектора с еднаква дължина, които впоследствие трябва да бъдат вградени в съответните равнини, използвайки един и същ ключ. Два адресни вектора, а именно: първичен адресен вектор (MAV) и вторичен адресен вектор (CAV), се използват като псевдослучайни адреси за адресиране на местоположенията на пикселите в процеса на скриване на информация.

Вграждането на данни се извършва по метода на заместване на два или три най-младши бита. В допълнение, в контейнера за изображения се въвежда цифров воден знак (ЦВЗ) (digital watermarking), предназначен да контролира целостта на данните след предаването. Авторите на предложението метод отбелязват, че използването на стеганографско вграждане в пространствения регион на изображението не изисква големи изчислителни ресурси, което прави метода приложим за „Интернет на нещата“. Освен това, предимствата на този метод включват невидимост на вграждането и висок капацитет: стойността на PSNR е 37,68 dB с капацитет 6 бит/ пиксел и 37,25 dB с капацитет 9 бит / пиксел.

4. ЗАКЛЮЧЕНИЕ

В разгледаните разработки за стеганографско вграждане на информация в цифрови данни за безопасното ѝ предаване в концепцията за „Интернет на нещата“ стеганографията е независим метод за осигуряване на информационна сигурност.

Цифровите изображения са най-често срещани в интернет и имат значителен информационен капацитет за скриване на информацията. Те са най-популярни в стеганографските методи и най-удобни за въвеждане на скрити съобщения. В повечето случаи тези методи са за постигане на малка изчислителна сложност, която е необходимо да притежават „умните устройства“, които ни заобикалят. За да се постигне това свойство, повечето проучвания предлагат да се използват методи, базирани на метода за замяна на най-младшия бит LSB в пространствената област.

Разгледаните стеганографски вграждания се характеризират със свойството обратимост, т.е. възможност за пълно възстановяване на цифровия контейнер след извличане на скрития файл. Това свойство е подходящо за инфраструктурата на Интернет на нещата, тъй като данните, предавани между смарт устройства, често се използват за допълнителен анализ.

На този етап обаче не е намерено универсално решение на проблема с осигуряването на сигурност в „Интернет на нещата“ чрез стеганографско вграждане. Някои от методите са практически неподходящи.

Изграждането на сигурна и безопасна информационна среда в „Интернет на нещата“ изисква разработването на нови ефективни методи, което е обещаваща област за нови изследвания с иновативен потенциал.

5. ЛИТЕРАТУРА

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MULTIPARAMETRIC OPTIMIZATION FOR THE SELECTION AND IMPLEMENTATION OF TECHNOLOGICAL SOLUTIONS FOR THE PRODUCTION OF BIODIESEL FROM WASTE OIL-CONTAINING MATERIALS

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Abstract: *In this work, a multi-parameter, multi-criteria parameter optimization of the mathematical model we have developed is performed. The use of reasonable parameter limits, determined through extensive statistical observations and analyses, enables the generation of optimal technological and logistical solutions for the use of biodiesel. Based on the selection of suitable oil-containing raw materials and such wastes, it allows the construction of optimum technological-logistical chains, providing the necessary amount of biodiesel in a certain territorial unit.*

Keywords: *Biodiesel, Waste Oils, Supply chain, Multi criteria decision making.*

1. INTRODUCTION

The gradual depletion of global oil reserves and increased greenhouse gas (GHG) pollution leads to the search for alternative sources of petroleum fuels. These fuels must meet the rising energy demand and reduce greenhouse gas emissions. Biofuels have the necessary qualities to replace conventional fuels. The European Union therefore requires their use to reach 10% by 2020 through Directive 2003/30/EC, adopted in 2008 [1]. Biodiesel is an alternative renewable fuel and the best candidate for the replacement of diesel in a number of advantages: it is renewable, non-toxic, biodegradable, has a higher cetane number, improves engine performance, increases engine power, reduces fuel consumption and has more smooth burning from diesel [2]. It is also known that its use reduces net CO₂ emissions by 78% on a lifecycle basis compared to diesel [3], also burning pure biodiesel reduces CO emissions by 46.7% and unburnt hydrocarbons by up to 45.2%.

Biodiesel reduces import from diesel from an economic point of view, new jobs are created and energy security is increased in rural areas [4, 5]. Despite these advantages, it is more expensive than diesel, due to the higher cost of feedstock and production costs. Chemically, this biofuel is a mixture of mono-alkyl esters derived from vegetable oils [6] such as: rapeseed, sunflower, soybean, peanut, palm and jatropha oil [7, 8], and algae. It can also be produced from other sources such as: animal fats [9], waste oils.

The main criteria for selecting feedstock for its production are: availability and price. Other criteria that also play an important role in the selection of feedstock are: local soil conditions, geographical location - climate and productivity - oil production per hectare.

The transesterification process is one of the most popular methods for producing biodiesel. It represents an equilibrium reaction between triglycerides and alcohol [10], resulting in the final product and glycerin.

The resulting biofuel can be used alone or by blending with diesel. A system known as the "B" factor has been adopted worldwide to determine the amount of biodiesel in the fuel. For example, fuel containing 20% biodiesel is designated B20. Pure biodiesel is B100. However, two special blends are important. These are B2 and B20 fuels. B2 is preferred to improve lubrication, while blends of B20 are preferred in addition to better lubrication and also to

reduce exhaust emissions. On the other hand, the B100 has many advantages and can replace a diesel, provided it is cheaply produced and in sufficient quantities. The mixture of 20% biodiesel with 80% diesel should be used in diesel engines without any modification, clean biodiesel (B100) should be used in the engine itself to avoid further problems. Their support and hassle-free operation. International standards for biodiesel are EN 14214 and ASTM D 6751.

In this paper, we view the production of biodiesel from both vegetable oils and waste oil-containing materials. They are also a very cheap raw material compared to untreated vegetable oils. These waste cooking oil and fats contaminate the environment if not recycled or used for other purposes. Those using to produce biodiesel will result in a significant reduction in production costs [11]. In the meantime, this can also significantly reduce the amount of arable land which is required to grow feedstock for biodiesel.

Waste fats have been increasingly investigated in recent years [12 - 14], they include as fats from the frying process and having similar chemical and physical properties to the plants from which they are derived.

2. AIM

The aim of this paper is to create multi-parameter optimization for the selection and implementation of technological solutions for biodiesel production. We need to create conditions for stable work between the structural elements of biodiesel supply chain (SC). These are: growing biomass (rapeseed and sunflower), collecting waste oils and fats, transporting feedstock to biorefineries, processing biomass and distributing biofuels.

3. PROBLEM STATEMENT

The problem can be formulated for optimal work of biodiesel Supply chain as follows: The location of the possible Biodiesel Search Centers and the possible Production Centers is specified. The type of biomass to be used, its geographical availability, as well as waste and oil collection centers are determined. Reference is made to the costs of biomass cultivation, the costs of collecting and transporting waste oils and fats, the costs of producing biodiesel by a given technology and the investment for the construction of the facility. The tax on carbon emissions and their quantity for each stage of the production lifecycle have been reported, respectively: biomass cultivation, waste oil transportation, biodiesel transportation and production.

We have introduced fixed and variable costs for the construction of each potential warehouse. The cost of producing each potential biorefinery at different production capacity is taken into account. The capacity (volume, weight) of the different modes of transport used for connection between different centers in the SC is also considered.

3.1. General formulation of the problem

The problem can be summarized, as follows:

- Locations of possible biodiesel search centers;
- Locations of possible production centers;
- Biomass feedstock types and their geographical availability;
- Costs of growing a unit of biomass for each type of feedstock;
- Costs for the collection of waste fats and oils;
- Cost of biodiesel according to the type of feedstock;
- Characteristics of transport logistics (costs, modes, stocks);

- Investment costs for biodiesel production capacity as a function of production technology;
- Specific GHG emissions for life-cycle stages;
- Relevant requirements for the percentage of biodiesel as a constituent of diesel fuel over the period considered;
- Carbon tax;
- Government incentives for biodiesel production and use.

Optimal parameters of the Supply Chain:

- Structure of the Supply Chain;
- Biomass grown in a region by quantity and type;
- Location of production facilities and areas for biomass cultivation;
- Location of waste oil and fat collection centers;
- Location of biodiesel search centers;
- Flows of each type of biomass and biodiesel between regions;
- Types of transport for delivery of biomass, biodiesel and diesel;
- Greenhouse gas emissions for each stage of the life cycle;
- Quantities transported for each transport connection and mode of transportation;
- Biomass Supply Strategy;

Distribution processes for biofuels and diesel delivered in search areas.

The task of multi-parameter optimization is to determine such parameters at given constraints, which ensure a reduction in total costs (capital investment and operating costs) and overall environmental impact over the entire life cycle of the SC.

4. MODEL FORMULATION

This section describes a common mathematical model that helps make decisions when designing and planning a sustainable SC based on the LCA methodology. The model liaises with the Emissions Trading Scheme to achieve the sustainability targets. SC guarantees the link between economic, environmental and social indicators. The study of social aspects (equality of work, health and safety) shows that they are dependent on the context of SC functioning, government policies and cultural norms. So in a mathematical formulation, abstraction from social aspects would not have a negative impact.

4.1. Mathematical model description

To start with the description of the MILP model, we first introduce the parameters, that are constant and known a priori, and the variables that are subject to optimization. Then we describe step by step the mathematical model by presenting the objective function and all the constraints. First of all, we introduce the set of time intervals of the horizon of planning $t=\{0,1,2,\dots,T\}$. The subscript t indicates the variable or parameter corresponding to the t^{th} interval of the planning.

In this part of the mathematical model that is used in the network design is described. Before describing the mathematical model, the input parameters, the decision variables, and the sets, subsets and indices are listed below.

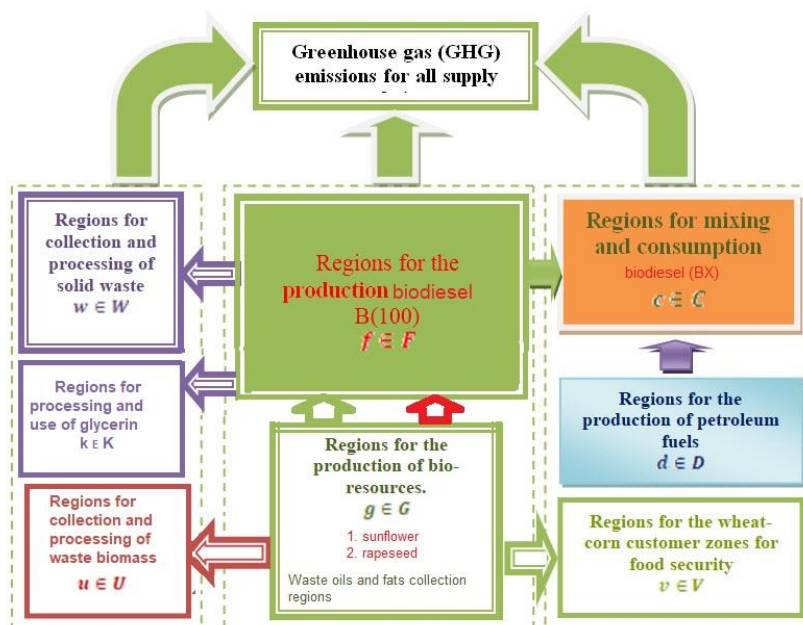


Figure 1. Superstructure of integrated biodiesel- petroleum diesel supply chain

4.2. Model of total environmental impact of IBSC

Environmental assessment criteria will be understood as the overall environmental impact of the IBSC operation through the resulting greenhouse gas emissions at each time interval $t \in T$. These emissions are equal to the sum of the environmental impacts of each stage of the life cycle. Greenhouse gas emissions are usually determined as follows at each time interval $t \in T$:

$$SZI_t = BSB_t + BSD_t + BSS_t + BTT_t + EWL_t + ESTRAW_t + BCAR_t + EWCO_t \quad (1)$$

where,

- SZI_t Total GHG impact at work on IBSC of the life cycle, $[kgCO_2-eqd^{-1}]$;
- $\left. \begin{matrix} BSB_t \\ BSD_t \\ BSS_t \\ BTT_t \end{matrix} \right\}$ Environmental impact of life cycle stages;
- EWL_t Emissions from solid waste recovery at each time interval $t \in T$;
- $ESTRAW_t$ Emissions from residual straw utilization in the regions for each time interval $t \in T$;
- $BCAR_t$ Emissions from the use of biodiesel (B100) and petroleum diesel in vehicles, $[kgCO_2-eqd^{-1}]$;
- $EWCO_t$ Emissions from the disposal of waste oils when not used for biodiesel production (B100).

4.3. Model of total cost of an IBSC

The annual operational cost includes the biomass feedstock acquisition cost, the local distribution cost of final fuel product, the production costs of final products, and the transportation costs of biomass, and final products. In the production cost, we consider both the fixed annual operating cost, which is given as a percentage of the corresponding total capital investment, and the net variable cost, which is proportional to the processing amount. In the transportation cost, both distance-fixed cost and distance-variable cost are considered. The economic criterion will be the cost of living expenses to include total investment cost of bioethanol production facilities and operation of the IBDS. This price is expressed through the dependence is:

$$TDC_t = TLC_t + TPT_t + TZR_t + TYW_t + TSC_t + TTXBA_t - TY_t - TQ_t + TYQZ_t \quad (2)$$

Where,

TDC_t	Total cost of an IBSC for year, [$\$/year^1$];
TLC_t	Total investment costs of production capacity of IBSC compared to the operating period and the purchase of the plant per year, [$\$/year^1$];
TPT_t	Total investment costs for IBSC solid waste treatment plants compared to the operating period and purchase of the plant per year, [$\$/year^1$];
TZR_t	Production costs for biodiesel production (B100), [$\$/year^1$];
TYW_t	Production costs for solid waste disposal, [$\$/year^1$];
TSC_t	Total transportation cost of a IBSC, [$\$/year^1$];
$TTXBA_t$	A carbon tax levied according to the total amount of CO ₂ generated in the work of IBSC, [$\$/year^1$];
TY_t	Government incentives for biodiesel (B100) production and use, [$\$/year^1$];
TQ	Total value of by-products (glycerol, cusp), [$\$/year^1$];
$TYQZ_t$	The price of unused waste oils for the production of biodiesel (B100), which is a penalty function. (This unused part of the waste oil is considered an environmental pollutant that should be minimized).

4.4. Model of social assessment of an IBSC

The IBSC Social Assessment Model is to determine the expected total number of jobs created () as a result of the operation of all elements of the system during its operation.

$$Job_t = SJ1_t + ST_t SJ2_t + ST_t SJ3_t, \quad \forall t \quad (3)$$

where the components of Eq(3) are defined according to the relations for each time interval,

$SJ1_t$	number of jobs created during the installation of bioethanol refineries and solid waste plants;
$SJ2_t$	number of jobs created during the operation of bioethanol refineries and solid waste plants;
$SJ3_t$	number of jobs created by cultivation bioresources for bioethanol production;
ST_t	Duration of time intervals, [$year$].

4.5. Economic objective function

The objective function associated with the minimization of the economic costs includes all the operating costs of the supply chain from purchase of the biomass feedstock to transportation of the final product, as well as the investment cost of biorefineries. The costs of the supply chain include the cost of raw material, the transport of raw material to the facilities, the cost of transport to the biorefineries, the cost of transformation into bioethanol and the cost of final transport to the blending facilities. The economic objective is to minimize the total annual cost over the entire timeframe.

$$COST = \sum_{t \in T} ST_t TDC_t \quad (4)$$

4.6. Environmental objective function

The environmental objective function corresponds to the minimization of the entire environmental impact measured through the Eco indicator 99 method. The cumulative environmental impact of system performance defined as the amount of carbon dioxide equivalent generated over the whole life cycle and during its operation is expressed by means of the equation:

$$ENV = \sum_{t \in T} ST_t SZI_t \quad (5)$$

4.7. Social objective function

As an estimate of the social impact of the system work, the exact coefficients that account for indirect jobs in the local economy are used. Then, the social impact (in terms of jobs) is determined according to the relationship:

$$JOB = \sum_{t \in T} ST_t Job_t \quad (6)$$

5. OPTIMIZATION PROBLEM FORMULATION

The problem for the optimal design of an IBSC is formulated as a MILP model for the objective function of Minimizing cost. The task of determining the optimal location of facilities in the regions and their parameters is formulated as follows:

$$\left\{ \begin{array}{l} \text{Find: } X_t [\text{Decision variables}]^T \\ \text{MINIMIZE } \{COST\} \rightarrow (Eq.4) \\ \text{s.t.: } \{System of Restrictions\} \end{array} \right\} \quad (7)$$

The problem is an ordinary MILP and can thus be solved using MILP techniques. The present model was developed in the commercial software GAMS [15].

6. CONCLUSIONS

This study examines the optimum location of biodiesel (B100) and diesel fuel production facilities and operation of BSC. An MILP approach for designing and planning BSCs based

on economic and environmental criteria has been developed. Developing a flexible optimization model is able to solve a wide range of problems with biofuels, as this area is changing at a rapid pace. All of them can very easily be included in the optimization model, which would bring significant benefits from the optimization approach. One of the valuable features of the approach is the ability to identify and solve a wide range of different scales and levels of problems, such as facility location, raw material selection, conversion and design facility location and performance. In addition, the model itself could easily be extended to cover strategic planning issues, such as investing or not in new production facilities, their location and the introduction of environmental and other external factors in the calculation of total costs.

Acknowledgements

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PREDICTION OF THE WEIGHT OF QUAIL EGGS THROUGH SHAPE FEATURES AND SPECTRAL INDICES

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Abstract: *In the present work, a method for indirect determination of the weight of Japanese quail eggs is proposed, taking into account changes in their internal properties. Visual data and transmission spectra is used. Shape features and spectral indices are selected and applied. It has been found that egg weight M can be predicted by the volume V of eggs and the spectral index GLI , $M=f(V, GLI)$. The resulting model has a coefficient of determination $R^2=0,89$, low error values, up to 3%. Mean square error $MSE=0,03$ and root mean square error $RMSE=0,2$. The results obtained can be used to indirect determination the weight of Japanese quail eggs when incubated, packaged.*

Keywords: Quail eggs, image processing, transmission spectra, shape features, spectral indices, feature selection, egg weight prediction

1.INTRODUCTION

The prediction of eggs weight (mass, M) from Japanese quail in poultry farming is related to the characterization of bird development, egg morphology, breeding capacity [14]. The refinement of different methods of measuring and indirectly determining the weight and volume of eggs is a main topic in available researches [3,7,21].

A common disadvantage of the methods presented in the available literature is that the analysis is performed only on digital images that are primarily suitable for fresh eggs. These methods of analysis do not take into account the effect of the storage of eggs, whereby physical, biological and microbiological changes occur in them which affect the weight of the eggs. For this reason, current studies are focused on the application of spectral analysis, in which, in addition to surface changes, the internal structure of the egg can be evaluated. A number of qualitative indicators, such as protein content, dry matter, moisture, active acidity, infections, have been identified using spectral analysis, which are indicators of the internal structure of eggs [12].

Transmission spectra in the visible and near infrared region were used to predict the change in internal egg characteristics [20]. Also, ultrasonic transmission techniques [16], determination of dielectric properties of eggs [19].

A review of the literature revealed, show that there is a need for a more in-depth analysis of the known methods and approaches applied so far, which will lead to the improvement and facilitation of the egg mass determination process in order to be implemented in automated systems [1,5]. Therefore, according to recent studies, the application of image acquisition, processing and analysis systems and spectrophotometric measurements in the visible spectrum is a major priority in the automated determination of egg weight and taking into account changes in their internal characteristics.

The purpose of the present work is to propose a method for indirectly determining the weight of eggs from Japanese quail, taking into account the change in the internal properties of eggs, using visual data and transmission spectra.

2.MATERIAL AND METHODS

A total of 108 Japanese quail eggs were used from three producers purchased commercially. An experimental set-up is shown schematically in Figure 1. The system consists of a video camera mounted on a mobile stand. Light source – diode lamp VT-2017 (V-TAC Innovative LED Lighting) 6400K, with white LEDs, with the highest light intensity at 450nm. Power consumption 17W, 220V, 50Hz, 141mA. The light source is mounted in a cylindrical body, 11cm in diameter and 16cm high. the cylinder has a lid on which an ellipse opening of diameters $d=15\text{mm}$, $D=20\text{mm}$ is made, on which the egg is placed. The entire experimental set-up is housed in a darkening enclosure that reduces the influence of ambient light. The video camera is connected to a personal computer (PC) via a USB interface. On the personal computer is software for obtaining shape features of eggs from digital images and transmission spectral characteristics.

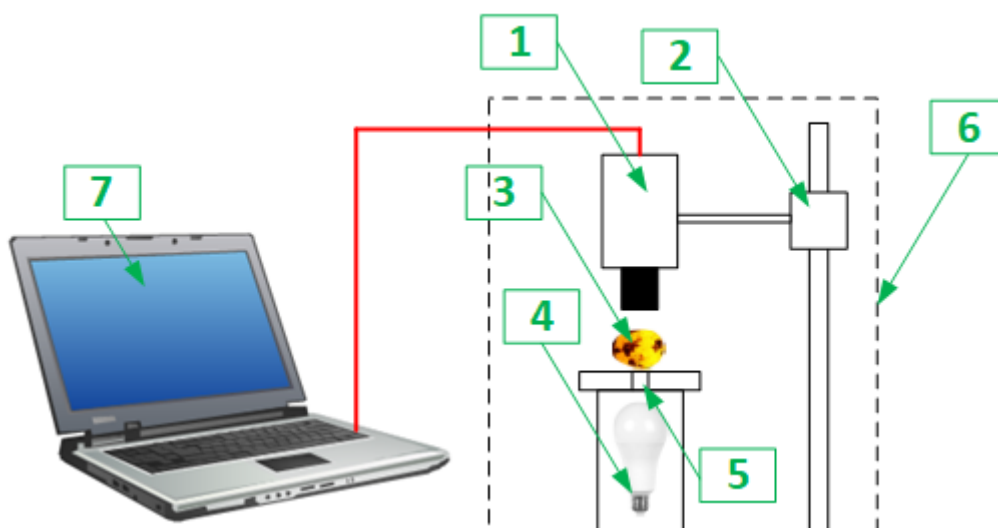


Figure 1. Experimental set-up, general view

1-video camera; 2-movable stand; 3-measured egg; 4-light source; 5-hole for lighting an egg; 6-darkening enclosure; 7-PC

Digital images were obtained during ovoscopy. They are obtained at a height of 7,5cm and a resolution of 640x480 pix.

The size adjustment is made with a digital caliper, with an accuracy of 0,02mm. A k_d , pix/mm size correction factor is obtained.

The basic parameters of eggs in their digital images are determined by the *regionprops* function in Matlab software (The math works Inc.). Through this function are determined: area of eggs A_{egg} ; perimeter P_{egg} ; long axis D ; short axis d . the other parameters are defined by the following formulas:

Volume, V_{egg}

$$V_{egg} = \frac{4}{3} \pi \frac{D}{2} \left(\frac{d}{2}\right)^2 \quad (1)$$

Ideal area, A_{ideal}

$$A_{ideal} = \frac{\pi d D}{4} \quad (2)$$

Area of bounding box, A_{mr}

$$A_{mr} = d \cdot D \quad (3)$$

Packaging coefficient, K_v

$$K_v = \frac{V_{egg}}{V_{sb}} \quad (4)$$



Coefficient of form, K_f
$$K_f = \frac{P_{egg}^2}{A_{egg}} \quad (5)$$

Eccentricity, K_1
$$K_1 = \frac{D}{d} \cdot 100 \quad (6)$$

Ovality, c
$$c = \frac{P_{egg}^2}{4\pi A_{egg}} \quad (7)$$

Roundness, R
$$R = \frac{1}{c} \quad (8)$$

Relationship between areas, K_A
$$K_A = \frac{A_{egg}}{A_{ideal}} \quad (9)$$

Relationship between areas, K_{AM}
$$K_{AM} = \frac{A_{egg}}{A_{mr}} \quad (10)$$

Obtaining spectral characteristics is done by converting the values from the LMS model into reflection spectra in the VIS region, in the range 390-730nm, by mathematical dependencies, where conversion is possible in both directions of equality [22]. The conversion functions used are for observer 2° and illumination D65. Conversion matrices are available in the [8] for the VIS spectral region (380-780nm).

Transmission spectra (T) for each egg were obtained as the ratio between the spectrum of the egg, I_{egg} and that of the white light I_{wl} :

$$T = \frac{I_{egg}}{I_{wl}} \quad (11)$$

Spectral indices according to [6] and [4] have been used. The indices are in the transmission spectra. The following formulas were used to calculate them:

Red Edge Index (REI)
$$REI = \frac{T_{740}}{T_{720}} \quad (12)$$

Photochemical Transmittance Index (PTI)
$$PTI = \frac{T_{530} - T_{570}}{T_{530} + T_{570}} \quad (13)$$

Carotenoid transmittance Index (CTI)
$$CTI = \frac{1}{T_{510}} - \frac{1}{T_{550}} \quad (14)$$

Triangular Vegetation Index (TVI)
$$TVI = 0,5(120(T_{750} - T_{550}) - 200(T_{670} - T_{550})) \quad (15)$$

Greenness Index (G)
$$G = \frac{T_{550}}{T_{680}} \quad (16)$$

NExG
$$NExG = \frac{2T_{520} - T_{620} - T_{420}}{T_{520} + T_{620} + T_{420}} \quad (17)$$

NGRDI
$$NGRDI = \frac{T_{520} - T_{620}}{T_{520} + T_{620}} \quad (18)$$

RGBVI
$$RGBVI = \frac{T_{520}^2 - T_{620}T_{420}}{T_{520}^2 + T_{620}T_{420}} \quad (19)$$

GLI
$$GLI = \frac{2T_{520} - T_{620} - T_{420}}{2T_{520} + T_{620} + T_{420}} \quad (20)$$

VARI
$$VARI = \frac{T_{520} - T_{620}}{T_{520} + T_{620} - T_{420}} \quad (21)$$

ExG
$$ExG = 2T_{520} - T_{620} - T_{420} \quad (22)$$

The following methods were used to select parameters of quail eggs suitable for predicting their weight:

- ✓ Feature Selection Method by Neighborhood Component Analysis (FSNCA) [10];
- ✓ Significant prediction parameter selection method (RELIEFF) [17];
- ✓ Method for selecting regression parameters by neighbor component analysis (FSRNCA) [11].

An initial model describing the relationship between selected parameters of quail eggs was used:

$$z = b_0 + b_1x + b_2y + b_3x^2 + b_4xy + b_5y^2 \quad (23)$$

The model coefficients, their standard error (SE), t-statistic (tStat), p-value are determined. Coefficient of determination (R^2), sum of squared errors (SSE), root mean squared error (RMSE), mean squared error (MSE) were used as the model evaluation criteria. The criteria used are available and explained in details in [9,23].

The model coefficients are analyzed, depending on the value of p, for each of them. Non-informative coefficients are rejected by the model.

An analysis of the residuals [18], which is determined by the difference between the values of the model and the actual measured $r=y-y_{fit}$, is made.

All data were processed at level of significance $\alpha=0,05$.

3.RESULTS AND DISCUSSION

Digital visual images and spectral transmission characteristics of the Japanese quail eggs spectrum were obtained. Shape features and spectral indices were selected by which the weight of eggs could be predicted. A model was developed and analyzed with sufficient accuracy to describe the relationship between the selected features and indices and the weight of Japanese quail eggs.

Figure 2 shows the spectral transmission characteristics for three quail egg producers. It can be seen that all eggs have the highest transmittance in the 380-480nm range, and to a lesser extent in the rest of the 480-780nm spectrum.

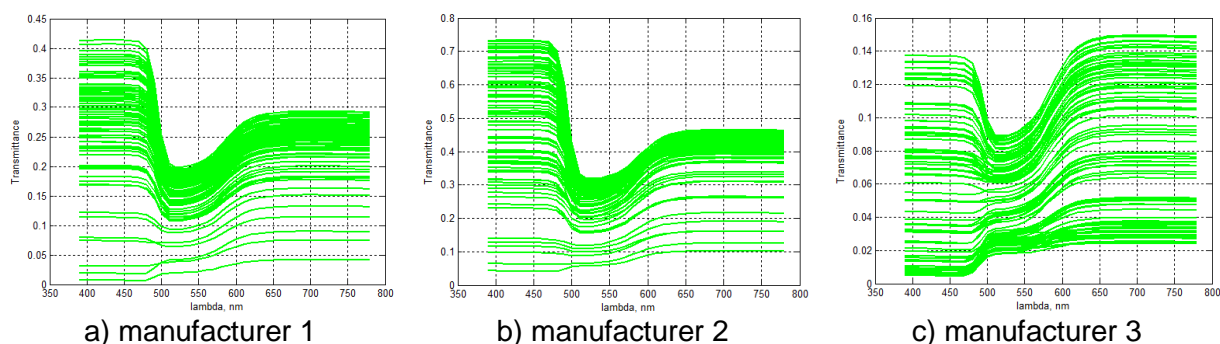


Figure 2. Spectral transmittance characteristics for three manufacturers

The results of the selection of shape features and spectral indices suitable for predicting the weight of Japanese quail eggs are shown in Figure 3. In shape features, regardless of the selection method used, the volume (V) of the eggs obtained by its long and short axes is clearly distinguished. In the spectral indices, GLI index, representing the ratio between the transition spectra at 420, 520, and 620nm, shows the largest relationship with the weight of eggs relative to the other indices, regardless of the selection method.

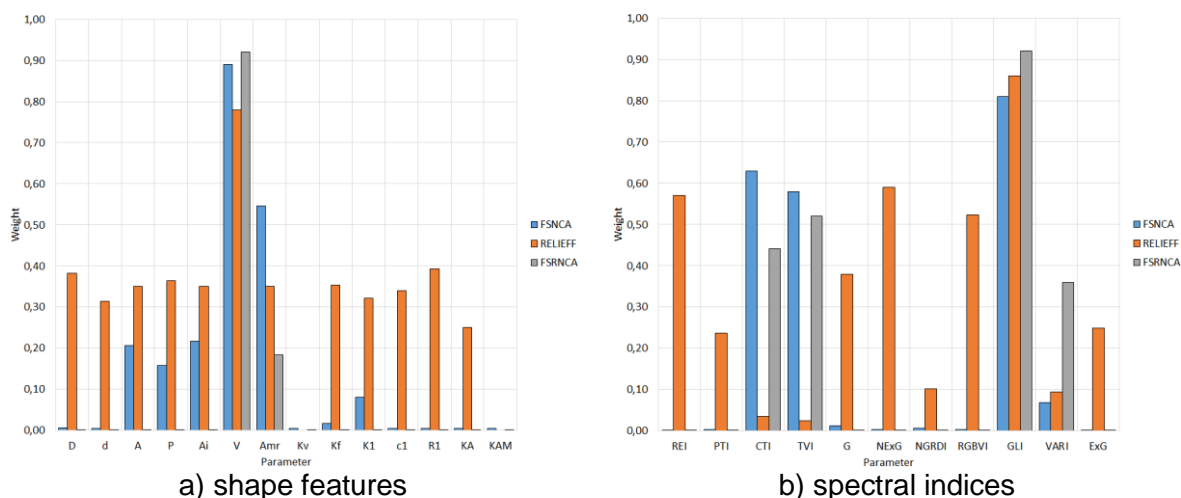


Figure 3. Results of methods used for parameter selection

Selected feature V and GLI index were used to construct a model for predicting the weight of Japanese quail eggs.

After removing the insignificant coefficients from the basic model having $p\text{-Value} \gg \alpha$, it was found that the relationship between the weight (mass, M) of eggs, the spectral index GLI and their volume V, $M=f(V, GLI)$, can be described with model of type:

$$z = b_0 + b_1x^2 + b_2y^2 + b_3x \tag{24}$$

$$M = -0,526 - 5,86 \cdot 10^{-9}V^2 + 0,531GLI^2 + 1,32 \cdot 10^{-4}V \tag{25}$$

Figure 4 shows the resulting model, in graphical form, together with the data used. It can be seen that, the area of change of the two factors V and GLI, where M has the highest values. This occurs when the two factors are at their upper levels.

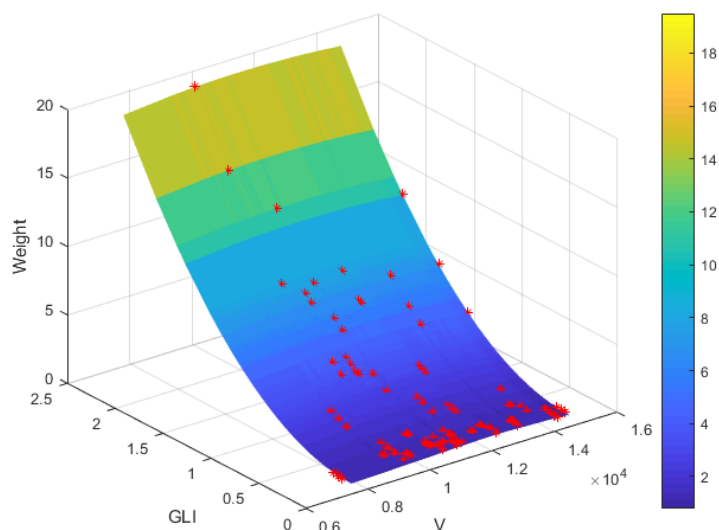


Figure 4. General view of the model obtained, $M=f(V, GLI)$

Table 1 provides details of the resulting model. A low standard error value is observed. The four coefficients are significant because p-Value is much less than the accepted level of significance $\alpha=0,05$.

Table 1. Model data

Coefficients		SE	tStat	p-Value
b_0	-0,53	0,00	-2,86E+08	0,00
b_1	-5,86E-09	0,00	-6,67E+00	0,00
b_2	0,53	0,00	4,59E+08	0,00
b_3	1,32E-04	0,00	1,27E+01	0,00

Table 2 lists the parameters for estimating the resulting model. It can be seen that the coefficient of determination $R^2=0,89$. SSE, MSE, and RMSE error values are low. The results show that the model obtained describes an essential part of the change in eggs weight. They are not a sufficient criterion for evaluating the model. It is necessary to analyze the residuals.

Table 2. Parameters of the model obtained

Parameter	Value	Parameter	Value
R^2	0,89	MSE	0,031
SSE	3,32	RMSE	0,18

Figure 5 shows the results of residuals analysis. As long as the points are in a straight line, the residuals have a distribution close to normal and it can be assumed that the preconditions of the regression analysis are fulfilled. As can be seen from the distribution of the residuals and their location around the normal line, under the normal probability plot, they are close to the normal distribution and the assumptions of the regression analysis can be considered to be fulfilled.

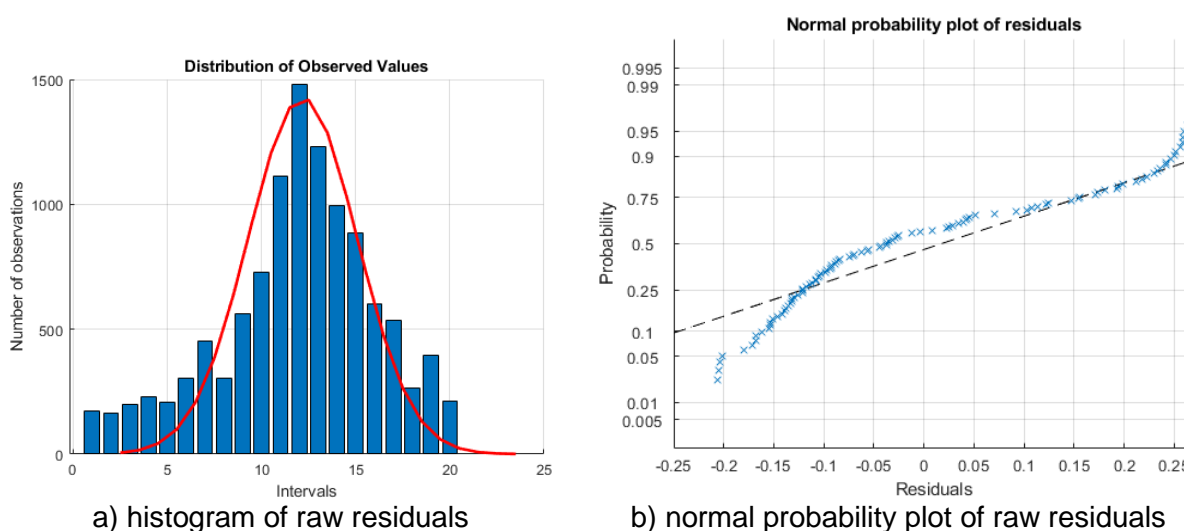


Figure 5. Results of residuals analysis

The results obtained improve those reported in the available literature. A method is proposed for indirectly determining the weight of quail eggs, taking into account changes in their internal characteristics. It is achieved $R^2=0,89$.

In the reported results of the available literature, methods for measuring the long and short axes with a caliper are mainly used to predict the mass of Japanese quail eggs. Khurshid et

al. [13] report the estimated weight of Japanese quail eggs on the long and short axes using a linear regression model $R^2=0,32$. Alkan et al. [2], improve this model by achieving $R^2=0,83$. Consideration of changes in the internal characteristics of Japanese quail eggs is important since the external characteristics of the eggs such as shape index, long and short axes do not change significantly during storage, whereas the change in egg weight may reach more than 3% [15].

4.CONCLUSION

The results of the present work show that the combined use of shape features and spectral indices derived from transmission spectra could be used as a criterion for predicting the weight of Japanese quail eggs, taking into account changes in their internal characteristics.

It has been found that the egg volume V and the GLI spectral index can be used to predict the weight M of Japanese quail eggs. The resulting model $M=f(V, GLI)$ has a coefficient of determination $R^2=0,89$ and low error values (below 3%). The residuals have a distribution close to normal and the preconditions for the regression analysis are fulfilled.

The analysis of the results obtained shows that the method for the indirect determination of the weight of Japanese quail eggs, using techniques for obtaining, processing and analyzing digital images and transmission spectral characteristics are useful predictors.

In subsequent studies, it can be determined which wavelengths are characteristic of determining the factors that affect the acquisition and processing of spectral indices.

The results obtained can be used to indirectly determine the weight of Japanese quail eggs when incubated, packaged.

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THE BRAIN-COMPUTER INTERFACE

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Abstract: *The Brain-Computer Interface (BCI), defined as systems that allow people to use a computer, an electromechanical arm or various neuroprostheses without the use of motor nervous systems, is a communication pathway used to establish direct communication between the brain and a peripheral interface. The brain-computer interface is often used to help or repair human cognitive or sensory motor functions. However, with today's developing technology, it hasn't only been used for this purpose and has started to be used in many different areas from advertising, to smart peripheral systems, to games, even authentication and security applications. The increase in access to BCI devices, together with the increase in their usage, has led to an increase in the number of applications that have been developed in health, engineering, and education. We hope that in the near future BCI devices will allow us to communicate without talking and will understand our thoughts and act accordingly.*

Keywords: *Brain Computer Interfaces, BCI, EEG, Human Computer Interaction*

1. INTRODUCTION

With the development of technology, human beings have tried to understand how the brain works and they used this new technology to communicate with computers. This system is called the Brain Computer Interface. Through the communication between the brain and the computer, people,

- whose brain motor part (but not cognitive part) is damaged.
- who cannot move their muscles properly,
- who have Lock - syndrome, multiple sclerosis (MS), Amyotrophic Lateral Sclerosis (ALS) and Spinal cord injury,
- who have increasing diseased areas due to aging and who have survived a hit and a trauma can benefit from this interface. Thus, these people
- can easily communicate with their loved ones and with those who are interested in them.
- may want to use external devices to make their lives more comfortable.
- may want to chat on the computer.
- may want to access the Internet.
- may want to switch the power on/off or open/close the curtains.
- may want to move the robotic arm to get food.
- may want to move their prosthetic arm.

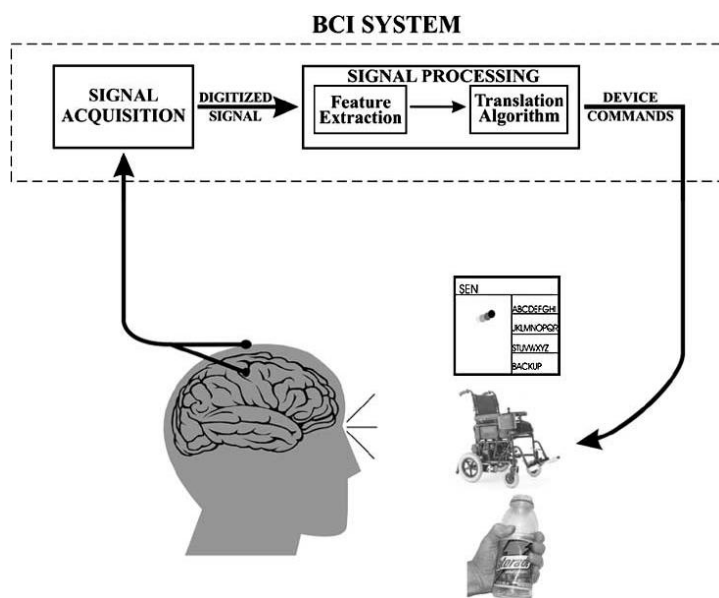


Figure 1. Basic design and operation of any BCI system [1].

2. BRAIN COMPUTER INTERFACE HISTORY

BCI was first introduced in 1924 by Hans Berger with the first EEG (Electroencephalography) device. Hans Berger invented a device that can detect a person's brainwaves. The first EEG consisted of silver plates placed under the scalp and a galvanometer with a sensitivity of 0.0001V connected to these plates. Berger recorded EEG signals for the first time. Analysing these recordings, Berger discovered that there were different waves and rhythms. Afterwards, he studied the relationship between brain diseases and brain waves. However, the usage of brain activities for communication purposes was not planned until early 1973. In 1970, ARPA (Advanced Research Project Agency) carried out a project that aims to improve human abilities by using brain activities and computer [2]. Trials first began on animals. Later, experiments were conducted on people. In recent years, with the development of electronic systems and the widespread use of powerful computers, BCI has piqued the researchers' interest more and became the subject of further research. Thus, in addition to the methods used in the past, new methods are being developed.

Today, a wide variety of BCI applications are available. Word processors, adapted web browsers, wheelchairs and neuro prostheses, and games are among these applications [3]. In EEG-based BCI studies, visual evoked potentials (VEP) [4], slow cortical potentials [5], P300 evoked potentials [6] and sensorimotor rhythms [7] are used.

The introduction of the products developed for general use has advanced in recent years. Among these products are, for example, Emotive EPOC, NeuroSky, HiBrain, iFocusBand, Muse, OpenBCI, and Enobio.

3. BRAIN COMPUTER INTERFACE TYPES

The main purpose of the brain computer interface devices or species is to capture electrical signals passing between the neurons in the brain and convert them into a signal detected by the external devices [8].

3.1. DEPENDENT BCI (INVASIVE BRAIN COMPUTER INTERFACE)

Invasive Computer Interface devices are the ones that are placed directly into the brain and have the highest quality signals. These devices are used to provide functionality to people who has a stroke. Invasive BCIs also cover the brain with external cameras and are used to regain the use of brain-controlled robotic arms and legs and limbs. These devices, which remain in the gray matter of the brain, produce the highest quality signals of BCI devices, but they cause the signal to weaken or even disappear when reacting to a foreign object in the brain [8].

For example, for invasive BCIs, when a patient with a stroke is shown the letters one by one with the help of a screen, If the patient concentrates and looks carefully at the letter that he/she sees on the screen, this leads to a visually triggered potential (GTP), which can be detected by the EEG device. This is possible because the patient concentrates and looks at the other letters for a certain period of time to create a higher GTP than the case [9].

3.2. INDEPENDENT BCI (BRAIN COMPUTER INTERFACE)

The non-invasive brain computer interface has minimal signal clarity as the skull disrupts the signals when it comes to communication with the brain. However, it is considered to be safer compared to other interfaces as it does not require any intervention to the brain. In non-invasive technique, in order to read the brain signals medical scanning devices or sensors are mounted on the headbands. As these devices/sensors cannot be placed directly on the desired part of the brain, this method is considered as less effective in reading the signals. One of the most popular devices under this category is EEG or electroencephalography, which can provide good temporal resolution. It is easy to use, cheap and portable [8].

In non-invasive BCIs, it is based solely on the user's trends. For example, when selecting a given letter, all the user has to do is to think about the letter that he wants. This mechanism has nothing to do with the movement or control of the eye. There is P300 potential detected by EEG [9].

Other non-invasive BCI devices use functional Magneto-Resonance Imaging (fMRI), Positron Electron Tomography (PET), Magnetoencephalography (MEG) and Single Photon Emission Computed Tomography (SPECT) [10].

3.3. PARTIAL DEPENDENT BCI (BRAIN COMPUTER INTERFACE)

Partially invasive BCI devices are placed inside the skull but remain outside of the brain, not within the gray matter. The signal strength in this BCI type is slightly weaker compared to Invasive BCI. However, they generate better resolution signals than non-invasive BCIs. Partially invasive BCIs have also a lower risk of scar tissue formation compared to Invasive BCI [8].

4. BASIC COMPONENTS OF BRAIN COMPUTER INTERFACES

In EEG-based BCI systems, the generation of appropriate commands to communicate with electronic devices, such as computers, depends on the processing of EEG signals (attribute extraction) and their classification based on the extracted attributes in different intellectual and visual situations. Figure 2 shows the main processing components of an EEG-based BCI system.

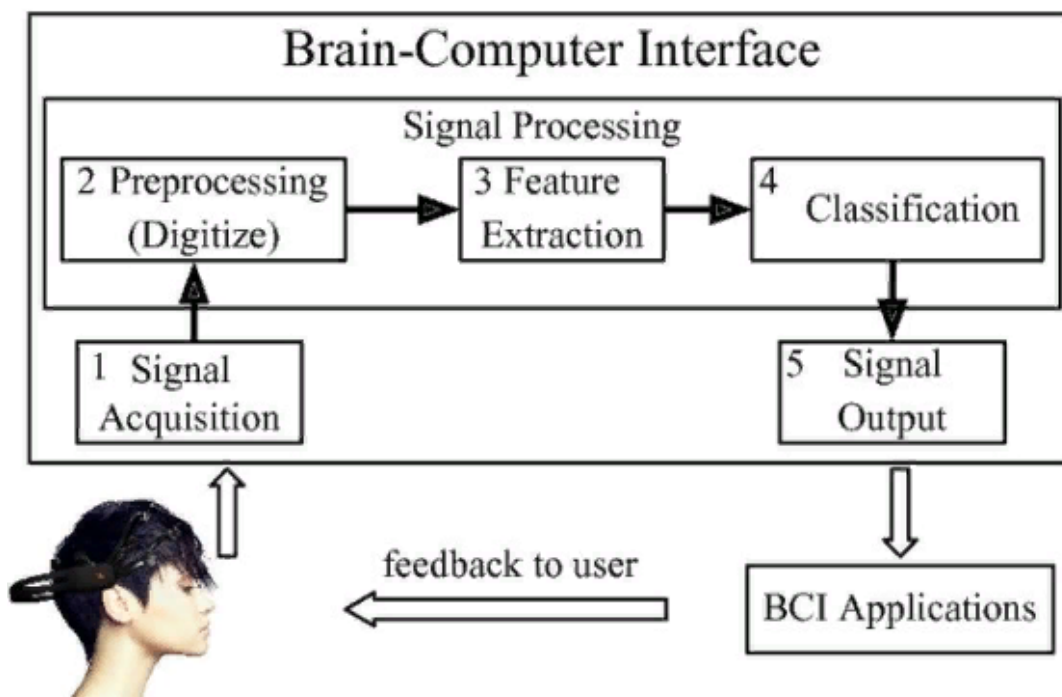


Figure 2. Brain Computer Interfaces components [11].

4.1. SIGNAL ACQUISITION

Signal acquisition is the first step in a BCI process. The brain consists of sections that perform different operations. The electrodes that will be placed close to the relevant section provide information about that region [12].

BCI systems operate by analysing electrodes of different combinations and the electrical signals received from these electrodes in different ways.

There are three ways to detect the electrical reflections of electrochemical interactions of electrodes and neurons in BCI systems [13].

Figure 3 briefly shows the computer interfaces and Signal Acquisition methods.

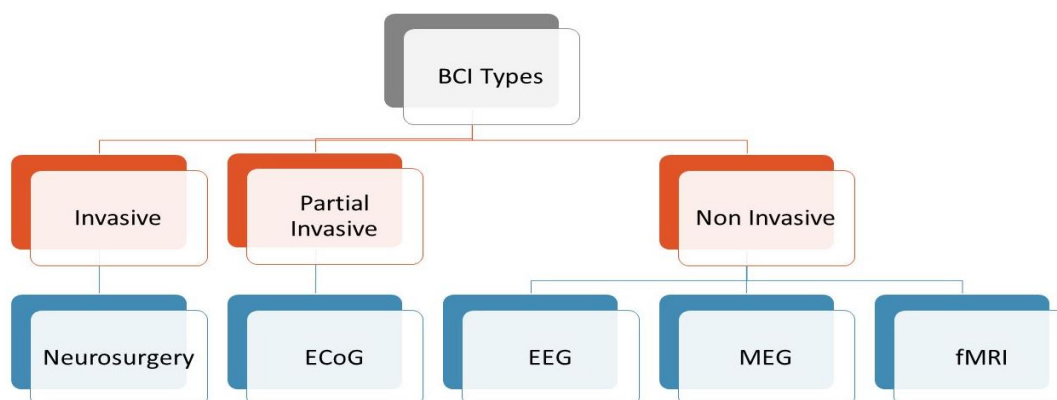


Figure 3. Brain Computer Interfaces Signal Acquisition Methods

4.2. SIGNAL PROCESSING: FEATURE EXTRACTION

In order to use the recorded signals purposefully, some features that best express the signal should be determined and studied with these features. These characteristics are called 'attribute' in the literature and are stored in a feature vector. Briefly, the feature extraction process is defined as the conversion of signals into a form that facilitates the classification.

Another purpose of the feature extraction process is to reduce the size of the data to be classified. The selection of the attribute is done in such a way as to answer the questions about which features will be selected and what the amount will be [14].

There are different features such as time domain, frequency domain and spatial domain [15].

4.3. SIGNAL PROCESSING: CONVERSION ALGORITHM

After summarizing the digital brain signal data and extracting some of its features, the patterns in this information should be scanned and identified. This is the only way the BCI system can "understand" which commands to perform. Various classifiers are used to analyse the properties of the collected data.

Classifiers used in BCI research are

- linear classifiers,
- neural networks,
- nonlinear Bayez classifiers,
- the nearest neighbourhood classifiers and
- combined classifiers.

4.4. OUTPUT DEVICE

In a modern BCI system, the output device can be any device, but generally, they are computers or computer-controlled robots. . In research and experiments, a computer monitor and cursors, icons and letter selections are generally used to provide feedback to the user [12].

4.5. OPERATING PROTOCOL

The operating protocol is the set of rules that determine the overall behaviour and use of the system. The protocol determines what kind of communication the system will use, what kind of brain signals will be analysed, and the types of interaction between the system and the user. In a laboratory environment where expert researchers and BCI technicians are available to assist the user or patient, this protocol may not be very detailed or important. However, if the BCI system is to be used alone by a patient in a real-life environment, and the patient has to turn the device on and off and give commands, the protocol details are extremely important [12].

5. RESULT AND CONCLUSIONS

In this study, the components of brain computer interfaces have been examined within the scope of human-computer interaction and for which purposes BCI is used.

The purpose of this study was to provide information about the brain computer interfaces. This research is considered to have concise and sufficient information about BCI, which we have heard frequently these days. It is thought that it will benefit the literature in this sense.

We believe that in the near future, BCI technology will be used in many fields along with the medical field and the devices developed using this technology will understand our wishes and thoughts and act accordingly.

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NON-INVASIVE BCI METHOD: EEG - ELECTROENCEPHALOGRAPHY

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Abstract: Brain Computer Interface consists of hardware and software that convert brain signals into action. It changes the nerves, muscles, and movements they produce with electro-physiological signs. The BCI cannot read the brain and decipher the thought in general. The BCI can only identify and classify specific patterns of activity in ongoing brain signals associated with specific tasks or events. EEG is the most commonly used non-invasive BCI method as it can be obtained easily compared to other methods. In this study; It will be given how EEG signals are obtained from the scalp, with which waves these frequencies are named and in which brain states these waves occur. 10-20 electrode placement plan for EEG to be placed on the scalp will be shown.

Keywords: Brain Computer Interfaces, BCI, EEG, Human Computer Interaction

1. INTRODUCTION

Brain Computer Interfaces are applications that allow users to communicate and control external devices by directly analysing changes in brain activity without using muscle and nerve cells, which are normal pathways of the brain. BCIs consist of a protocol that is responsible for data detection, attribute extraction, attribute transformation, and output devices and the management of these four components, which determines the start, end and run timing of the system.

Figure 1 shows the basic elements of a Brain Computer Interface System. Signals are received by different BCI methods, the computer has been signalled by the computer interface and the results are obtained in the application interface. This process continues with feedback in the form of a loop.

With the development of electronic systems and the widespread use of powerful computers, BCI began to draw researchers' attention more and has become the subject of further research. Thus, in addition to the methods used in the past, new methods are being developed.

Today, a wide variety of BCI applications are available. Word processors, adapted web browsers, wheelchairs and neuro prostheses, and games [2] can be named among these applications. In EEG (electroencephalography) -based BCI studies, visual evoked potentials (VEP) [3], slow cortical potentials [4], P300 evoked potentials [5] and sensorimotor rhythms [6] are used.

The introduction of products developed for general use has advanced in recent years. Among these products are, for example, Emotive EPOC, NeuroSky, HiBrain, iFocusBand, Muse, OpenBCI, and Enobio.

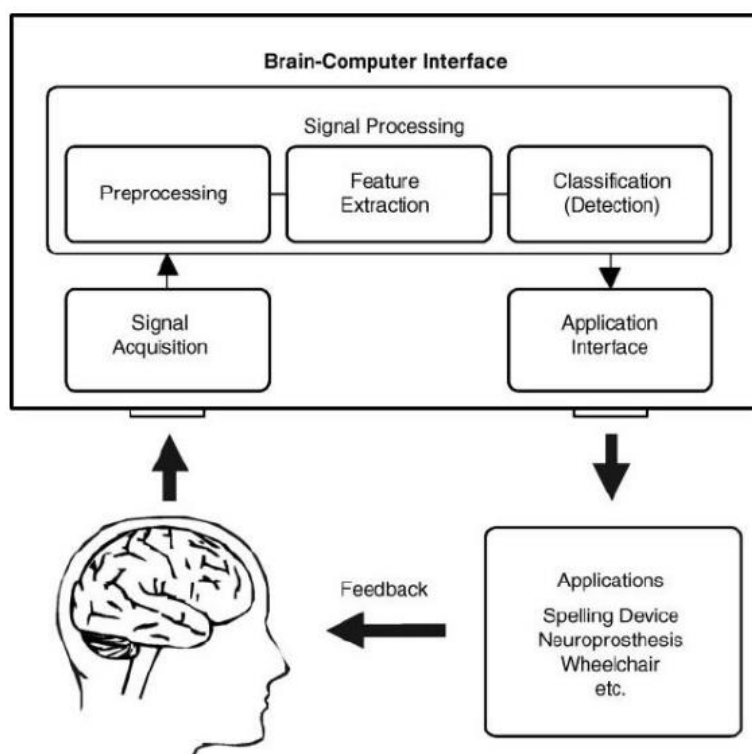


Figure 1. Basic elements and operation of a Brain Computer Interface System [1].

2. BRAIN COMPUTER INTERFACE TYPES

The main purpose of the brain computer interface devices or species is to capture electrical signals passing between neurons in the brain and convert them into a signal detected by the external devices [7].

- Invasive Computer Interface devices are the ones that are placed directly into the brain and have the highest quality signals. These devices are used to provide functionality to people who had a stroke. Invasive BCIs also cover the brain with external cameras. It is used to regain the use of brain-controlled robotic arms and legs and limbs. These devices, which remain in the gray matter of the brain, produce the highest quality signals of BCI devices, but they cause the signal to weaken or even disappear when reacting to a foreign object in the brain [7].

- The non-invasive brain computer interface has minimal signal clarity as the skull disrupts the signals when it comes to communication with the brain. However, it is considered to be safer compared to other interfaces as it does not require any intervention to the brain. In non-invasive technique, in order to read the brain signals medical scanning devices or sensors are mounted on the headbands. As these devices/sensors cannot be placed directly on the desired part of the brain, this method is considered as less effective in reading the signals. One of the most popular devices under this category is EEG or electroencephalography, which can provide good temporal resolution. It is easy to use, cheap and portable [7].

Other non-invasive BCI devices use functional Magneto-Resonance Imaging (fMRI), Positron Electron Tomography (PET), Magnetoencephalography (MEG) and Single Photon Emission Computed Tomography (SPECT) [8].

- Partially invasive BCI devices are placed inside the skull but remain outside of the brain, not within the gray matter. The signal strength in this BCI type is slightly weaker compared to Invasive BCI. However, they generate better resolution signals than non-invasive BCIs. Partially invasive BCIs have also a lower risk of scar tissue formation compared to Invasive BCI [7].

Among the partial BCI devices, EEG is generally preferred as it is attainable and easy to apply.

3. ELECTROENCEPHALOGRAM (EEG)

Electroencephalogram (EEG) markers are low-amplitude (peak-to-peak 1-400 VV) bioelectric markings (usually placed on the scalp to avoid pain) measured by electrodes on the brain surface or scalp. Figure 2 shows the placement of the brain electrode.

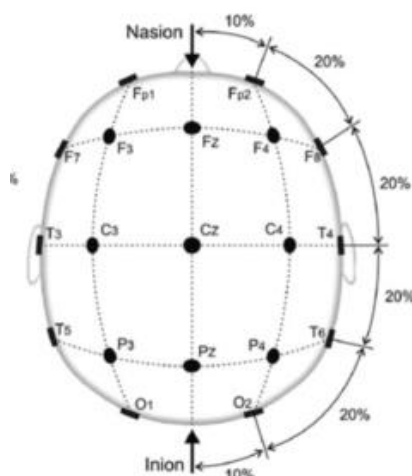


Figure 2. “10–20” system of electrode placement. F = frontal, T = temporal, C = central, O = occipital, P = parietal. Odd numbers = left hemisphere, even numbers = right hemisphere.

- The activity called by the right motion image is most noticeable at the electrode (center left) in position C3.
- The activities on the hand movement images side are on the contralateral side.
- Foot motion footage calls on Cz.
- Since the corresponding cortical areas are very close to the brain, the distinction between right and left foot movements is not possible in the EEG.

Research reveals that a large amount of neurological information is stored in these signs. In recent years, the researches on EEG signals have gained momentum, and both of these methods improve patient treatment methods and establish a BCI with the help of these signals to communicate with electronic devices.

The amplitude of the EEGs detected over the head is 1-100 μ V from top to top and the frequency band is 0.5-100 Hz [9]. Although the EEG signal has a broad frequency band (0.5-100 Hz), clinical and physiological attention is concentrated between 0.5 and 30 Hz. This frequency range is divided into 5 frequency bands.

- Delta (δ) Signal: They are in the frequency range of 0.5–3.5 Hz and their amplitudes are between 20-400 μV . The amplitude tends to be in the highest and in the slowest waves. It is normally seen in adults in deep sleep and in infants.
- Theta (θ) Signal: The frequency of these signals is between 3.5-7.5 Hz and their amplitudes are between 5-100 μV . Theta is linked to inadequacy and daydreaming. In fact, the lowest waves of theta represent the line of being awake or asleep. In adults, high levels of theta are considered abnormal.
- Alpha (α) Signal: This signal frequency is between 7.5 and 12 Hz and amplitudes vary between 2-10 μV . Hans Berger called the first rhythmic EEG activity he saw as “alpha wave [10]. The interval seen in the posterior regions of the head on both sides is higher in the amplitude on the dominant side. It appears by closing eyes and loosening. It is about rest, meditation, and before falling asleep.
- Beta (β) Signal: Beta is a brain signal in which the frequency ranges from 12 Hz to about 30 Hz. Amplitudes vary between 1-5 μV . The symmetrical distribution is usually seen on both sides and is prominent from the front. Beta waves are usually divided by β_1 and β_2 to obtain a more specific range. Waves are small and fast when resisting or suppressing motion or solving a math task. In these cases, an increase in beta activity was found.
- Gamma Signal: A signal with a frequency range of 31 Hz and above. It reflects the mechanism of consciousness [11]. The amplitudes are less than 2 μV . They carry the characteristic sign of sleep [12]. Gamma wave is seen in REM sleep, learning moments, moments of extreme happiness and it is very difficult to detect by EEG [13].

Figure 3 shows the waves that can be measured by EEG signals.

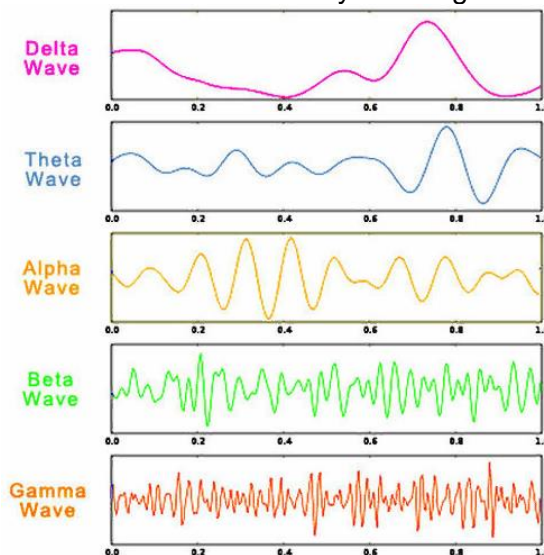


Figure 3. Brain waves in normal EEG [14].

4. BASIC COMPONENTS OF EEG

In EEG-based BCI systems, the generation of appropriate commands to communicate with electronic devices such as computers depends on the processing of EEG signals (attribute extraction) and their classification based on the extracted attributes in different intellectual and visual situations.

Signal acquisition is the first step in a BCI process. When we think that the brain consists of sections that perform different operations, the electrodes that will be placed close to the relevant section provide information about that region [15].

Figure 4 shows signal acquisition through different methods.

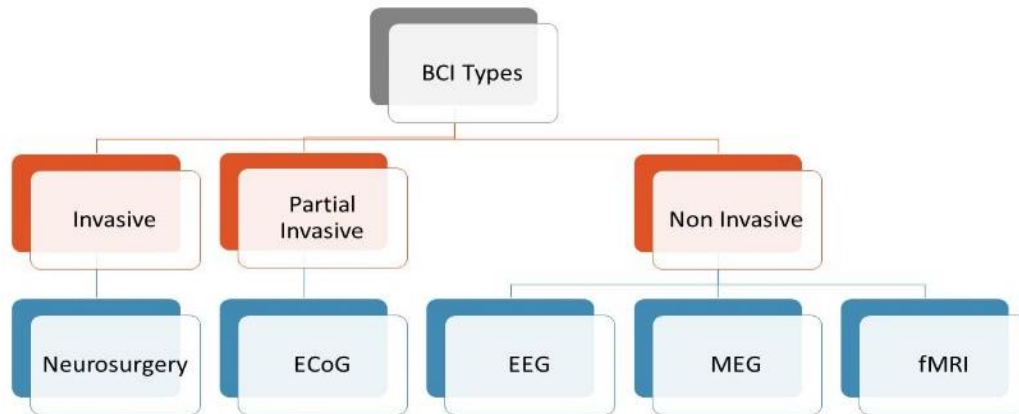


Figure 4. Brain Computer Interfaces Signal Acquisition Methods

Generally, after EEG data is recorded, they must be pre-treated to remove noise or reveal the necessary information embedded in it. EEG signals contain a lot of noise and are highly affected by the electrical activity of the eyes, muscles, or facial or jaw muscles [16]. The amplitude of these muscle activities is many times greater than that of EEG, so it is not easy to distinguish these artifacts. In addition, signals from brain activity that are not related to the desired movement must be distinguished from these signals. Since the signals received from the electrodes placed on the skull or brain are at frequencies of 0 Hz and above, their structure is easily degraded. To improve the quality of these distorted signals, it is necessary to do something. This quality is called the “signal to noise ratio”. High ratio represents the quality signal. The signal to noise ratio can be improved by using noise cancelling filters and ignoring unwanted data and artifacts. Many spatial, spectral and temporal filters are used to perform the pre-processing process [17, 18].

After summarizing the digital brain signal data and extracting some of its features, the patterns in this information should be scanned and identified. This is the only way the BCI system can understand which commands to perform. This process is called signal processing. To analyse the properties of the collected data; linear classifiers, neural networks, nonlinear Bayez classifiers, closest neighbourhood classifiers, and combined classifiers are used in various classifiers.

In a modern BCI system, the output device can be any device, but generally, they are computers or computer-controlled robots. In research and experiments, a computer monitor and cursors, icons and letter selections are generally used to provide feedback to the user [15].

Figure 5 shows the basic components and processing steps of the brain-human interface

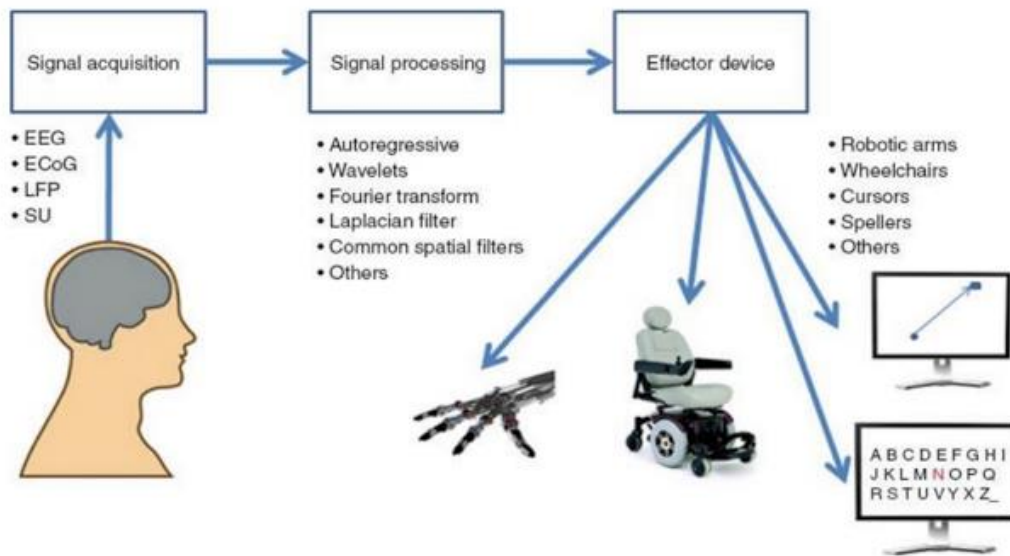


Figure 5. Basic Components of Brain-Human Interface System And Process Steps [19].

5. RESULT AND CONCLUSIONS

This study provides information about EEG, which is one of the non-invasive methods of brain computer interfaces. In EEG method, electrodes are placed on the scalp and this application doesn't cause any pain. The frequency measured from the scalp is between 0-100 Hz. The measured frequency range corresponds to a wavelength. Different wavelengths emerge at different moments. For example, a delta wave occurs in deep sleep whereas a theta wave occurs under stress.

Brain computer interface applications are used in many different fields such as medical, neuro-ergonomics and smart environment, neuromarketing and advertisement, educational and self-regulation, gaming, and entertainment, security and authentication[20].

We believe that in the near future, BCI technology will be used in many fields along with the medical field and the devices developed using this technology will understand our wishes and thoughts and act accordingly.

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STUDYING THE ATTITUDES OF THE STUDENTS OF SPECIALTY "MIDWIFE" CONCERNING PERFORMING UNIVERSAL NEONATAL HEARING SCREENING

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Abstract: *Hearing is one of the five human senses and represents the ability to perceive sounds through the hearing system. The presence of normal auditory perception is one of the prerequisites for the emergence and development of speech in children.*

Conducting neonatal auditory screening is part of the early neonatal screening and incorporates examining infant's hearing shortly after birth. A screening device is used that emits very low sounds with the help of simultaneous "otoacoustic emissions" from the inner ear of this acoustic stimulation. The latest researches show that in one or two in a thousand births the child has congenital deafness or impaired hearing.

Aim: *To acquaint midwifery students with the implementation of universal neonatal hearing screening using information from the Trakia Electronic University.*

Materials and Methods: *The conducted survey allows us to study students' attitudes towards the audio screening. Study materials are accessible via the Internet in our e-university.*

The use of digital and multimedia materials is a way of enhancing the students' professional competence and the effectiveness of the learning process.

Keywords: *Neonatal screening, Algorithm, E-university, Student.*

1. INTRODUCTION

Over the years, the training in the "Health Care" university programme has undergone numerous transformations to reach the levels of depth and punctuality it has today. This development should be continued as the study course adapts to the development of technologies and makes optimal use of them [4].

The applying of ICT in healthcare education creates the conditions for students to fully realize their intellectual potential and creativity. The computer technologies impose a pedagogical interaction between subjects in the learning process and by improving their interaction there emerge opportunities for synergy, for individualization and differentiation of training and for direct feedback between the subjects. This largely depends on the tutor's professional and pedagogical skills and on his technological proficiency and IT-competence [5] [7].

Hearing is one of the five human senses and represents the ability to hear sounds through the auditory system. The presence of normal auditory perception is one of the prerequisites for the appearance and development of speech in children. It is considered that the embryo begins to hear intrauterine after the twentieth week of pregnancy and is able to hear sounds coming from outside the mother's body, moreover the low-frequency sounds are heard much better than the high-frequency ones. The hearing develops completely until birth.

Hearing screening is a part of early neonatal screening and incorporates a test of the baby's hearing a few days after its birth. At this stage, the screening is performed by neonatologists, and our idea is that during the course of their studies the midwifery students should acquire the knowledge and skills to perform it.

The purpose of this study is to get the students to single-handedly become acquainted with the theoretical part of and the algorithm for performing universal neonatal hearing screening (UNHS) using information from the Trakia Electronic University as well as to research students' attitudes towards obtaining understanding about conducting UNHS.

1.1. Neonatal auditory screening techniques

Hearing loss is one of the most common diseases and it comprises a pressing medical, social and economic problem. Early diagnosis of hearing impaired children and subsequent treatment is a modern solution to this problem and allows for the development of speech and talking.

Early neonatal hearing screening aims at detecting congenital diseases and their early treatment and prevention of their complications. Carrying out this type of auditory examination presents a timely diagnosis and saves both the child and its family and social circle from suffering. For the purpose of the examination is used a screening apparatus emitting very weak sounds with the help of which are simultaneously registered so-called "otoacoustic emissions" from the inner ear which are a result of this sound stimulation. Recent research shows that in one or two in a thousand births, the baby is either deaf or hearing impaired.

Electrophysiological methods for hearing testing are an integral part of pediatric audiology. Of particular importance is the electrical reaction audiometry, which consists of determining the auditory sensitivity by recording electrophysiological brain activity that occurs in response to sound stimulation. [1]

"For assessing the hearing in newborns, infants and toddlers the applied audiological test has to provide objective information about the hearing function. Therefore when screening children this age the choice falls on Brainstem Evoked Response Audiometry (BERA). It records electrophysiological activity that appears from the 8th cranial nerve and the auditory stem structures, forming five to seven characteristic auditory evoked potentials (AEP), which carry information about the integrity of the auditory path to the level of the brain stem, the latter included "[1], [6].

Modern medicine uses reliable, objective, non-invasive electrophysiological methods for hearing testing. These methods are: otoacoustic emissions (DPOOE and TEOOE) and automated auditory stem evoked potential (A-AEP).

- Otoacoustic emissions examine the functional state of the external auditory sensory cells and objectify the functional state of the inner ear. They are a non-invasive, very sensitive and inexpensive testing method. They detect small hearing impairments, which are most difficult to diagnose taking into consideration the discrete impairment of auditory function. According to international data their diagnosis accuracy is 90%.

- Automated Auditory Stem Evoked Potential (A-AEP) is a method of examining auditory nerve pathways in the brain stem. It is likewise an objective screening research method that requires more qualified staff. Recently, combined devices have emerged on the medical equipment market, incorporating both methods. The method used for auditory screening is selected with consideration to the local experience and the world's national programs for neonatal hearing screening, namely: TEOAE (Transient Induced Otoacoustic Emissions) is the most appropriate screening method for our country. The necessary equipment is of the type: UAE - SCREENING (TEOAE and DPOAE). [3]

1.2. Hearing Screening Implementation

1. Initial hearing screening for all newborns is performed by the 48th hour in a soundproofed room.
2. Specially trained midwives or nurses in Obstetric-Gynecological clinics / wards perform the initial hearing screening.
3. All newborns from neonatal intensive care units should be examined prior to their discharge.
4. If the screening indicates hearing impairment, the test is repeated the next day.
5. Clinical audiological diagnosis of children with suspected hearing impairment shall be performed in specialized ENT clinics by the end of their third month.
6. All newborns with risk factors for hearing impairment are subjects to periodic audiological monitoring.
7. All children shall be subjected to audiological examination before entering school.

2. METHODS

In the modern society the majority of the students adhere to new technologies. Observations show that the use of multimedia tools is gaining in popularity. The advantages of these tools are that information is easier to read and remember because of the visualization and the fact that one click can view all the material.

A large part of the information is perceived through the senses sight and hearing – 89%. Up to 60% of the information so received is memorized. The lack of necessity to take any kind of action for searching, comparing, classifying or processing data, facilitates access to the information and makes it more easily presented. Huge volumes of information can be presented to a wide audience [4].

To achieve the aim of this study, we created digital materials (text, video and survey) accessible online for the students of Trakia University, Branch Haskovo. The study was conducted over the period February-April 2019.

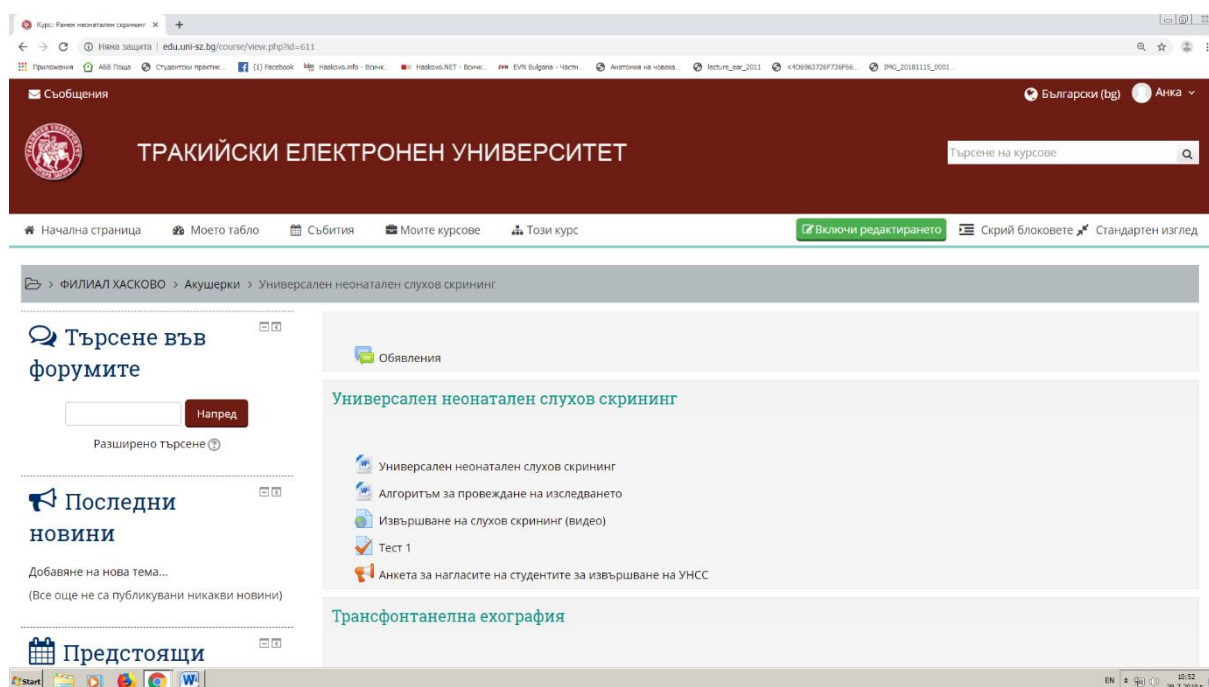


Figure 1. Early neonatal screening course

Fig.1 presents that Trakia Electronic University course UNHS students' self-study activities include Nature of (Preliminary Theoretical Knowledge of) hearing screening, Algorithm for Conducting the Research, Test 1, and Survey about Students' Attitudes towards Learning How to Conduct UNHS. We used a direct online survey to analyze students' attitudes. The survey covered 48 students from all midwifery courses (Fig. 2). Documentary and statistical methods were used to process and analyze the information collected.

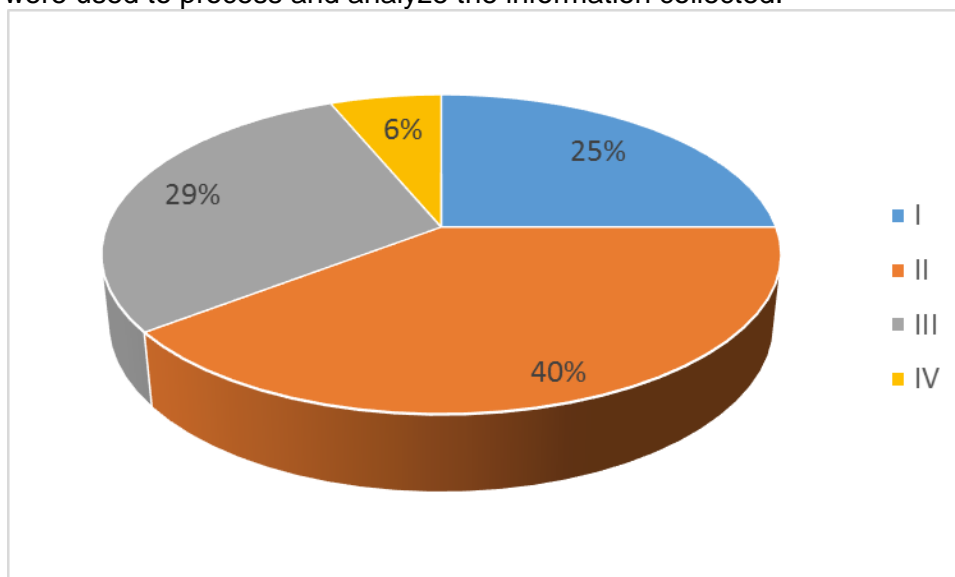


Figure 2. Covered students presented by years

3. THE EXPERIMENTAL PART

The virtual university courses developed hitherto provide the midwifery majors with opportunities for upgrading the lecture acquired knowledge and possibilities for self-directed studies. In the newly created course we provided information that was not included in the curriculum and which introduces midwifery students to auditory screening that is currently performed chiefly by neonatologists. Through these materials which include a video the students gain an understanding of the nature of universal neonatal hearing screening and its algorithm. Each student has the opportunity to join the virtual course at a convenient time. The survey created in the current study gives us a notion of the students' attitudes - to be trained to do the examining.

4. RESULTS

A large percentage of our respondents (69%) assert they have not seen the examination conducted with the screening system. This is because the initial hearing screening of all newborns is performed by the 48th hour in a soundproofed room. Such a specialized room is only available in the neonatal department which has limited access for students because of the specifics of the ward. It has been scientifically proven that detecting hearing problem in the first 48 hours after birth is of great importance. Screening studies carried out immediately after birth give an opportunity to improve the quality of life and the personal and social development prospects of the affected infants.

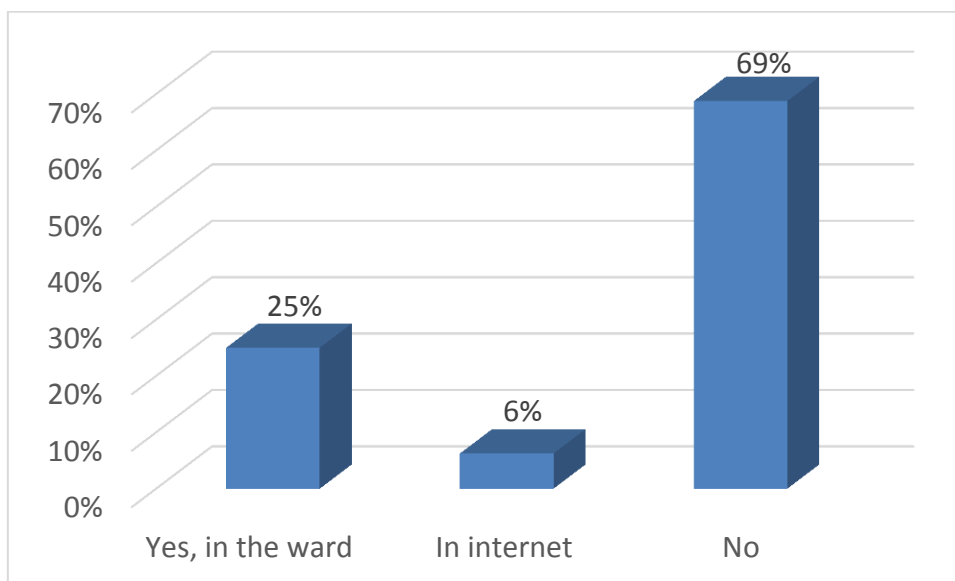


Figure 3. Knowledge about the test screening examination system "MAICO ERO-SCAN OAE"

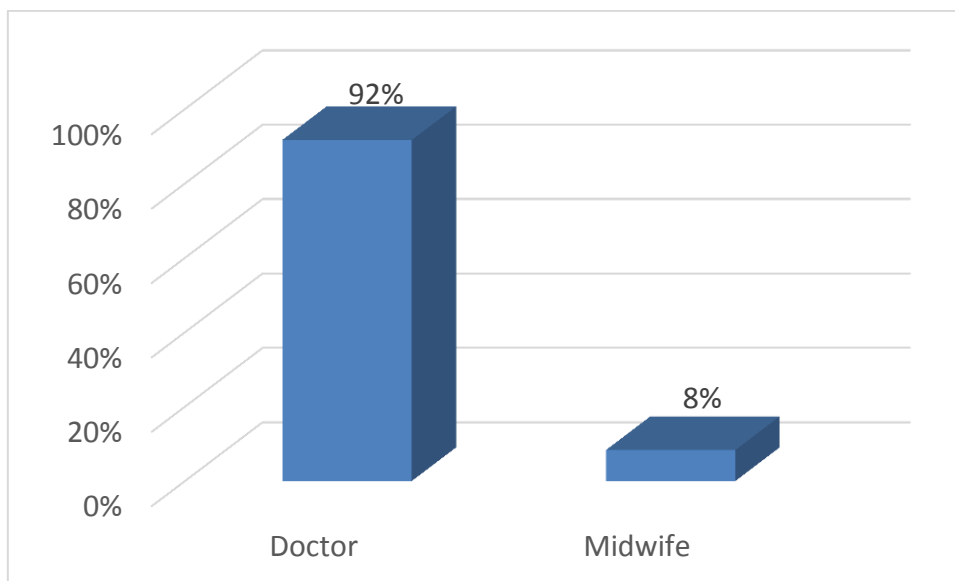


Figure 4. Screening performer

The responses received from the students are more than convincing - 92% of the medical personnel performing the screening are neonatologists and only 8% are midwives. Considering the competences of the midwives a larger percentage of them could be directly involved in performing the examinations. Preparing and establishing an optimal program for training the midwifery students to conduct UNHS is necessary. The risks posed by UNHS include false positives and possible delay in diagnosis in case of false negatives. These risks are however acceptable in view of the subsequent results.

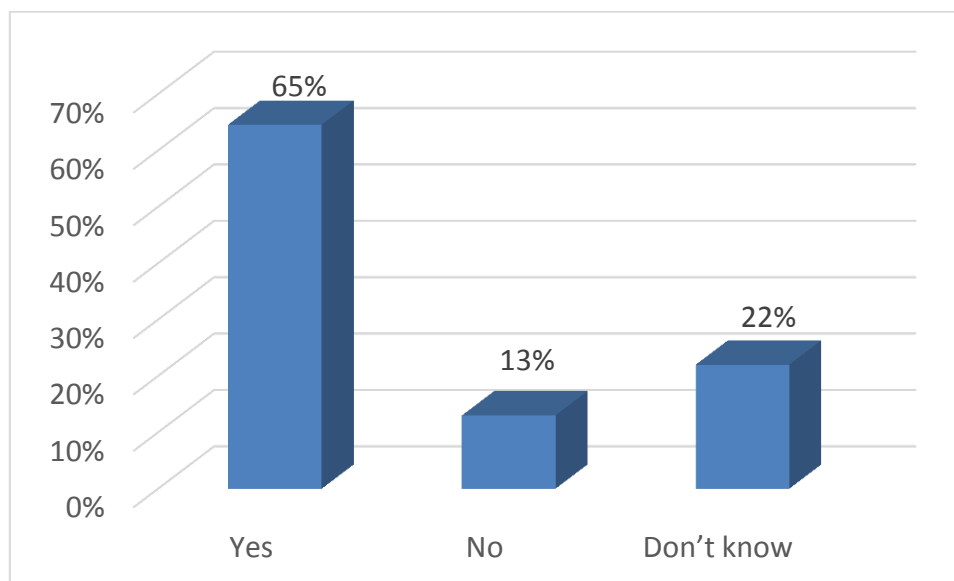


Figure 5. Willingness to be trained to the screening system

The willingness of 65% of those interviewed to go through the training process is clear. These are second and third year students. The remaining 22% are hesitant because of insufficient knowledge and practical experience as yet, 13% are reluctant to participate in conducting a neonatal hearing screening. Students' initiatives to participate in the auditory examining and their desire to acquire additional knowledge and skills need to be supported. It is advisable for midwives of the intensive care unit to carry out this type of examination as their main responsibilities are to monitor and care for healthy newborns and premature infants. Learning is an active process that can be stimulated by appropriate methods and tools. Computer technologies are such tools. They should be used to connect learners with virtual libraries, which will make the educational process more attractive and will implement the principles of transparency and accessibility [2] [7].

Regarding the question of whether they are willing to perform the screening, the majority of respondents (81%) answer they would not have any problem to conduct it and only 19% consider they might meet difficulties. This proves that, regardless of the course of study, students could competently and independently perform neonatal auditory screening algorithmically and respond in a timely manner to deviations in the graphical test.

Training students is a huge responsibility for tutors. The mentors should show a model of professional behavior and care to the future midwives. Applying an individual approach to their trainees with competency, experience and professionalism teachers form future midwives as professionals and as personalities.

5. CONCLUSION

The research clearly reveals that students are ready to undergo training and to carry out UNHS by themselves. A midwifery training program for universal neonatal hearing screening is being considered by the university lecturers. It is advisable for midwives in the intensive care unit to carry out the auditory examination, as their main responsibilities are to monitor and care for healthy newborns and premature infants.

The development of educational methods should go hand in hand with the advancement of technology in order for both to be mutually beneficial and necessary to one another. The

access to information in our daily lives provided by the virtual university plays a key role in adapting the educational process to the dynamics of our reality. Interactive digital teaching methods have proven themselves around the world with their convenience and practicality. This study proves that it is not enough for the tutor to be competent only in his teaching activity, but along with that to find new and effective ways and methods for the active participation of the trainees in the learning process.

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THE TRAINING AND EDUCATION OF AGE PEOPLE IN THE CONTEXT OF THE NATIONAL STRATEGY FOR ACTIVE LIFE OF ADULTS PEOPLE IN BULGARIA - RESEARCH

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Abstract: According to the data of the National Statistical Institute [www.nsi.bg], on the basis of the census as of February 1, 2011, the population aged 50 and over in the Republic of Bulgaria is 2 943 055, or 40,0% of the total population of the country.

In response to the challenges posed by an aging population, in June 2012 The Council of Ministers of the Republic of Bulgaria has adopted a National Concept for the Promotion of the Active Life of the Elderly for the period 2012-2030. [www.mlsp.government.bg]. [3]

The concept includes six operational goals and objectives in the fields of labor market, pension system, healthcare, education, long-term care and so on.

As noted in the National Strategy for Active Life of the Elderly in Bulgaria for the period 2019 - 2030. [www.mlsp.government.bg] [1], lifelong learning and lifelong learning will contribute to people's ability to follow structural changes in the labor market.

According to the results of the author's study, educational programs even for people out of the employment range are linked to the opportunities they provide for acquiring new knowledge and skills, but this knowledge satisfies the personal needs and needs of the elderly.

Keywords: population, population aging, training, education, labor market, active life, strategy, concept.

1. INTRODUCTION

The National Strategy for Demographic Development of the Population of the Republic of Bulgaria for the Period 2012-2030 [www.mlsp.government.bg] [2], prioritizes overcoming the negative effects of an aging population and improving the quality characteristics of human capital.

The following main areas are included in this priority:

- Adopting a comprehensive cross-sectoral approach to the active and productive life of the elderly in good health and adapting social systems to demographic change and an aging population - labor market, pension system, social assistance and care, health, education, culture and others. ;
- Developing solidarity between generations;
- Improvement of the general educational, spiritual and cultural level, qualifications, abilities and skills of the population of all ages.

Bulgaria ranks fifth in the world in terms of percentage of the elderly population within the total population - 24.2% of the population of the Republic of Bulgaria is over 60 years of age [4].

According to the estimates of the United Nations, in 2050. Bulgaria will be one of the oldest countries in Europe with values from 300 people over 60 to 100 people aged 0 to 14, meaning that the adult population in Bulgaria will be about three times the youngest population [4].

In response to the challenges posed by an aging population, in June 2012 The Council of Ministers of the Republic of Bulgaria has adopted a National Concept for the Promotion of the Active Life of the Elderly for the period 2012-2030. [www.mlsp.government.bg] [3].

The concept includes six operational goals and objectives in the fields of labor market, pension system, healthcare, education, long-term care and so on.

The subject of consideration and analysis in the report is specifically the identification of the opportunities for improving and maintaining the educational status of the elderly in the Republic of Bulgaria.

The results of a telephone interview with the main focus of the assessment of the educational and training programs for the adult population are the subject of analysis.

2. SOME DEMOGRAPHIC CHARACTERISTICS OF THE ADULT POPULATION IN THE REPUBLIC OF BULGARIA

According to the data of the National Statistical Institute [www.nsi.bg], on the basis of the census as of February 1, 2011, the population aged 50 and over in the Republic of Bulgaria is 2 943 055, or 40,0% of the total population of the country.

Compared to the 2001 census, its relative share increased by 4.1%.

Women in this age group are 1 632 558 and men - 1 310 497, respectively 55.5% and 44.5% of the population, or 1246 women per 1000 men.

The higher mortality rate for men and the lower average life expectancy for men also determine the higher number of women in this age group.

Of all persons aged 55 and over, 53.7% were aged 50-64 years, 36.1% were aged 65-79 years and 10.2% were 80 years of age or older.

In all three age groups, women predominate, with the highest share of those aged 80 and over - 63.9% of all of this age group.

The educational structure of the population aged 50 and over is identical to the educational structure of the entire population.

As of 01.02.2011. the number of persons with tertiary education is 564 425 people, or one in five over 50 years (19.2%) has completed tertiary education.

Persons who have completed secondary education are 1 249 992 (42.5%), with basic and lower education are 1 090 534 or 37.1%, and 38104 or 1.3% fall into the category 'never attended school'.

The educational status of men as a whole is higher than that of women - the relative share of men with secondary and higher education is 64.1%, against 59.7% for women. The share of women with primary and lower education is 10.7%, and 1.8% have never attended school. In men, these percentages are 6% and 0.7%, respectively. The highest is the share of persons with tertiary and secondary education among persons in the age group of 50-64 years of age - 74.2%. The share of people with primary and lower education is highest among people aged 80 and over - 62.5%, and 2.7% have never attended school.

3. METHODS, EXPERIMENTS, RESULTS

A / Methods

For the purposes of the report, the following methods are used:

a / a statistical method that involves the collection and processing of data;

b / a sociological method which is related to the choice of the way of data collection;

c / analytical method related to the analysis of the summary results of the study.

B / Experiments and results - they relate mainly to the implementation of the measures of the strategic documents for training and education of the elderly so far and the evaluation of these measures by the respondents. In addition, the research aims, based on the results obtained, to experiment with training and education programs in specialized and relevant areas through specific measures in separate target groups. This implies that the results of the experiment will also have the nature of expected results in the future and will be permanent.

3.1. Results of the author's research

Methodology of the study

The survey is based on data collected by telephone (telephone interview).

Respondents interviewed are persons over the age of 62 with a pension status - current or upcoming. The number of respondents is 102 people from Sofia and other regional centers of the Republic of Bulgaria.

Summary results

A / Profile of the respondents:

a / total number of respondents - 102 people;

b / gender structure - 63 of the interviewees are women and 39 are men, or in percentage, 61.76% of the interviewed are women and 38.24% are men [fig.1].

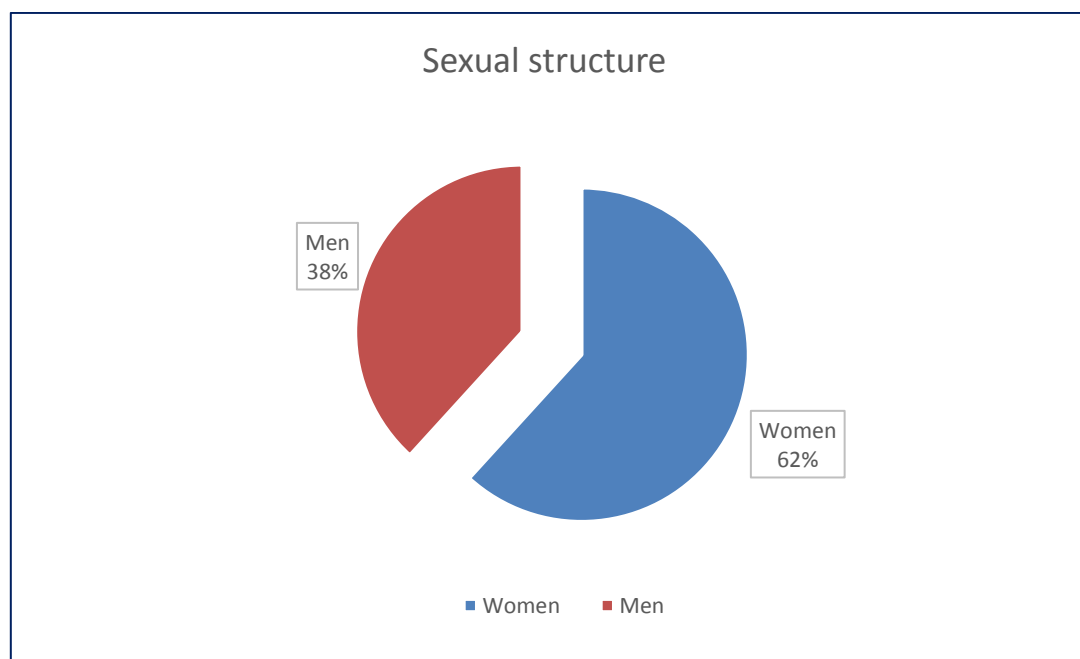


Figure 1. Sexual structure

c / age structure [fig.2]:

All interviewees are over the age of 62, and the following age subgroups are formed on the basis of the given age information:

- 62 years - 65 years - 32 people or 31,37%;



- 66 years - 69 years - 28 people or 27,45%;
- 70 years - 75 years - 23 people or 22,55%;
- 76 years - 80 years - 19 people or 18,63%

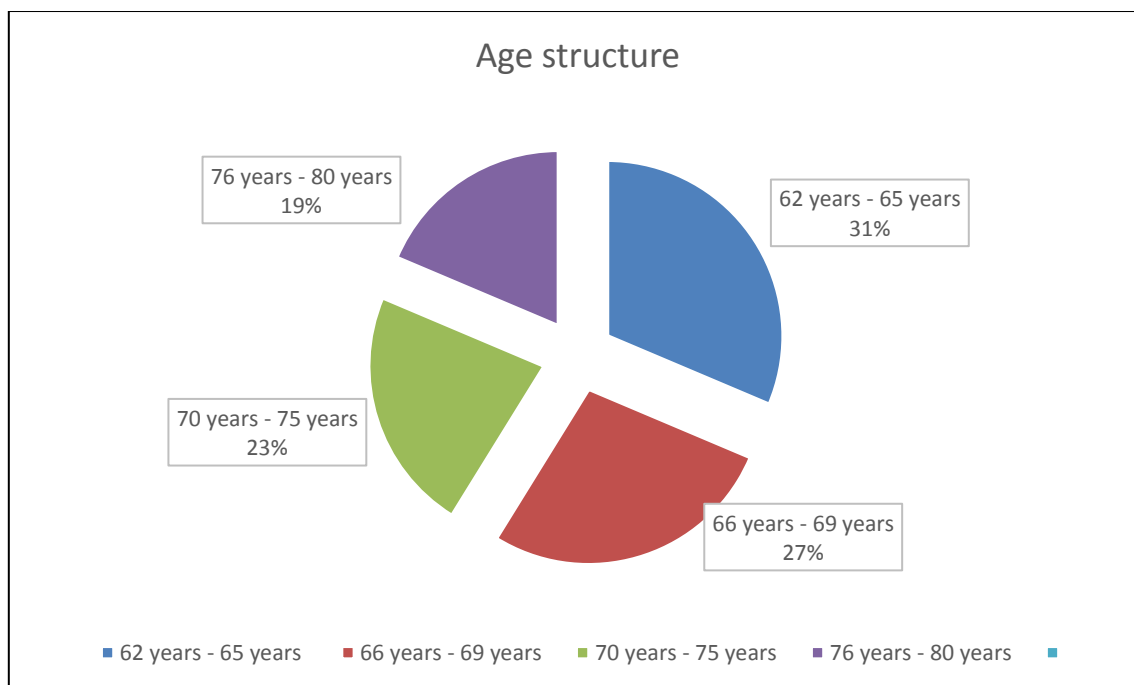


Figure 2. Age structure

d / working after acquiring the right to a pension [fig.3]

- out of 102 respondents, 37 people work (after acquiring the right to a pension) or 35.28% under a contract of employment;
- 18 people are civil servants or 17.64% of the total number of respondents;
- 23 people have their own working company - or 22.55%;
- 24 people quit their active employment after retirement - 12.53%.

B / Analysis of summary answers:

Answer the first question in the telephone interview:

1. What are the needs of the training programs for people of retirement age:

a / new knowledge and skills for finding a job;

b / personal improvement through acquiring new knowledge and active life;

c / Expand communications.

Answer "a" is preferred by 15 respondents or 14.71%;

Answer "b" is preferred by 26 people or 25.49%;

The answer "c" is preferred by 61 people or 59.80%.

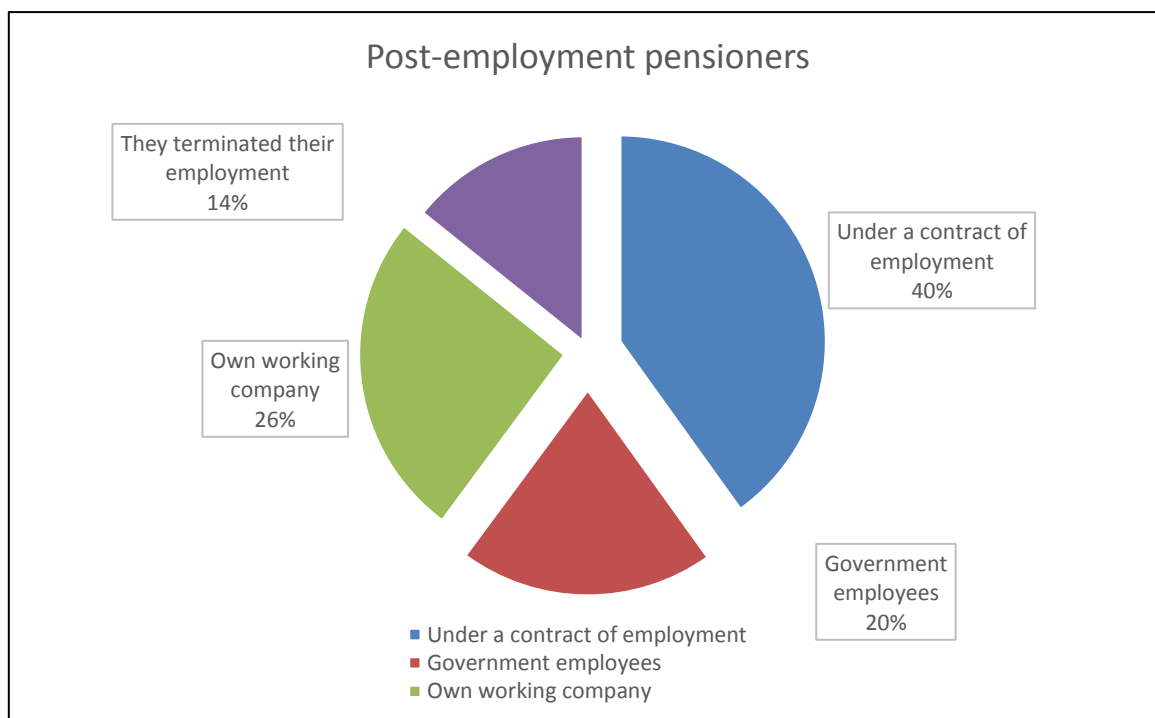


Figure 3. Post-employment pensioners

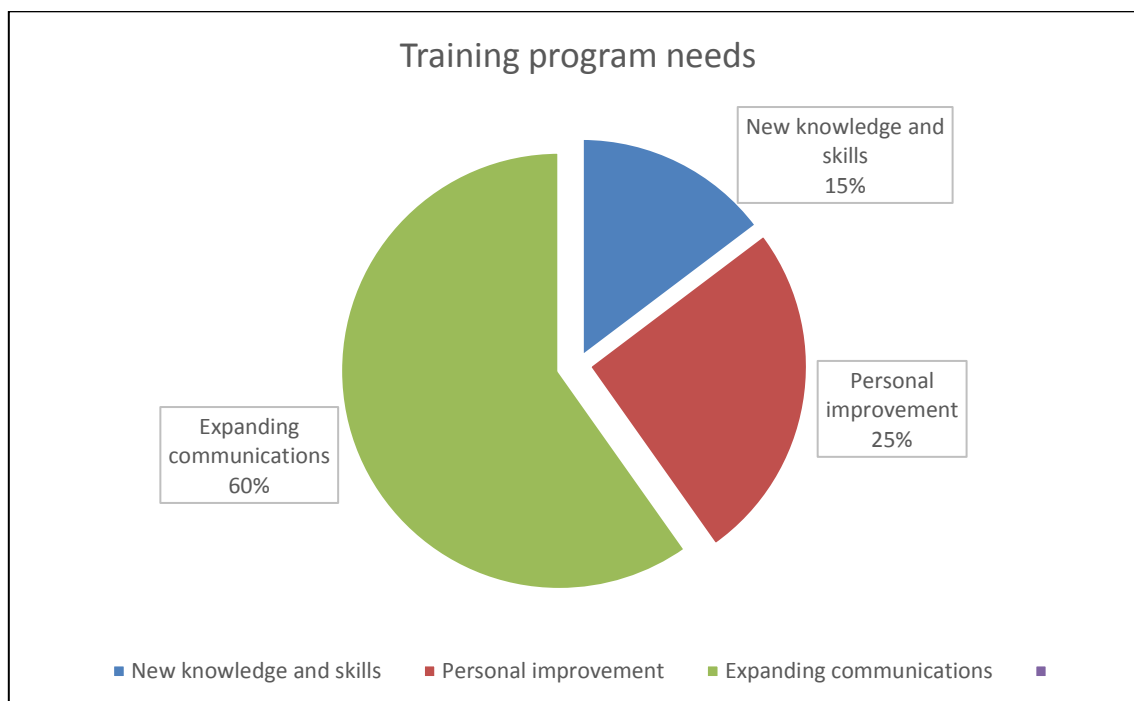


Figure 4. Training program needs

2. Answer to the second question in the interview [fig.4]:

Do you link retirement education programs to [fig.5]:

a / gain new knowledge and skills for personal needs and related to some of your needs;

b / opportunities to meet new people and hence an opportunity for a wider range of social communications;

c / a more active life.

The first suggested answer was preferred by 66 respondents or 64.71%;

The second answer was preferred by 23 respondents or 22.55%;

The third answer is preferred by 13 respondents or 12.74%.

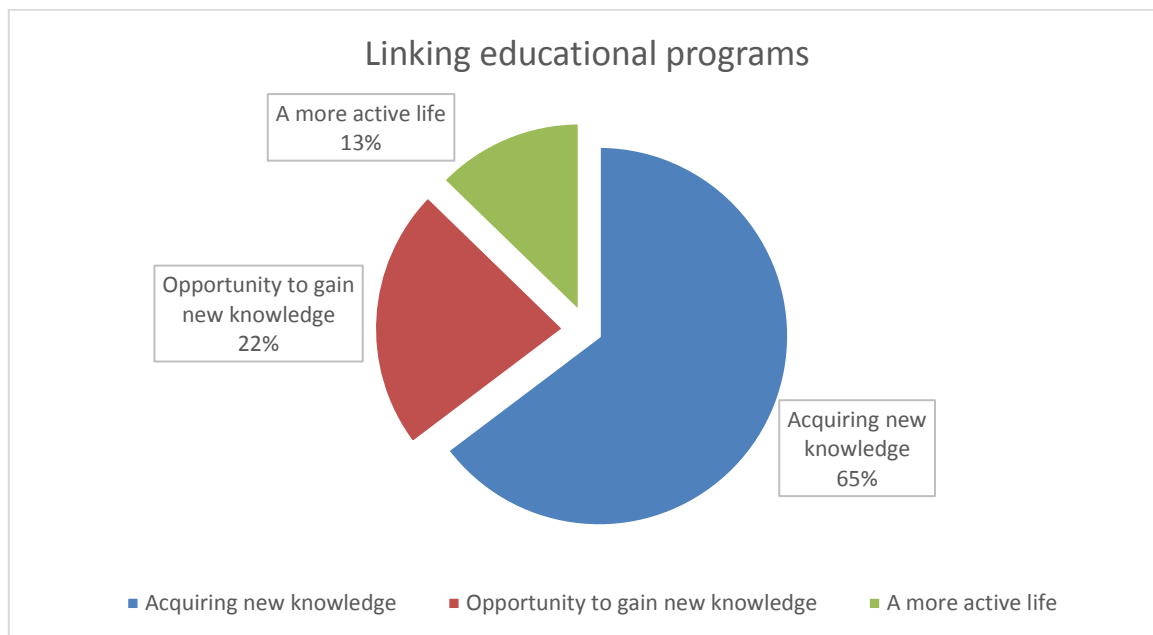


Figure 5. Linking educational programs

3.2. Conclusions based on summary results.

A / With regard to the profile of the respondents:

a / The gender structure shows the predominant share of women, which corresponds in general to the gender structure in the Republic of Bulgaria;

b / The age structure shows a relative disproportion between the different age groups with an ever-decreasing proportion of people with increasing age. This aspect can be explained in part by the mortality rates in the different age ranges.

Answer the questions:

- Question 1:

The ranking of the preferred answers to the first question shows that the respondents see the training and its functions as both a tool for leaving the labor market and an instrument for an active life.

The training, respectively the accumulation of new knowledge and skills, is related to the employment of one quarter of the interviewees, apparently with the current employment, with the change of the previous job.

Finding a job is related to the training programs and the result of them by the smallest proportion of respondents.

- Question 2:

In the answers given by the respondents to the second question, educational programs are seen as a mechanism for meeting personal needs and needs through the accumulation of knowledge and skills - nearly 2/3 of the interviewed.

The educational program, as a mechanism for expanding social communications and contacts, is viewed by a little less than a quarter of the interviewees.

Of those interviewed, just over a tenth view educational programs as a mechanism for an active life.

Obviously, if the answers to the two questions are to be linked, active life also links older people to employment where training programs have a specific pragmatic contribution.

In this way, the pursuit of learning to acquire new knowledge and skills also has its economic motivation.

Educational programs, even for people outside the employment range, are linked to the opportunities they provide for acquiring new knowledge and skills, but through this knowledge, the personal needs and needs of the elderly are met.

Expanding the range of social contacts and communications as an expected outcome can be justified in two ways - once, by joining educational groups and second, as opportunities for communication after acquiring individual skills, and again as a result of participating in educational programs.

The analysis of the results of the study calls for the following conclusions, which are related to the need for:

- First, preparation and implementation of up-to-date training programs for the elderly - in accordance with the needs of the elderly and the needs of the labor market;
- Secondly, the preparation of educational programs for the elderly, connecting above all to their personal needs and personal needs - such as the acquisition of digital skills, language training and other skills needed by the modern man.

The preparation of such programs, in terms of their effectiveness, should be preceded and based on the results of a large-scale national budget-funded study.

Such research will give concrete results reflecting the vision and needs of the elderly population of Bulgaria, and the results will be linked to the specific directions and measures of the strategic documents.

4. CONCLUSION

As noted in the National Strategy for Active Life of the Elderly in Bulgaria for the period 2019 - 2030. [www.mlsp.government.bg] [1].

Continuous learning and lifelong learning will contribute to people's ability to follow structural changes in the labor market.

Adequate and timely action on lifelong learning and the inclusion of the active aging generation will be crucial. The number of young people entering the labor market in the next decade will not be able to meet all the requirements of the labor market.

This will have implications for both the education system as a whole and the vocational training system and the training of specific staff in particular.

Therefore, it is important to take synchronous measures to properly assess skills, prevent them from being lost and to make the most of those available.

Measures proposed under this priority include:

- Promoting opportunities for older people to participate in the labor market;
- providing vocational training opportunities;
- improving working conditions;
- provision of specialized services for older workers;
- Provision of flexible services in the labor market, promoting reconciliation of work and care;



- and other measures.

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- [6.] www.nsi.bg

UNIVERSAL DESIGN FOR LEARNING AND ITS TECHNOLOGIES: MULTIFORMAT /MULTISENSORY BOOKS IN INCLUSIVE EDUCATION

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Abstract: *The article aims to give visibility to discussions on inclusion in the interdisciplinary context from the Universal Design for learning-DUA and its technologies in the actions developed under the International Project on Multiformat/ Multisensory Books from a scientific exchange between Brazil and Portugal with financial support from CAPES. The qualitative study (Martins, 2004), of a bibliographic nature with a methodological framework for reviewing the literature and the current educational legislation, including the Brazilian laws and guidelines, CF/88, LDB/96 (Brazil, 1988, 1996, 2008, 2015), Guidelines of the Ministry of Education of Portugal- Decree-Law No. 54/2018 and international guidelines such as Unesco (1990, 1994, 2000, 2016) and UN (2015). The theoretical backing is based on the studies of Alves, Ribeiro & Simões (2013); Castelin & Quaresma da Silva (2018); Freire (1987); Gatti (2011); Nunes & Madureira (2015); Rapp (2014); Sousa (2012, 2018); Yunes (1995); and others. We found that the DUA approach and its technologies are facilitating resources for inclusion, because they promote affordable and inexpensive pedagogical practices that use different educational technologies. Actions developed in the project were socialized that allow the expansion of access to reading with more flexible and personalized approaches, making it possible to adapt them according to the educational context.*

Keywords: *Educational Technologies; Universal Design for learning; Accessible reading, inclusive education; Multiformat/multisensory Books; SENSEBOOKS;*

1. INTRODUCTION

The article configures itself as a fragment of doctoral research, is part of the topic educative technologies and aims to discuss strategies of Multiformat/multisensory literature through the approach of the Universal design for learning – DUA, and Its resources and technologies imply in accessible communication and ways to foster discussions regarding educational and adaptive technologies in the interdisciplinary context. The actions that will be socialized are developed under the SENSEBOOK Project – multisensory Books, approved by the announcement N. 2 of 29/05/2014 In the framework of the Academic Development Program Abdias Nascimento (MEC/SECADI/capes), funded by the coordination of improvement of higher education personnel-capes in Brazil.

The project deals with a scientific exchange between Brazil and Portugal and cooperates in the development of research and products that enable communication accessible to all by means of Multiformat/multisensory books from a set of resources and Educational and adaptive technologies that favour inclusive processes. These works bring together in a single specimen [23], a combination of strategies with a DUA approach [18] that assist communication, digital and technological interaction with the reader/A, by making reading

practices more accessible by the creation, adaptation and dissemination of books in different formats.

Based on the referential [27] that deals with the changes in the information society, the need to reflect the relations of the digital world arose with the processes of inclusion of people who present some Type of disability [6] and which depend on adapted and technological resources for access to communication and information [10]. In considering this context, we refer to the question that motivated this study to investigate how do Multiformat/multisensory books based on the DUA approach and its technologies imply more accessible communication?

This qualitative study [17], a bibliographic nature, is methodologically anchored in the case study [24], because it is an empirical investigation, with a poorly investigated phenomenon, which requires in-depth study.

We elect to review the literature and current educational legislation the normative devices that guarantee the right to education, special education policies [3], [4], [5], [6], as well International Guidelines - Unesco [25], [26], [27] and Onu [2015] which refer to specialized support services that need to be implemented for the actual realization of inclusion, ensuring not only the insertion in learning environments, but enabling access to knowledge, permanence and success through learning.

The theoretical framework is supported by the studies [1]; [7]; [8]; [9]; [12]; [13]; [15]; [18]; [20]; [22]; [23]; [28]; [29]; [30]; and others. The discussion of the data presupposes bibliographic review of the literature and the current educational legislation in the two countries studied, including the Brazilian laws and guidelines and guidelines of the Ministry of Education of Portugal [10] in addition to Analysis of reading strategies presented in Multiformat/multisensory books with a DUA approachable [18] and its digital resources and adaptive technologies imply in the accessible communication pointing out alternatives for Encourage discussions in the interdisciplinary context.

The work developed in this study, discusses actions developed through this international project, indication the contributions of Multiformat/Multisensory books as accessible instruments and potentializes of learning [20] making the communication more approachable [8] by considering the strategies used as digital resources and adaptive technologies that potentiate media literacy by facilitating access to the information.

It is concluded that the approaches of the DUA approach [18] and its technologies favors the educational context [30] and its contributions in the creation of Multiformat/multisensory books should be widely disseminated in the middle Interdisciplinary, as a way of sensitizing the educative community [29] and the partnership with professionals from different areas.

2. BOOKS YOUR ADAPTIVE TECHNOLOGIES

To understand the increasingly inclusive and digital world [16] It is pertinent to discuss that there is no way of thinking about digital inclusion dissociated from social inclusion, since any effort of inclusion [16] Requires the use and appropriation of technological elements, knowledge of the local reality, adaptation of content and languages, creation of specific methodologies, accompanied by a continuous evaluation process.

Reflecting on the importance of the literature for global education [21] we highlight the use of Multiformat/multisensory books with a DUA approach [18] and its technologies that assist in the transdisciplinary approach of Inclusive education [6] especially in understanding that such works [8] constitutes cultural artefacts, since they are created/adapted considering the specificities of the public that will be contemned.

In the face of the needs of reformulation of the current education and information system [14] in his work "The Builders of information" indicates that the "dynamics of contemporary society demands more and more skills of its members", punctuating the various information

that permeate the daily lives of people and the celerity of this information, reflecting in the mode of (re) signifying and interpreting this information [26], reflecting on the sensitization of future Professionals [13] and researchers involved with the theme of inclusion and their adaptive technologies and media education and their developments.

If the act of reading is part of the communication process [23] It evidences that this practice "becomes vital for the development of people", since it occurs among the subjects in a daily way, involving the Social interactions and exchanges that are encouraged by various situations, whether expressed by memory, culture, traditions and resulting from different social contexts [22].

By highlighting the role of reading practices in the context of accessible information and communication [7] and by encouraging the creation of books contemplating the use of a diversity of digital and technological resources [8] Provide the transformation of these materials into a supportive/adaptive tool that contemplate different specificities [30].

Producing more accessible books, of an inclusive nature, that reach an audience that once were not contemned, means valuing such social and cultural practices through mediation of reading [8], because they make it possible for different audiences to have access to communication in a more accessible and effective way, constituting [12] of a liberating and emancipatory act.

In this sense, when addressing the actions elaborated under the SENSEBOOKS project in Brazil and Portugal, [8] Research, studies, creation, testing, reproduction and dissemination of inclusive materials in different contexts are developed in existing laboratories in the affiliated universities [8] which work with the community by offering projects that involve civil society making it accessible to all, providing opportunities for actions to make possible actions Inclusive and digital in different spaces of action, by promoting educational actions, minimizing the barriers of access [30] based on situations of social exclusion and denial of the right to communication.

Thus, we consider that the Multiformat/multisensory books developed, conceptualized [23] as "printed books that bring together in a single copy different formats and which contemplate different Needs ". Of these multiple formats and accessible strategies, we will cover some digital resources and adaptive technologies based on DUA – [18], with a set of techniques that are used in the production of these materials, constituting as alternative and auger communication systems, which in the words of [11] "are adaptations according to the potentialities and specific needs of each user".

For the DUA [18] approach aims to develop pedagogical practices that allow access to the curriculum, participation and progress of all students, regardless of their capacities. Therefore, it is a curricular approach that understands the diversity of students, considering what they learn, how they learn, and why they learn [20].

Among these strategies used by Sousa [23] is highlighted the increased text, the use of Braille in the Portuguese and English versions, embossed images with braille caption, use of easy writing, use of the pictograms system for Communication-SPC, Quick Response Code (QR) that refers to the digital context and allows interactions through these resources to content, audiobook versions, Videolivro, use of Portuguese sign language – LGP among others. It should be clarified that the materials discussed here/socialized are available on websites for consultation, by recommending the digital format, which favors the exploitation of different resources and there are copies in the printed version with support from institutions, Making the works more inclusive, accessible to different audiences¹ [9], thus achieving a maximum number of readers.

¹Available from: <http://crid.esecs.ipleiria.pt/>> Access in June/2019

3. CONCLUSIONS

This study provided opportunities for the socialization of fragments of the authors' investigative practices, making it possible to discuss the contributions of Multiformat/multisensory books and their technologies with a DUA approach, allied to the importance of the use of digital and technological resources adapted in the search to broaden and allow access to communication and information, while respecting a right of all.

From the aspects discussed in this study, they indicate the relevance of fostering themes that refer to the right to communication [9] and the educational policies that provide legal support [5]; [6], the importance of media literacy [27] as a support of knowledge and critical education of society, the set of digital resources and the relevance of educational and Adaptive Technologies by considering a diversity of knowledge under different perspectives and specificities, making it possible to broaden discussions in scientific and interdisciplinary spaces.

Discussing more accessible literature and its technologies of DUA approach with different professionals who work in different areas of knowledge, are configured as privileged spaces for socialization of knowledge, besides leveraging future studies and the development of products and materials committed to the specificities present in the educational and social contexts. By encouraging discussions about more accessible literature practices and its importance, it is configured in a major challenge nowadays.

We found that the studies of DUA in the educational field are recent [2] that have recently been incorporated into the educational legal documents in Portugal [10], however, are still little widespread in the educational area in Brazil.

It is concluded that the evidences presented in the study and in the socialization of the actions already developed indicate the potentialities of Multiformat/multisensory books with DUA approach and their adaptive technologies in the educational context and corroborates to the insertion of this theme in the guidelines of initial and continuous training of different professionals, favoring the interdisciplinary, scientific and technological environment.

By disseminating the actions developed within the scope of the project, we socialized practices and technological resources in Multiformat/multisensory that can be used by all, favoring the communication accessible, due to more flexible and personalized approaches, enabling adaptations according to the needs of the educational context that is increasingly technological, digital and innovative.

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PEDAGOGICAL ASPECTS OF INTERCULTURAL COMMUNICATION

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Abstract: *The authors research the intercultural communication in the context of complex education as a special model of communication in the article. They justify from a scientific point of view that the specificity of the conception of “intercultural communication” as a pedagogical phenomenon is associated with the creation of intercultural orientation of education.*

This requires the transformation of the content, problems, culture-oriented forms of the educational process and determines the dialogue of the subjects of pedagogical communication in accordance with the cultural standards of the target language affecting the development of personal and professional qualities and skills of students. Based on this, it is important to consider the development of communicative competence as a willingness and ability to implement successful communication, including intercultural communication. The authors emphasize the need of the formation of cultural literacy of the future specialist and provide a rationale for the formation of this process.

Keywords: *intercultural communication, communicative competence, multicultural education, cultural literacy*

1. COMMUNICATIVE COMPETENCE

In the complex of competencies that future specialists should possess, the communicative competence is essential. Communicative competence is the most important quality the person needs in all situations of the life.

The communicative competence is the ability to interact with other people (verbal and non-verbal). The trend we see today is that the secondary education graduates have unsatisfactory degree of this competence. The negative aspects of the situation intensify by the fact that the various alternative forms of the traditional lesson, for example, research projects, including teamwork, group discussions and presentation of results, aimed at the formation of key competences, depend on the elementary ability of students to communicate. Why this competence is dominant?

According to the authors, the first reason for increasing the role of communicative competence is related to the contemporary requirements of society, namely:

1. Requirements of the professional business world, in which there is a lack of practical communication skills of secondary education graduates. We are seeing a growing interest in various communication trainings, business communication and public speaking courses. The solution of the problems in the business environment today is determined not by the unique thinking and actions of one or the other specialist, but by the effective organization of the collective work of the specialists in the structure, i.e., by their communicative competence.

The role of electronic communications systems is increasing today and in this regard, it should be noted that concepts such as “virtual negotiations”, “virtual trade”, “virtual conferences”, “webinars” and others are coming up.

The authors believe that in today’s context, it is not enough for a person to be a good specialist, it is necessary for him to be an effective employee in his organization. This means, above all, being able to work in a team to achieve a common results, to participate in decision making, to be able to make meaningful statements to others and to understand the views of their partners. Future teachers also need to be able to work with information, using different information technologies, productively to solve conflicts, publicly present the results of the work, etc.

According to data from sociological research, 64 % to 96 % of working hours of top-managers occupied by direct and indirect communication - planned meetings, briefings and discussions with colleagues and partners, official talks, phone calls, work with e-mail and documentation.

There is a rapid development of new services and intellectual products, the services being carried out in the process of interaction between clients and representatives of the companies, which requires certain communication skills of their employees.

Finding a job by young expert depends on a properly written professional resume, the ability to perform himself well during the interview, and later - on the ability to build positive relationships with colleagues and partners. It should be emphasized that the communicative competencies are becoming an essential requirement for many contemporary professions and positions in the modern business world. The role of language schools, centers and schools in enhancing the communicative competence of young experts is becoming increasingly important.

- Requirements of the emerging civil society that develop horizontal social relationships as a balance of vertical hierarchical relationships, and this require a change in the level of communicative culture of society. Blurring borders and mixing different ethnic and social groups leads to the emergence of a so-called “multicultural society”, which requires the development of competences in the field of intercultural communication.
- The total development of mass communications and the use of manipulative technologies today require the modern person to be able to orient himself in the field of media, to play the role of “critical viewer” and “critical reader”. The ability to evaluate the information, the ability to express one’s point of view, to make “summaries” of other people’s ideas and opinions, are also within the content of communicative competence. The second reason can be formulated based on the needs of the educational field itself. By definition, the main purpose and meaning of personality education is to develop the practical abilities /the skills necessary to succeed in personal, professional and social life, and one of the main skills to achieve this goal is its communicative competence.

In the list of general education the skills and the cognitive activities of trainees included in the educational standards, the half of them is related to communication:

- Adequately perceive oral speech and be able to transmit the content of the text in short or extended form, in accordance with the situation of speech communication;
- To select and use language tools in accordance with the communicative task and situation;
- To develop their own monologue and dialog speech, in accordance with the accepted ethical standards of communication;
- To have the ability to read texts of different styles and genres freely, to carry out information-semantic analysis;



- To make written statements that adequately transmit the content of the hearing or read text with a degree of concreteness; to draw up plans, abstracts, summaries;
- To be proficient in at least one foreign language at the level of functional literacy [1].

The third reason for the entry of communication skills among the key competences is that communication, understood as “the exchange of meaning (information) between individuals through a common system of symbols (signs)”, is not limited to verbal communication and is a way, and at the same time a condition for the existence of any macro- or micro-human community [2].

It is well known that every science considers every phenomenon from its position and describes it by its own language. Therefore, in psychology, linguistics, sociology and related scientific fields, there are descriptions of communicative competence and its composition as its own subject of research.

But the field of education does not explore subjects that need to be described, but deals with children and young people. It helps them through existing culture to develop their abilities, knowledge and skills to live normally in society.

In modern practice, the main result of school education is the combination of subject knowledge, or the totality of the information received and learned by the students. Along with that, this type of knowledge is not used by the student in practical situations in their life and activities. The logic of the competence-oriented approach involves the formation of skills and the development of this basis of abilities that enable young people to realize them in society.

In this sense, the communicative competence, on the one hand, is a characteristic of the personality, his ability, which, on the other hand, is manifested in his behavior and activities, enabling him to handle life-changing, practical situations, including communicative ones [3].

According to the authors, when it comes to communicative competence, it is necessary to determine what kind of understanding of communication is taken as basic. There are two models of communication in linguistics:

- Subject-object,
- Subject-subject.

In the first model, any communicative action is carried out by only one participant in communication, and the characteristic of the actions of other participants is spontaneity, reactivity and manageability.

In the second model, each communication participant performs any communicative action. When it comes to competence, only the subject-subject position of the communication participant can be considered, as the spontaneously responding person cannot be called competent. In today's fast-paced life, with emerging different communities and groups with their own interests, languages, subcultures, the “subject-subject” model of communication is of particular importance. It is the ability of people to negotiate with each other. Therefore, the communicative competence is the ability to solve communicative problems: to determine the goals of communication, to assess the situation, to take into account the intentions and ways of communication of the partner / partners, to select adequate communication strategies, to evaluate the success of communication, etc. All of these communication tasks are prerequisites for successful communication.

In other words, the communicative competence is the willingness and ability to carry out successful communication, including intercultural communication. Moreover, the contemporary geo-economic and geo-cultural situation forces the person to live in a global world, which means being able to participate in an effective, mutually beneficial dialogue with representatives of all cultures and peoples.

2. MULTICULTURAL EDUCATION

The tradition of multicultural education is being formed in Kazakhstan today. It recognizes as a fundamental idea the cultivation of respect for the diversity of cultural traditions. Kazakhstan's successful experience in creating and developing a model of interethnic and inter-religious co-existence continues to generate real interest in the world.

It is obvious that the large number of ethnic groups living in the territory of Kazakhstan for centuries causes the need to pay special attention to the issues of integration and interaction between them.

One of the most important goals of education is to teach children and young people to perceive positively cultural diversity in the modern world as a necessary condition for the development of free and harmonious individuals.

Multicultural education is based on the principle of cultural pluralism, the recognition of the equality of all ethnic and social groups that make up a society, the inadmissibility of discrimination against people on grounds of "national or religious affiliation, gender or age".

The essence of multicultural education is a process of training by integrating and preserving the cultural identity of the individual in a multiethnic society. Its mission is to help people to find themselves in the global world of culture, without interfering with the realization of others. This task is solved through dialogue of individuals, cultures, civilizations - dialogue on relevant positions.

It is an important part of modern education, contributing to the learning of other cultures by the young people. They study the general and specific in the traditions, the lifestyles, the cultural values of the peoples, and it includes their education in the spirit of respect for other cultural systems. Multicultural education helps to turn diversity into a useful factor for the development of society, it provides a faster adaptation of young people to changing conditions, helps them to form the multilateral picture of the world. From this perspective, multicultural education should be the most important component of young people's overall preparation for the life in the 21-st century. In these reflections we see underlying inseparable connection between "education - culture - society" when talking about the development of human intelligence through the cognition and boundless abilities to perceive and enrich their knowledge. In today's global world, the culture of tolerance is becoming the basis of the ongoing processes of modernization of society.

From the point of view of philosophical and cultural studies, it is a culture of the positive attitude, even, of the positive attitude towards differences, and in particular, a culture of communicative openness to the "other", which includes the whole spectrum of meanings between complete "rejection" and "accepting" of this "other" and "other people". The culture of tolerance presupposes the active development and application in life of the principles of tolerance and harmony in the modernization of a modern multicultural society. Culture of Tolerance is the active attitude towards what happens is formed by recognizing the human rights and freedoms, including the mutual understanding and respect for the views, culture and lifestyle of other, "different" people [4].

The most important part of the concept of global education is the development of students' intercultural literacy, i.e. understanding the others' culture.

Various aspects of the formation of the intercultural literacy, the levels of its formation and the rationale for the need for this process in contemporary schools are discussed in R. Henvey's work "An achievable Global Perspective" [5].

The intercultural literacy is based on the understanding that the diversity is an objective characteristic of world culture and a driving force for its development. R. Henvey distinguishes between four levels of intercultural literacy.

- At the first level, the young people become acquainted with superficial, attractive strangeness. These features become common stereotypes and they are perceived as

something exotic. This level is related to the knowledge gained from the media, films and more communication channels.

- At the second and third levels, the young people penetrate into the essence of the particularities of culture that contrast with their own peculiarities. On the second level they are annoyed with their absurdity and differences, but on the third level they already seem justified in their own way, to some extent - rationally.
- At the fourth level, the perception of culture through the eyes of culture “holder” is possible. This level is difficult to achieve, but a person’s ability to change his or her psychological orientation makes it possible to achieve at least several aspects of the fourth level. A special property of the human personality - the ability to see himself in the place of another person, helps this process.

Intercultural literacy fosters empathy and respect for other’s points of view, traditions and culture, and a desire to resolve conflicts peacefully. Empathy is the ability to see ourselves in another person’s place [5].

In the modern society there are more people with this ability than in traditional society because the representatives of the industrial urban community increasingly have to change their social roles.

The educational system is the system that is called upon to help young people to see and understand the common and the different between cultures, to look at their own culture through other peoples’ eyes and thus learn a lot about it.

Multicultural education and intercultural literacy provide multifarious approaches to education of the young generation. Today it is necessary to move from the ordinary transfer of knowledge to the formation of relations between facts and occurrence. It contributes to the activation of the processes of transmission, perception and processing of information, facilitates the tasks for personal development, and enables the orientation in the information flow.

Cultural literacy allows identifying the main directions of development of world culture, the role and contribution of each ethnic community, ways of interaction and interpenetration of cultures. In terms of value orientation of the individual, it leads to respect the cultural values of humanity as a whole and of each ethnic group separately, desire to understand and accept cultural diversity as a positive factor in the development, rejection of stereotypes in relation to other peoples [6].

The formation of intercultural literacy contributes to the schooling of respect and interest in cultures of other nations, the pursuit of understanding the most important specific and common characteristics of these cultures, understanding their similarities and differences, which is fully corresponds with the principles of intercultural interaction.

The practical justification for the need for multicultural education is explained by the objective processes taking place in the world community. The integration of people in the global whole, in the multicultural community is a major trend of our time.

The social life is gradually becoming more complex, and pedagogical activities become impossible without people specially trained for it. Therefore the existing special social institution - the educational system is changing in accordance with social transformations and social needs.

Today we can emphasize the following goals of the multicultural direction in the education system:

- Cogitation the concept of “culture”, the understanding that each person is a representative of a particular culture and the diversity of cultures enriches society;
- Overcoming prejudices and stereotypes, getting acquainted with the history and culture of different ethnic communities, respect for all people, regardless of their nationality, race, gender; ability to evaluate contemporary and historical events from the point of view of different cultural groups;

- Personal contacts with representatives of different communities and attempts to adapt to an unusual cultural environment;
- Dissemination of ideas of multicultural education.

The specific tasks of multicultural education arising from these goals are:

- Deep and complete absorption by the learners their national culture as a condition for integration into other cultures;
- Forming ideas about the diversity of cultures in the world, promoting a positive attitude towards the cultural differences that ensure the progress of humanity;
- Creating conditions for integration of learners in the cultures of other peoples;
- Developing skills and abilities for productive interaction with representatives of different cultures;
- Education in a spirit of tolerance and humane intercultural communication.

Z.T. Gasanov proposes to include in the course of training in the field of “intercultural communication”:

- Introducing young people to the system of scientific knowledge of human rights and freedoms, about nations and their relationships, races and religions;
- Formation of civil and universal human qualities;
- Developing a positive experience in the culture of communication with people of different nations, races and religions.
- The content of education should include the following areas:
- Ethnic and demographic situations in different countries, continents and all over the world;
- Social and ethnic changes in the world;
- Unity and indivisibility of the contradictory, multi-ethnic world [7].

The students at school must acquire intercultural interaction skills that contribute to their active socialization in the modern world.

There are some models of intercultural interaction in the education that differ in three aspects:

- On the teaching method - didactic or empirical;
- On the content of training - general cultural or particular cultural;
- On the area in which the main results are planned - cognitive, emotional or behavioral.

The main types of training programs in preparation for intercultural interaction are: teaching, cultural orientation, coaching, educational games (cultural role-playing games), discussions, trainings. Thus, the intercultural communication as a pedagogical phenomenon, contributes to the creation of an intercultural orientation of learning, focused on the dialogue between subjects in pedagogical communication, in accordance with cultural norms. It also influences the content and forms of the organization of the learning process.

3. CONCLUSIONS

The modern conditions require young people to apply creative activities to generate new ideas for modeling in practice the openness, tolerance, flexibility and breadth of thinking. Personality culture is a challenge for the new information and communication society, with its global problems and crises. Therefore, the increasing use of scientific knowledge and the positive experience are a great potential for young people. They with their knowledge and



intellectual capital become a major resource for world development. In this process, the role of multicultural communication is crucial.

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FUTURE ELEMENTARY SCHOOL TEACHERS' LEARNING ISSUES OF LITERARY WORKS OF SYR REGION POETS AND ZHYRAUS

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Abstract. *The task of society is to educate, to form creative personality and to develop student's activeness in society. The more future specialist is able to make changes, the more intensely he knows the nature and the environment. In this regard, regional literature creativity of the works of poets and zhyraus of the Syr region is a source of enthusiasm for literature lovers.*

The promotion of the literary heritage of poets and zhyraus who lived in Syr region is one of the main ways of combining education and upbringing. It is possible to increase desire of "Pedagogy and methods of elementary education" specialty students to study scientific literature and literature in the field of thematic-ideological, genre and artistic skills by introducing the poetry of Syr region. For this purpose, the teacher should be able to use the most effective methodology for the implementation and to consider the ways in which the student's creative work and ones feelings can be enhanced.

Keywords: *poets and zhyraus of Syr region, educational problems, elementary level education, imagery/ work of fiction, regional literature.*

FUTURE ELEMENTARY SCHOOL TEACHERS' LEARNING ISSUES OF LITERARY WORKS OF SYR REGION POETS AND ZHYRAUS

It is a challenge to educate young people on a scientific basis, if we say that the country joins the civilized countries in the form of today's generation. Formation of the basis of national consciousness of high culture on the basis of cultural and spiritual treasures of the population is a key issue in today's educational process. The discipline literature is difficult in this direction.

The task of society is to educate, to form creative personality and to develop student's activeness in society. The more future specialist is able to make changes, the more intensely he knows the nature and the environment. In this regard, regional literature creativity of the works of poets and zhyraus of the Syr region is a source of enthusiasm for literature lovers.

The works of poets and zhyraus of the Syr region are one of the spiritual channels that make up the history of our national literature. The continuation of the creative process from oriental poetry through the works of the Syr region poets and zhyraus remains a traditional artistic basis of the development of national art.

The promotion of the literary heritage of poets and zhyraus who lived in Syr region is one of the main ways of combining education and upbringing. It is possible to increase desire of "Pedagogy and methods of elementary education" specialty students to study scientific literature and literature in the field of thematic-ideological, genre and artistic skills by introducing the poetry of Syr region. It is necessary to say, by explaining to students that the power of literature is a process of eternal renewal, that a group of these literature makers is poets and zhyraus.



Oriental literature and Kazakh literature, which had a long history of historical roots, had gained exceptional force in the nineteenth century. The nineteenth century is a facet of our national literature, and it is a period of time when the legitimacy of the internal tradition was based. Clearly, the oriental tradition, which has a centuries-old history, has been the source of our national literature, which has come to a new level in the written process. It is known that the heritage of the Syr region poetry, which is a prominent branch of the Kazakh literature, is an artistic continuation of the historical and cultural development. Famous scientist A.Seydimbek commented on this fact: "The secret of this is the fact that Syr region has long been a social and political landmark of the Kazakh people. The nomads of the Great Steppe were the political and social destiny of the Syr region before the beginning of the twentieth century. This historical process also contributed to artistic tradition and ensured the transformation of art schools of all Kazakh steppes around" [1].

It is worth noting that when it comes to the creativity of poets and zhyraus, they can not speak without the literary traditions of the eastern countries that they were taught. It is well-known from the history of literature that mankind has taken the spirituality from oriental literature and culture to its origins. The influence of the famous oriental stars such as Ferdowsi, Sagdi, Nauai, Nizami in the literature of other peoples is a sign of this. This tradition did not turn out the poetry of Syr region. All the Syr poets who have been educated in madrasahs in Central Asia have almost a tradition of oriental literature. They brought the Oriental Classical Literature samples to the Kazakh concept, bringing the novelty to the Kazakh literature and forming an Oriental tradition.

One of the main works in the study of the works of poets and zhyraus in Syr region is the students' ability to perceive and influence the artwork, to understand the artwork in all its contexts. For this purpose, the teacher should be able to use the most effective methodology for the implementation and to consider the ways in which the student's creative work and ones feelings can be enhanced.

In the course of studying the works of the Syr region poets, students should be integrated into the issues of aesthetic, moral, civic education, reading, motivation, logical thinking, enriching their spiritual world. It is beneficial to explain the ideological content, analyzing the works of poets, such as Balky Bazar, Turmaganbet, Shorayak's Omar, Karasakal Erimbet, Kete Zhusip and Kangly Zhusip, who contributed teaching artwork of the Kazakh steppe, as well as the poetry of traditional poetry of Eastern traditions. Including genre features of poets and zhyraus' works contributes to the expansion of literary-theoretical knowledge of students. In this regard, it is good to keep in mind the opinion of the scientist B.Karibozuly "...Although it was born in the tradition of Oriental literature, but in terms of content, thematic, formal character, became a great contribution to the development of our native literature, becoming the works of Kazakh literature" [2, p. 31].

Acceptance of a student's artistic work is a world that can be realized by his soul, heart, and spirit. No matter what a good work, the student should feel the emotions of the author as well as his inspiration. It is in the hands of the teacher to wake up this feeling in a student.

Poetry teaching is one of the most pressing issues in literature learning. The students should be able to read and understand the poem while studying such kind of poems. It is obvious that the student who possesses this knowledge has rich vocabulary, the higher level of knowledge and intelligence. As a result, the future specialist will be able to read independently the poems of the Syr region poets, which is based on some interesting stories.

There is a world in the creative work of poets and zhyraus, where students are attracted to humanity and love. One of the ways to learn literary analysis is to teach students to look at the creative world of art and to learn creativity. It is not only the ideological and artistic quality of the work, but also its contents. The method of teaching and composing analysis is closely interconnected. In the process of training students should constantly improve their theoretical knowledge and it is better to teach them the methods of analysis.

In recent years, the study of the works of poets and zhyraus has gained momentum in the new level. The traditions of the traditional culture of our people for centuries are, first of all, considered as a contribution to common values with national consciousness. The students are trained by being acquainted with the deeply thought-out intelligent propaganda of the poets and zhyraus, such as, Bally Bazar, Karasakal Erimbet, Budabay Kabyluly, Dur Ongar, Eshniyaz Sal, Kete Jusip, Shorayak's Omar, Kangly Zhusip, Turmaganbet, Nurtugan, Sarsenbay, Abzali, Zhyenbay, Kushheney, Nartai, Manap and etc who made the secret of the pearl, and learned to absorb their scientific thinking.

Life is characterized by close relationships between different characters in the oriental literary works of its poetry. The systematic review of the works, based on the main artistic features, the nature of the realities of life, is obviously augmenting the students' essential aspect of these works and their desire to explore the lives of representatives of the local literature.

“Fiction is the value of literature. Teaching imaginative literature is the development of the creative thinking, the enrichment of the spiritual world, the perfection of aesthetic taste and the moral qualities of the student” [3, p. 62], - said literary researcher Kazhym Zhumaliev. During the study of the works of poets and zhyraus, their works, which affect the issues of human emancipation, are taken into the main form. For example, in the fables of the well-known poet Turmaganbet Izteleuov, ethical improvisations are often promoted. The poet is known by his fables as “Lukpan Haqim”, “Father and Child”, “Suleiman and hedgehog”, “Four friends” and others. Using the fable for the reader, he invites us to the goodness. As a weapon of irony and ridicule, one of the Oriental classics, written on the example of Rabguzi, the fables “Lukpan Haqim” and “Father and Child” is common to most Eastern nations. It is evident that the poet intended to preach humanity and righteousness in the fable “Father and Child”.

If born whole, no one neglects you young

You seem like a pillar in heaven,

Turmaganbet sums up such an undertaking of a fable:

Do not say young, if smart consider him a big brother

Said the genius Lukpan Aplatov [4, pp. 118-119].

As the Kazakh people said, “Do not say young, if smart, consider him a big brother”, moral and human justice is preached in the fable. The main idea of the work is to state that “smart people come out among youngsters”.

In one of his works, Suleimen was dissatisfied with the situation in which his father, Dauit, had been pushed aside by a shepherd who had been unfaithful to the ripe grain. If he puts himself on, he will say that he will solve the problem in a different way.

“Let not lose hope from the harvest

Which he courted in winter and summer

Share a little with others

Until they reached sheep milk

Then you share and wool" [4, p. 118], -

by saying this he gives a fair assessment.

The main idea of the fable is to describe the fact that the wise man, despite the difficulties and hardships, takes away the last problem by saying "Do not say young, if smart, consider him a big brother". This word has a great educational value.

We know the mysterious and deserving of the common problems of the human race, which has become a cornerstone of the Turmagambet poet, which is among the contemporaries was known as "living vocabulary of eastern languages". The poet had such a great deal of his knowledge that he educated and educate the whole family of Syr region poets.

The poet Absaly Egizbayuly, who freely enjoys the classical literature of the East, learns good traditions and singing in Kazakh poetry, also wrote stories written in oriental version with excellent plot. The poet shows the brevity of life, warns of instability in wealth, referring to the fables "Dat", "Four Dervishes", "Maksut" based on ancient myths of Eastern people and gives a conscious mind.

The poet's stories contain philosophical views and judgments. The epic "Dat" begins with the most frequent thesis writing:

The scientist, who overcame my knowledge,

Honest person also passed away the life

There are many innocent people,

There is also a tyrant who strangled the land [5, p. 108].

One value in the ideological content of epic is humility and exposure to evil. The position suggested by the poet is not to abuse the person, to humiliate materialism and violence. Exemplary of purity, politeness, benevolence and loyalty is often seen in the poet's compositions.

The main subject of the epic "Maksut" is the noble object of humanity, genuine friendship, unity and solidarity. The poet also begins his work with propaganda:

Before we passed, there were many people,

Everyone will pass, but history will stay.

Uneven life, the epoch does not move,

Then your good deeds will stay [5, p. 116].



The poet mentions the world's transformation, the instability of the world. The idea of the fable is that if you are fair to the people, it will be compensated, that the benefits of human beings are not dependent on wealth, but on loyalty. It is the idea that only a good leader will be able to achieve his goal.

Literature of each nation can contribute to spiritual world development by developing its moral vigorous traditions and qualities. The impressions from the works of the poets and zhyrau remain in the minds of the generations and remain as a unique aesthetic phenomenon in the spiritual world.

Today there is a requirement for a new scientific study of the creative heritage of representatives of regional literature in the sphere of education. The opinion of the researchers suggests that the Syr region poetry has a common idea of the whole Kazakh people, and that the core of the country is the artists, who have recognized learning and education and are learning art, and have been able to convey that noble idea to their people through their works. The actual idea that they have raised does not eliminate their significance, and in time, their significance increases. The need for today's generation to grow up to meet modern requirements also increases. Currently, when the country has gained independence and retained our ancient heritage, revived our historical figures, our spiritual treasures, we are now looking for a new way of looking at the scientific heritage of the Syr region poetry, re-examining, analyzing and learning.

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STRATEGIES AND INNOVATIONS IN TEACHING EAP TO MEDICAL BACHELORS

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Abstract: *The use of new technological tools in the classroom enables many new ways of teaching in foreign languages. Unlike the old methods that rely on unidirectionality, new technologies also require new ways of teaching, managing work, and therefore a new ethos. The introduction of new technologies also leads to a change in the status of the teacher, which also requires a change in the training strategy. This article reflects a pedagogical experiment aimed at testing the readiness of both the teacher and the students to acquire new knowledge and skills in a modern, interactive way. For this purpose, during the whole course of foreign language training over two semesters at the Medical College at the Medical University - Plovdiv, two groups of students in the specialties "Medical Cosmetics" and "Instructor in Food Safety" are taught in two different ways - one studying English in the traditional way with a textbook, while the other using only "interactive" methods without using textbooks or similar tools. At exit, a survey is conducted among one of the groups of students to evaluate their attitude towards the new approaches in learning a foreign language.*

Keywords: *technology, classroom, EAP, medical bachelors*

1. INTRODUCTION

Foreign language training applies many methods and approaches - grammatical, audio-lingual, direct, communicative, but leading with contradictory success to the acquisition of the most important language skills. The basic concept that is used today to determine the command of a foreign language is communicative competence [3],[4],[6] defined as a set of linguistic, sociolinguistic, discourse and strategic competences. The linguistic criterion for language proficiency refers to the ability to use vocabulary, syntax and target language grammar correctly, while in socio-linguistic terms it is important to respond adequately to the situation according to the circumstances and the relations with them. Discourse competence [3], [6], treats the interpretation of the broader context in order to achieve cohesion and coherence between different sections of the unfolding language use. With respect to the strategic goals of the discourse, the question that arises is how to eliminate the so-called "white noise", in R. Jakobson's words, i.e. detecting and correcting errors in the communication channel between the producer and the recipient of speech. The overarching aim is to find those approaches that mediate communication skills across the broadest contextual spectrum. Thus, the communicative approach to the acquisition of a foreign language becomes playful and simulative, seeking closest kinship with the corresponding reality, in such a way that this same reality outlines its possible manifestations.

Language-oriented learning is a manifestation of the communicative approach and is a change in the educational paradigm, a response to the changed roles of teacher and student in producing pedagogical impact, reflecting the change in goals in socio-cultural discourse [9]. This method also changes the role of the teacher, who, from the 'last resort' in the behavioural model, focusing on repetition as the basis for habit formation, now becomes more of a 'manager' and the classroom- an 'experimental laboratory' [1]. The communicative approach is asymptotically group-individual, since its horizon is the successful

communication that is appropriate to the interpersonal and textual context [1],[7]. The goal is to build functional skills, not so much theoretical knowledge of a foreign language. In this sense, communication is raised to the highest level and is a mirror of the peculiarities of modern times. However, its ontological value is inextricably linked to technology [8], which is its main vehicle. Using advanced training tools such as computer technology, the Internet, interactive whiteboards, etc. is a fundamental, but not the only condition for efficiency - modern teaching approaches to functionality, pragmatism and individualization must also be appropriate at the technological level. The present study seeks to investigate the effectiveness of the communicative approach in bachelor's foreign language training.

2. METHODS

For the purpose of the study, two groups of students from the newly-found specialties of "Medical Cosmetics" and "Instructor in Food Safety" performed the functions of a control and experimental group. The students from both groups were approximately at the same level at baseline, which was measured by an entrance test. The control group – "Instructor in Food Safety", followed the standard approach to learning a foreign language based on the use of specialized textbooks and handouts. The lessons in the experimental group, "Medical Cosmetics", were conducted without the use of a textbook and were implemented methodologically through several groups of activities:

- Based on the use of modern audiovisual tools and the Internet
- Based on individual projects
- Based on interactive methods in pedagogical-linguistic terms
- Dialogue based

Each group consisted of 10 people, which is optimal for foreign language specialized training. The course took two semesters, for a total of 60 teaching hours of 45 minutes each. The level of command of the language was A2 - B1, and in addition to mastering the necessary general communication skills at the B1 level, the acquisition of basic terminology in the field of rehabilitation and kinesitherapy was required. The language level of the groups was determined by an entrance test and a short individual oral interview.

The training process for the control group included work following a textbook, entitled "Nursing" [5] (a compilation of 8 general medical units), ancillary handouts with exercises and theoretical material. The textbook includes exercises in all basic non-writing language skills, with writing being assigned in a separate module of study - "academic writing". Control was carried out after each unit by progress tests.

The training in the experimental group included many different activities, with the aim of avoiding repetitions of the same exercises. The main approaches were:

- composing dialogues on set topics and key phrases, panel discussions, discussions in small groups, eliciting a token speaker
- role-playing games simulating real-life situations typical of the specialty
- independent projects on separate topics of the material
- extracurricular classes delivered, visits to specialized facilities (communication was in English)
- group presentations, visualization of topics through movie screening

Each activity was subject to participation control, as appropriate - a variety of questionnaires and other materials were used to determine the level of language acquisition without resorting to standard tests. The text tasks were in the form of crossword puzzles, snippets for linking, writing short questions and others. The only condition was not to use a theoretical presentation of grammar and definitions of vocabulary.

The language of communication for both groups was English, with explanations in Bulgarian being made only for the grammar in the control group, whereas in the experimental Bulgarian was prohibited.

The final test for both groups included exercises that tested all foreign language skills, without writing - reading comprehension and language use, listening comprehension and speaking. The exam difficulty level for both groups was in line with the Cambridge PET exam level [2]. The individual parts were equally weighted in the evaluation. The total number of exercises in reading comprehension and language use was 8, in listening comprehension - 4, and the oral test - performed in pairs - included three tasks - a monologue, a dialogue with another student in the group and a dialogue with the teacher. The total number of hours allocated for the final test was 8, 4 of which were for the test itself and 4 for preparation.

The Cambridge Exam Scale was used to assess skills [2]. A score corresponding to excellent was a score above 80%, very good - for success rates between 74-79%, good for 67-74%, average for 60-67%.

Apart from the tests, the students from the specialty of “Medical Cosmetics” did a survey by completing a separate questionnaire in English, gauging their propensity to working in this new approach. There are five questions to answer (see Table 3) and the possible options are three – a) Yes, certainly; b) Yes, to some extent; c) Not at all)

3. RESULTS

The results from the final tests are presented in Tables 1, 2, 3.

Table 1. The results from the entrance and final tests in Cambridge Exam Scale are presented in Table 1. (Number of students – 10)

Group/Skill/Score in Cambridge Exam Scale	Reading Comprehension and Language Use	Listening Comprehension	Speaking	Total
	Entr/Final Test	Entr/Final Test	Entr/Final Test	Entr/Final Test
Control Group	66%/74%	59%/61%	49%/55%	58%/ 63%
Experimental Group	65%/80%	63%/83%	53%/92%	60%/85%

Table 2. Breakdown of results in final tests by individual components. (Number of students – 10)

Group/Skill	Reading Comprehension and Language Use			Listening Comprehension			Speaking		
	Excellent	V. Good	Good + Aver.	Excellent	V. Good	Good + Aver.	Excellent	V. Good	Good + Aver.
Control Group - Grades	5	2	3	4	2	4	3	1	6
	7	2	1	6	3	1	9	1	-

Table 3: Results of the survey, completed by students in the experimental group. (Number of students – 10)

Question/Answer	Yes, certainly	Yes, to some extent	Not at all
Q 1: Do you think using the Internet helped you learn English?	10	-	-
Q 2: Do you think role-play games can be useful in learning a foreign language during your college years?	5	2	3
Q 3: Do you think platforms such as Moodle can be more useful than set paperback textbooks?	8	1	1
Q 4: Do you think group presentations and watching video clips are effective tools in foreign language learning?	8	1	1
Q 5: If possible, would you only be able to learn a foreign language using college electronic platforms, i.e. remotely?	3	5	2

4. DISCUSSION

The analysis of the data shows unequivocally that the experimental group performed much better in terms of the communicative side of mastering a foreign language. In particular, the implications of the study are:

- There is a significant difference in the results of the two groups, especially with regard to mastering communication skills. This fact is most evident in the oral component, which requires the greatest interactivity;
- There is a significant difference in progress, as the experimental group gained over 25% and as a whole falls into the descriptor mark “A”, according to Cambridge Exam Scale, level PET, while the control group barely passes level “C”;
- The greatest convergence between the results of the two groups is found in the Reading Comprehension and Language Use component, due to the fact that it has the least interactivity involved. However, the experimental group also performed better in this component, which confirms the assumption that more flexible and varied lexical grammar exercises are more effective;
- The performance of the two groups is very different, with the control group being overwhelmingly at the bottom of the scale, suggesting that either the material was difficult or, more likely, the mode of acquisition was insufficiently motivating. The mere fact that the two groups were equal in foreign language skills at the outset is rather a confirmation of the latter idea;
- For the experimental group, the reason for the overwhelming majority of strong assessments confirms the strong motivation of innovative methods - individualization, extracurricular forms and group activities.

In terms of the survey performed, the implications suggest that, first of all, all students confirm the need for a decisive introduction of new technological aids in training, and in particular using the Internet. As for the answers to Question 2, it has been found in the course of work, that role-play games are ambivalent in the eyes of the trainees. This could be due to the fact that students were not trained at their secondary schools to acquire knowledge and skills using such methods. Group presentations and watching video clips are also viewed favorably by students and this could be accounted by the latter willingness to do individual work and to resort to something they do not consider cumbersome, as watching a film. The answer to Question 5 suggests that students are not ready to fully supplement teachers by the new technological means. In the eyes of the former, teachers are indispensable and cannot be entirely replaced by technology.

5. CONCLUSIONS

Although the study is not comprehensive enough to draw more fundamental conclusions, the experiment was worth the efforts of both students and teachers alike. Nevertheless, on the part of the teachers, the process was also innovative and motivating, which determined the final product - a much better mastery of the foreign language skills of the students in the experimental group.

Undoubtedly, the results of the study, as much as it does not claim to be representative, show that the students of the Medical College, Plovdiv, also have the desire and ability to work with new electronic means in their foreign language course. They do not diminish the role of the teacher, but they see him in a new role. Students believe that new technologies can only help the learning process and make it easier and more interesting.

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ABOUT THE ECONOMIC IDENTITY, LEARNING AND DIGITAL PERSONALISATION

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Abstract: *In the report is considered a few substantial issues of economic identity, learning and digital personalization in the contemporary society. There are interdisciplinary reflections to economic uncertainty, risk management and need to a new economic digital identity for optimal searches, analysis, substantial knowledge and smart innovative digital skills and personalization. By dialectical and cognitive phenomenological methods are revealed important points of value and analyzed critical determinants for development of knowledge management, digital personalization and economic identity. The results of reflections, added concepts and cognitive and axiological analysis are summarized in conclusions at the end.*

Key words: *identity, economic identity, digital personalization, learning skills, education technology, philosophy of digital society, personalism, education sciences*

1. INTRODUCTION

Axiological economic and social transformations determine wide digital perspective of search and development of working, learning and professional building of personality. It grows up with working identity and innovation of subject, as well as with cost, used and added value, economic and social wealth. There appear a few new interesting features of economic self-identity of personality concerning different kind of proper category of individual and organisation value, and cost types of management, search, innovation and business work.

Sociological survey was conducted on students in the Faculty of Social Sciences (University "Prof. Dr. Asen Zlatarov", Burgas, Bulgaria). It has provided a database, which helps to analyze actual problems of axiological transformations, economic identity, learning to learn, digital personalisation and new educational problems and challenges of students and youth.

[4] The study showed that despite negative impact of world financial, economic and social crisis, and uncertainty on labour market and for work realization, it also creates prerequisites for seeking sustainability through learning to learn within self-determination and adaptation in organisation and society. In this context, it is necessary deep substantial economic thinking, learning and digital culture of young people and students to build early economic digital capacity for disclosure and adequate response to existing economic difficulties, educational and social challenges of building economic identity, and successful face of professional personality and prosperity. Negative impact of world financial, economic and social crisis and axiological transformations of it can be overcome by smart design of research and creative thinking and effective governance at all levels of learning, old and new virtues and education in the socio-economic system (SES) and techno-economic system (TES). [4, 10]

2. ECONOMIC DIGITAL IDENTITY

Economic uncertainty, lack of clear long-term economic and digital identity of subjects, organizations and institutions of the contemporary society are significant prerequisites for



diversion and self-esteem in the socio-economic life. Situation is getting worse if there is a gap of funds and supporting for learning and education, inclusion and participation on the markets and social life. Moreover, often contradictions between subjects, organizations and institutions, competition and complexity of relationships create and provoke emergence of new needs, abilities and skills for presence and representativeness of products and services, as wells as participation and standing of prestige and growth, however to be short.

Economic identity refers to a notion that people make economic choices on the basis of monetary incentives and their identity: holding monetary incentives permanent, people are held back by actions that contradict their perception or concept of themselves. Foundation of economic identity was formulated for the first time by economists George Aklerlof and Rachel Kranton in the Quarterly Journal of Economics (2000), which presents a framework for integrating social identities into standard economic models. Social identity and ethnic identity are dependent on economic models, their failures and successes, which, on the contrary, affect the factors of economic uncertainty and growth. [1]

Economic identity depends on the cost and valuable thinking, substantial knowledge and perspective of activities of subject and organization. It is a complex core to define it by full value, because of concept is multilayered in information and cognitive reflections of Mind and experience in the middle of existence, decision making and choice, evaluation of material and ideal work and their results of self-management and interaction with people. Economic identity is a basis for the state and development of economic personality with successful postmodern type of management, sense of value and meaning of life.

Loss of one's own economic identity and a lack of adequate conditions for acquiring a new economic identity is a loss of subject not only for economic relations and markets, but it is also a prerequisite for alienation of subject in organisation and society, depression and even personality trauma, because of it is a loss of substantial valuable memory in the forms of material and non-material property of personality. In this context, the problem of economic uncertainty is not only economic, but its essence has an important, even fateful, multidisciplinary and broadly systemic origin, centered on conditions of crisis economy, and unknown to the end processes of economic and social change, financial and economic plans, programs and strategies.

Information digital identity is a form and substance of representation of live impressed unity and diversity of personal and organisational internal and external face. Information and cognitive self-determination are necessary to more intellectually reveal of working knowledge reality and value of desire, meaning and way of life, their provision and support through scientific information, knowledge and paradigm. Its development depends on the nature and identity of person, systems, technologies, axiological matter and level of smart functions and manifestations.

Economic digital identity is a kind of primary category. It is a source of important cost data that is provided and presented as an orientation in the external and internal reality of the subject and its participation in the economic and social life of society. It facilitates acquaintance, quality of relationships and interactions between subjects as producers and users of information products and services. It diversifies patterns of transmission by accelerating and sharing of information and knowledge, communication, change and work with them. But this is a sticky point and problem of digital reality and reliability of data and knowledge that extend information complexity and increase time for identifying and valuing digital and social products and services, systems, collaboration and cooperation.

The economic digital identity is at a core of long-standing issue to learning and building of economic personality for markets, education, science and governance of organization and society, because it predetermines new valuable breakthroughs and cost problems in thinking and learning, research and creativity, innovation and practice with data, knowledge and management of systems. For example, a reproductive problem is an issue for creating



producers and consumers digital identity as substantial presence, representativeness and behavior in all dimensions of life, digital markets and society.

Cost and value of digital personalization and economic digital identity is increasing in conditions of insecurity and economic hardship. There is no guarantee for a complete solution of subjective and objective contradictions, as well as mandatory successes. Because digital information code and e-signal, TES and SES, and network are means of transmitting of data and knowledge, despite the fact that more and more automated information, computer and communication devices, systems and technologies appear on the one hand, and they expand and diversify by growth of economic identities, risk management and managerial innovation personality and organization, on the other hand.

Problem of the digital economic identity, smart communication, innovation and social innovation remains a lack of resources, investment, experience and a reliable digital environment for building, improving and growing digital personalization and identity, digital economy and markets. It is because social, economic and information environment are transformed under influence of many substantial systemic and non-systemic digital figures, factors, attempt at various types of strategies, models and values of searches, knowledge, management and meaning of work and life as well.

Humans and digital machines are a digital issue because they all have to communicate and compute with learning what the proper information object and valuable category is to be assigned for each real and digital item, point and line. Mutual learning humans-machines goes on to progress within "a kiss" of digital touch facing of different proper categorization frameworks and design of meeting.

There needs economic self-identity of personality and organisation because trials and errors of subjects, people and organisations are not countless. Furthermore, it helps closely for effective conduct of learning, working and training. A tricky issue is learning models of humans and digital machines, and quickly valuable interpretability and explainability of data and knowledge in communications. And a high cross-intricate point is use of new techniques to extract valuable insights from each and every model of learning and working with knowledge to effective management, privacy of information (IPR/Intellectual Property Rights, GDPR/General Data Protection Regulation) and protocol (Internet). [8, 9]

Development of digital personalization and economic identity through virtual reality and technology has diverse and wide-ranging innovative potentials and challenges not only to TES and SES, but is also to the essence, cognitive insights and learning of personality, organization, society and world social networks. This requires a new kind of design, proper categorization workable framework and architecture of research, education and invention to realistically accurate, faster and more complete reflections and representation of knowledge and economic identity through Big Data, cognitive and valuable resources of human and technical nature in systems, technology, relationships and interactions. One is a need of economic self-identity of personality and organisation. But there often is a perplexing juncture in climax of desire level within personal value and cost level of information and knowledge framework and management.

In the context of crisis economies, competitive information and innovation management, economic shocks and valuable reductionism, the uncertainty is a live multiplex cost factor for overcoming and analyzing. In this discourse, the quality of information and precision of its consumption and management determine the results of reflections and experiences of subject and people. Or vice versa, there is an emotional and intellectual link between technical devices and subject through internal and external values, systems and communications. In this context are important issues of contemporary worldview, creative thinking and adaptability, philosophical paradigmatic thinking of economic identity and necessary modern skills that reveal competitive potential, personal chances and growth. This is possible through workable digital personalization; because of the best powerful societies develop digital markets and digital societies from about two decades to now.



A search smart necessity of knowledge and values emerges with increasing of volume effect and speed of data and information processes to many novelties, inventions and rebranding. But it is interesting tackle in field of innovation that new does not change the essence of the new or we do not know how. It is real and substantially difficult to study it and teach within full value of all dimensions of the Being and educational sciences. Hence someone is difficult to manage it.

Increasing of data (Big Data) and systems is necessity to highlight accuracy and reliability of information with application of analytical axiological models and management styles of high-profile personal knowledge, culture, skills and a clear economic and social position. Tricky is that it has to provide a rapid, reliable, valuable and effective thinking and communications, deep understanding, working knowledge and reflection on transitions of different types of boundaries of representations of products and services, openness and accuracy of personal positions, roles and actions. It is especially useful in system assessments to stimulate material and intellectual work, personal and professional cost, used value and added value success, but also attempts in risky and crisis situations and phenomena in education, science, TES and SES, social and economic life.

Big Data and relevantly of it a big challenge is an issue for measure of free space of digital identity as a full valuable constructed phenomenon and a free way of existence and realization of the subject's digital personalization by growth of digital identity and communication. Substance of similar contradictory is a contemporary unbelievable issue for the future of the digital markets and societies.

Uncertainty in the contemporary systems depends on reliability of data, digitalization and ontology of information unit. A huge problem and substantial challenge for successful and effective solutions is digital personalisation, race with speed of thought (thinking) and axiological movement of electronic digital form of information signal, face and information management, knowledge management and innovation management. New types of intricate exposures, subtle risks and prospects for improving of synergy on human and technical nature (machines, systems and networks) and their digital identity, personal inclusion, programmatic and smart managerial personality are emerging in such a space.

3. EFFECTS WITH OR WITHOUT INFORMATISATION DEFECTS

Information is precious good, but it can also be a treacherous illusion. It is a commodity and a goal of thinking, but it is a weapon, which often not only misleads, but raises and captures, and releases, and puts in dependence anyone. Similar negative phenomena affect the Soul and Mind, as well as thinking and feelings. Physiological functions of the brain and self-awareness are often for example long (chronic and bad) information stress/distress in the cognitive personal and organisational design of working and spontaneous functions. In similar situations of information stress/distress, information signal blocks live content of information units, thereby blinding and distorting thought and thinking in the direction of the surface reflections of information phenomenon. Loss of power creates a state of unpleasant denial or inability to properly understand and observe content and meaning of a message, depth of reflection and scope of knowledge, and fullness of mental and emotional awareness on a base of focusing concept and category of consideration. Similar negative state is easily overlooked because information unit as a wave and spatial design of e-signal is easily noticed or not at all. Often due to more important external and internal stress information management, they are underestimated at the same time in learning and working with information sources (especially Internet) and managing expectations and goals with data and knowledge.

An essential issue and complex contradiction is difficulty of the most accurate, correct solution for valuable cognitive reasons to integration or self-exclusion and self-deception of subject in a micro- or macroeconomic and social organization, and society. In this aspect,



personality becomes increasingly important in research of philosophical and socio-economic systems, crises, and risk management. There is a need for business and professional personality to focus on accuracy and precision of subject as primary digital specialist and manager of resources/reserves and activities, increasing responsibility and effectiveness of digital management, and maintaining a balance between real cost, used and added value of products and services, as well as between returns, exits and failures of personality and organisation.

Loss of sensitivity to change something, its prediction, but not directly in the information reality of the socio-economic environment, is a serious problem, because the reasons for it have a substantive character and are a complex systematic challenge for person to overcome own deficits and deviations of basic vital functions and valuable cognitive design structure of aim, plan and program.

Reinforcement of certain signs-symbols in a concept and pattern of identity through information directly affects the information state and self-determination of the consciousness and subject. In this context, information identity, image and effects of it, for example, mark and brand slow down or speed up information and communication processes, knowledge and identification of subject and necessary things for quality thinking, valuable solution, actions and economic behavior.

Learning, training and education support decisions and choices for effective self-management and rational participation on the labor market and in the economic and social life. In this discourse, reliable worldview is necessary to facilitate observation, testing and application of data and knowledge to develop capabilities and new skills with mastering the learning and research material, as well as looking for innovation work and improving the quality of life. Need for intelligent information digital competences, culture and reliability of data is particularly high in working with various and numerous information sources, phenomena and facts.

Intelligence is considered not only as the innate quality of adaptability of living organisms – adaptation to changes in the external and internal environment. But it is valuable thinking, search and learning design of work with ideas and ideals, and workable axiological models of them also. Similar valuable quality is influenced by sensible and smart mental prerequisites, as well as by scientific, education, economic, social and cultural heritage, which requires measures for deeper and wider objective observation and self-assessment of personality and people in the social, economic, political and cultural areas like never before. Smart management of actives and passives depends on the workable digital identical economic perfection of personality and organization.

Competencies, skills and self-assessment of it need substantive indicators of diversification, risk and reliability, meaning and new approaches to the application of data and knowledge in job search, career guidance and development. Moreover, in the wake of growing economic uncertainty and crisis, information relativistic indicators of thinking, recognition, assessment and reliability of high and ultra-high sensitivity or absurdity, apathy and emotional intelligence grow up. It is because reason for improvement of human matter has deep substantive information cognitive and axiological character, which is often changeable by value. A core axiological challenge is pressure, race and growth to high sign prestige, world wide popularity and long brand reputation.

Paradigmatic scientific thinking and recognition are a foundation of substantial creation and cognitive reproduction, and application of data and knowledge, models of research and learning, training and education. It is a high ideal of special research work and creating new reproductive types of work and values, as well as an important ideal of learning to learn within working knowledge in the whole informational and cognitive spectrum of searching, creation, reproduction and innovation of data, cognitive and axiological objects, systems, technology, heritage and experience of personality, organization and society. They need to be explored in different TES and SES, as well as be analyzed and improved with new



materials, knowledge and opportunities for intelligent and sustainable added value and economic growth. [7, 10]

Digital thinking and learning need quality and substantial equivalent of information unit, cognitive information objects, cost knowledge, real experience and value to build a working useful reality like never before. Because there digital work needs more smart information with cognitive model-patterns of observation, solution, assessment, and applications that are relevant to goal, plan, will, transformation and prospect of change without losing a cost and value either by themselves or neither by reality and by the digital economic and social reality, even to mark growth and development in their own right like never before. For it could help axiological information divisions, constructive and creative thinking, working knowledge, digital personalization, learning and management of reliability.

Coding, presenting, communication and interacting of man-machine and machine-people are a basis for expanding of feasibility of techno-economic and socio-economic systems that change information environment by enriching it emotionally and intellectually. But not everywhere it is equitable, reliable and complete. For example, digital identity of performance management problems and solution require new quality of axiological thinking, added value, design and working approach with reliability of data and knowledge management to asset performance and preventing failures. Among plurality of information units and requirements on different by kind rules and knowledge, an issue is supporting of equal effectiveness, regardless of generation capacity and complexity of axiological information division, subject and organization.

Sign figures and axiological information analytical and creative divisions of knowledge, word figures and thinking figures of learning, communication and rhetoric require a wide focus, long concentration and deep transformative leading of belongings. Clear and strict models and standards in management imply repetitions of operations and standard procedures. And for development of a personal style manager and leader need actions with high-quality personality traits and personal prestige, and organization image. The latter facilitates identification, orientation and cooperation of personality, values and join work of group, team and organisation.

Thinking and building of economic self-identity of personality and organisation are useful for improvement of government, assets and increasing of effective management and entrepreneurship. And the concepts help for no losing of leading principals, sources of data and knowledge, and axiological economic substance and categories. By them everyone economic model has really supporting in reproductive cost and value of future proof.

There are definitive and cognitive differences between economic identity and economic self-identity of personality, as well as between economic identity and economic self-identity of organisation in different workable border fields and zones of thinking, recognition and actions. It is because personality and organisation explore different by kind substances of information, knowledge, attempt, activities and value. And they work and grow up with these materials and ideas, which they have and could manage.

Further, the economic self-identity of personality and organisation is real and an ideal conceptual valuable state, and a special frontier of competitiveness to entrepreneurial culture and management. It includes different important economic self-identical factors as human capital, agility, resilience, openness and innovation, and a set of economic and social virtues. Without economic self-identity the personality and organisation are weak economic link of systems in business learning to learn, work, innovation and management.

Variety of multiple systems, networks and different types of management are prerequisites not only for seeking the most appropriate approaches and models, but also different axiological information and knowledge divisions with a specific style of speed, accuracy and completeness in the action of subject as user (generator of data), manager and leader. But if the latter is overexposed, occupying valuable information space alone, for example as a self-identification in communications and interaction of organization, there remain hidden



reservations and rationality of decisions and actions by subjects in depressed personality and lack of initiative. Humanistic paradigm could help to find more rational solutions of it like never before.

Purposefulness and character of subject are a valuable active for representing and building economic identity and successful career of postmodern subject as specialist and manager. Thinking, abilities, knowledge and learning experience are a critical basis of different cost and value of communication, relationships, actions and behaviors. Personal ideas and ideal predetermines a variety of possibilities, experiences of reflections and building with them on the path of equilibrium or inequality, safety or uncertainty in following or opposing known and accidental risks, factors and crises. In terms of self-governance, inclusion and participation of a person with a particular model and personal concept, for example in social marketing programs, is a prerequisite for a certain type of personality, which needs to be reliable identified and motivated in a social and economic environment. This is a serial issue of management because it requires reproductive and working communication and interaction at a mutual understanding level, for example between manager and team, and organization members, but also as an open system. But there is a strange valuable involvement how to fix the deficit of time and special dimensions for full multidimensional efficient economic scale and digital identity of data and knowledge with a given model of management and digital market.

Change of information socio-economic value, systems and technology require high skills and personal intelligent culture, as well as a new universal digital model of perfection, precision and competitiveness of personality, organisation and management. It is highly probable that in times of economic uncertainty and crisis economies, delays in action will be neutralized or left without value of critical, fateful financial and economic dependencies, social constraints and poverty.

Necessity for a smart type of reliability is not enough, because besides an objective and subjective side, information is not only a critical part of subject, system and network, economic and social life. Relativistic information indicators and correlations for reliability enhance the accuracy and assessment by serving to expand application, data and value processing, and usage results. [10] It is because more or less indicators are logical value of degree and a level in precision of reflection, research, knowledge, price and pattern of personality and management.

Humans and machines systematically work and develop economic identity. Current state of personalization has any indication of data and self-thinking, but there appear important substantial issues about properly categorizing of value for building of economic and social self-identity of personality and organization, optimal learning, educational technology and digital personalization for successful realization of subject and organization. Substantial working knowledge, economic identity, smart innovative digital skills and personalization could help for learning, training and development with better cost and productivity to efficiency and effectiveness by data, analytics and valuable assets.

Uncertainty determines need to inter- and multidisciplinary research, axiological categorizing, universal education technology, economic and social digital identity. Educational technology will use and expand digitalization, personal and organization digitalization, as well as a need of building and supporting economic self-identity of personality and organization with better cost and productivity efficiencies through analytics, research and innovation models of management. The economic self-identity of personality and organization grows up with work and improvement of economic data literacy, knowledge, perspective of value and rebranding. The World Financial Crisis (2008) is not over and people still suffer from the consequences. Numerous reductions in living standards lead to poverty. Education sciences are an interdisciplinary area that includes surveys on matter of poverty, labor studies, substantial work, cost and value analysis, personalization, markets and public freedom. Key instruments in scientific research are all types of data: statistics, administrative data, research and

indicators of policy and economy, and so on and so forth. However, complex issues remain quality processing and prospecting of large databases such as reliability of information, learning and integration of systems with improved comparative substantive indicators, correlations and analytical tools and innovation, as well as with priorities and activities for digital personalization, innovation and competitive small and medium-sized enterprises also. Personalization, learning and digital personalization reflect disruption of major contradictions, and development of subject, people, Human Being, systems and socio-economic as well.

TES goes on to unbelievable digital empathic eyes and digital empathic hears for progress of robotics and digital systems and technology. SES expands digital personalization by social innovation, digital market, added value and e-government. TES and SES discover new identical used and added value of them and create a need to working economic self-identity of personality and organisation for development.

Philosophy and education sciences have a specific role playing to new liberal democratic processes, whose research structure serves contributions and policies as a challenge for smart, sustainable and inclusive growth. [5] The Horizon 2020 Program for Research and Innovation works with priority of smart and sustainable economic growth and inclusion. At the end of the second decade of XXIst century It is a step to following a new, third strategy of European Union for next, third decade of age. But it is difficult without philosophy and education sciences to find optimal universal way for cohesion to competitive and innovative economy and widest progress by all dimensions of knowledge, heritage and the Being within success and axiological meaning of educational technology, work and life.

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METHODS FOR THE DEVELOPEMENT OF SPECIAL COMPETENCE OF LECTURERS OF SPECIAL SUBJECTS IN MILITARY EDUCATION SYSTEM

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Abstract: *The article deals with the topical issue concerning the theoretic substantiating and experimental check of the author's method of development special competence of lecturers of special subjects of higher military educational institutions. The authors has proposed their own vision of the content and structure of the phenomenon under the research as a multidimensional integral psychical formation, which is a structured complex of special qualities, abilities and manifestations of a lecturer that give him/her and opportunity to perform successfully certain professional functions as a subject of special activity in the military education system. The study is novel in definition of the complex of organizational-and-pedagogic conditions as a system of necessary and sufficient factors determining the high-performance process of special competence development. The article reveals the main stages of authors' method for developing special competence of special subjects lecturers in the postgraduate education system. There are given the main results of pedagogical experiment witnessing the effectiveness of innovations proposed.*

Keywords: *military education, lecturer, special subjects, competence, pedagogical experiment.*

1. INTRODUCTION

In the context of Armed Forces of Ukraine reformation conditioned by transition to European safety standards and acute need for defensive potential of the state, the prior meaning goes to the statement of improvement of officers training quality in the higher military educational institutions. Military education system should provide education and raining of military specialists according to the needs of Ukraine defence. It requires realization of the modern methodological approaches to the organization of military educational process, improvement of structure and content, organizational forms, methods and technologies of officers training. The driving power of this process shall become the lecturers of special subjects, whose special competence directly influences the quality of future military specialists training.

In such a way, there is an acute need in systemic development of high military school special subjects lecturers' special competence that proves its topicality for the modern pedagogical science and military and pedagogical practice. Modern time requires essential changes in training military lecturers towards the increase of their special competence, practical proficiency in solution of difficult pedagogical tasks in the conditions of Russian Federation aggression towards Ukraine.

Regarding the absence of the integral system of military-and-pedagogical education, the development of military lecturers' special competence shall take place within the system of non-stop education. Concerning the non-stop education methods N. Nychkalo notes, that the everlasting ideas of humanism, considering the human being the epicentre of all planet's live activity, underlie the concept of non-stop professional education. This implies the need of creating conditions for comprehensive development and all-sided activity for very each citizen during all the life at all stages of his/her personality development [4, p. 46].

So, pedagogical task concerning the development of special competence of military lecturers of special subjects consists in defining the optimal conditions, which would provide the stable



and constant development and self-improvement of personal and professionally important qualities of a lecturer, his/her special competence development in general.

The constituent part of the non-stop education is the postgraduate education system, the main task of which implies specialists' retraining and their special competence improvement, which is critical for the specialist in order to achieve development and self-realization. The postgraduate education is considered to be the flexible system of the constant education, which rapidly reacts for the demands and requirements of the society, constantly providing the development of special competence of the specialists.

The analysis of scientific researches for the issue of military specialists' special competence development [1, 2, 9] allowed to define that this problem may be solved by their studying in the postgraduate education institutions using the distance learning technologies. That will enable future lecturers to get, and those, who teach – to improve the necessary special knowledge in education philosophy, pedagogics and psychology of higher school, methods of educational subjects teaching, to get and develop corresponding skills and experience of higher school lecturer.

So, by defining the topicality of the issue of development of special competence of special subjects lecturers in higher military school for modern military-and-pedagogic theory and by finding the possible direction of its development with help of definition and implementation of the optimal pedagogic conditions, which would provide the stable and constant development of personal and professionally important lecturers' qualities in the system of postgraduate education, we defined the aim of this research as follows: theoretical substantiating of pedagogical conditions and methods of special competence development, as well as experimental check of their effectiveness in the postgraduate education system.

2. MATERIALS AND METHODS

The effectiveness of the process of development process of special competence of military higher educational institutions special subjects' lecturers essentially depends on the systemic understanding of the essence of "competence" phenomenon and the structure of this new formation in activity of any specialist.

Analysis and generalizing of scientific researches allowed us to define the special competence of lecturers of higher military educational as an integral professionally important formation, which characterizes their proficiency as of special subjects lecturers and manifests itself in ability and readiness to perform pedagogic activity on the basis of knowledge and skills in both pedagogy and correspondent special educational subject, values and motives gained in the process of military professional training, and military service experience, as well as subjective treatment of pedagogic activity and constant self-improving [5, p. 194].

We may see from the this definition, that professional competence is a multi-dimensional integral formation, which is a structures complex of professional qualities, abilities and approving of a lecturer as a pedagogic activity subject, that enable him/her to successfully perform the certain professional functions as a special-and pedagogic activity subject in the military education system.

Competence research also shows that independently of its type, it is possible to generate the universal structure of competence as pedagogical phenomenon. It is important first of all from the view of education, id.e. for the targeted development of competence by educational means.

On the basis of the conducted analysis of the available methodological approaches to defining competence components and considering the requirements of subject-activity approach to understanding of special competence essence and the structure of pedagogical activity of lecturers of special subjects, we consider the following components to be the main ones: value and motivation, cognitive components, emotions and will component, subject and activity, reflexive and subjective components.

It should be mentioned that special competence is not a simple amount of some values and motives, cognitive abilities and practical skills or of work experience within the speciality. It is a dynamic combination of personal and professionally important qualities, special knowledge and skills, values and motives, where subjectivity is an integral characteristics. In educational activity military lecturer's subjectivity gains the essential meaning for the lecturer himself/herself, for both self-realization and high-quality teaching and education of the students (cadets). The lecturer shall strive to use and develop personal abilities for his/her pedagogical activity improvement and increase of its effectiveness.

We attribute the following to the lecturer's subjectivity characteristics:

- adequate self-esteem and reality perception: people see military pedagogue as he/she is, but not as he/she would like to see himself/herself. Lecturers with the developed personal qualities are more tolerant to contradiction and uncertainty which is also connected to objective perception. They tend to critical thinking and are not afraid of problems with no definite solutions;
- positive perception of himself/herself and students: military pedagogue shall positively perceive him/herself and his/her students with all their strong and weak features, as they really are, without uncontrolled need to moralize, control and criticise others;
- sincerity and plainness: subjectivity of military lecturer manifests itself in his/her inner need in pedagogical activity, Motives, emotions, feelings to his/her pedagogical activity are spontaneous, with no conditions. Lecturer sees in his/her students the goal but not the means of self-affirmation and self-realization;
- concentration on the work: his/her subjective characteristic is being focused on the pedagogical activity, favourite work, a sense of duty and responsibility for his/her activity results. Such state is possible when a work and a person are meant for each other;
- independence: a lecturer strives to have his/her own independent opinion concerning an issue, and not relies upon opinion of others, oppose the attempts to impose the common position, critically estimated the situation, makes his/her own independent conclusions;
- unconventional vision: he/she is able to estimate objectively and decently the events seeming common and daily to others; sees something new in usual things, seldom complains for boring and not interesting work;
- realizing the social significance of military pedagogic activity: he/she has a sincere desire to help the students to become better, shows understanding and friendliness to them, considers the social interest to be a priority in his/her pedagogical activity;
- tending to subject-subject relations: a lecturer shall have no prejudice in relations with students and respect them;
- self-sufficiency: he/she is in balance with educational environment in which he/she is, but keeps inner independence from it. He/she is self-sufficient and selfreliant, so professional thinking and behaviour do not depend from the social influence. He/she is able for creativity in different types of pedagogical activity [8].

So, lecturer's subjectivity, which bases on the deep realizing of his/her own potential and understanding the need for professional development, is a source of his/her activity in pedagogical sphere basing on his/her own military and professional experience and maximum realisation ow creative potential. Achievement of subjectivity is a difficult way that requires constant and persistent self-cultivation of a lecturer, but provides the development of a sound, active, positive and creative image of a lecturer of a higher military school - an effective organizer of educational process.

So, organization of an effective development of special competence of special subjects lecturers in the postgraduate education system requires solution of the task to thoroughly analyse, define, realise and comprehend the factors, influencing the success of this process, and on this basis to define pedagogical conditions necessary, possible and actual for implementation into educational process.

Analysis of scientific approaches to definition of the concept "organizational-and-pedagogical conditions" gives an opportunity to make a generalized conclusion that we shall understand

them as a set of necessary and sufficient organizational and pedagogical circumstances and factors, which provide a favourable pedagogical environment for successful development of special competence of special subjects lecturers.

Following the modern methodological instructions stipulates a range of organisational-and-pedagogical conditions. 1) motivation of special subjects lecturers for development and self-development of their professional competence and provision of their subjectivity; 2) integration of forms of course (intramural) and inter-course (distant) improvement of pedagogic qualification – their continuous improvement, self-improvement and self-development; 3) pedagogical modelling of development of special competency of special subjects lecturers in the postgraduate education system; 4) differentiation of education content according to levels of their professional competence development, pedagogical length of service, scientific degree [7].

The methods of development of special competence of special subjects in the postgraduate education system are divided in three stages:

- 1) reproductive – for lecturers who have no pedagogical education, scientific degree, and whose pedagogical experience is less than 3 years;
- 2) partially-searching - for lecturers with no pedagogical education whose pedagogical experience is from 3 to 10 years;
- 3) creative – for lecturers with pedagogical education and those with scientific degree, and whose pedagogical experience is over 10 years.

At each stage of methods realization there are conducted specific tasks, the integral amount of which comprises the single general goal – development of the components of special competence of special subjects lecturers, definite principles, keeping interrelation and dependence of inner components.

The task of the first stage is an initial training of a special subjects lecturer to military and pedagogical activity and development of value-and-motivation and emotion-and-will sphere of military pedagogue, acquisition of basic psychological and pedagogical knowledge, primary analytical, predictive, diagnostic, reflexive, organisational and communicative skills, as well as the qualities necessary for military-and-pedagogic activity subject. Organisation and optimal conducting of retraining courses and pedagogic qualification improvement courses underlie this stage. Total hours for courses is 432; 286 hours are lecturer-led; and 146 hours are for self work.

Fulfilment of tasks concerning special competence development at this stage is achieved by development of knowledge in theory and pedagogics history, mastering of theory and practice of educational lessons preparation and holding along with studying subject matter of pedagogical course subjects, development of psychological and pedagogical competence; preparation of certain pedagogical works in the sphere of education philosophy and methodology, acquisition of special subjects teaching methods and approaches. Reproductive teaching methods shall dominate in educational lessons at this stage. The main task of educational lessons is acquiring by the lecturers of an essential amount of thoroughly selected, generalised knowledge system, which will further provide the scientific and theoretic basis for becoming a military lecturer, his/her pedagogical skills improvement and self-education. Herewith, at this stage special subjects lecturers actively participate in academic and methodological meetings, scientific-and-practical seminars and conferences, visit demonstration, open and test lessons, pass distance course "Special competence of a special subjects lecturer".

At the second stage the development of special competence of special subject lecturers is aimed to mastering of topical theoretical aspects of educational sciences and improvement of practical skills in application of traditional and innovative types of educational lessons in special subjects. The basis of this stage is comprised of the courses for improvement of pedagogical qualification of special subjects lecturers. Such courses last up to one month, total number of educational hours is 216, 144 hours of them are lecturer-led; and 72 hours are for the self work.



At this stage the development of special competence of special subject lecturers takes place due to domination of partially-searching and creative types of educational lessons – business game, round table, brainstorm, case-technology and others. Such approach provides mastering of educational content and favours getting practice in usage of active teaching methods and technologies. One more important task is also stimulating to self-education and scientific-and-search activity, which will become the basis for the next stage, where self-education and self-development make the foundation for special competence development. Except of qualification improvement courses, special subjects lecturers take part in scientific seminars and conferences, individual training, methodological councils meetings, visiting the lessons of leading teaching methodology experts, hold open and demonstrative lessons by themselves, are involved in preparation of teaching and academic and methodological literature. At this stage special subjects lecturers mostly develop a subject-and-activity component of their special competence, form an individual pedagogic technique and speech culture, improve a pedagogical communication culture and organisation of interaction with the students (cadets).

The following, third stage is aimed to provide the constant self-improvement of special subjects lecturers. I. Ziaziun noted, that "Self-cultivation for a pedagogue... is a targeted process, it is the continuation of professional education, when the future teacher transforms from the educational object ("I am a student, so let them teach me") into the subject of own life organization ("I am a future specialist, I prepare myself for that"): I choose the aim to self-improve by my own..." [3, p. 44].

Subjectivity of special subjects lecturer in this case is provided by deep comprehension of education process dependencies, realization of the system of inter-subject relations, by the ability to critically analyse pedagogical facts and phenomena, to reflect and project his/her activity, to use own experience in new situations; by conscious and creative solution of educational tasks, by an ability to diagnose the results of his/her own activity and to correct it. An effective means in the process of pedagogical speciality mastering by special subjects lecturers is information-and-communication technologies. Using presentations, educational films, computer simulators, elements of military professional activity modelling in educational process allows to form an integral idea of the studied object.

Special subjects lecturers' special competence development goes on by education under the distance course "Special competence of a special subjects lecturer", personal holding of open and demonstrative educational lessons, workshops for young lecturers, participation in scientific-and-practical conferences, writing scientific and research works etc.

The main idea of the method is the appropriate and coherent selection of the content of course and distance training of special subjects lecturers, its successive mastering with progressive passing from traditional (reproductive) to innovative (creative) ways of activity of those who study, balanced combination of all available forms of educational process organisation, development of subjectivity of special subjects lecturers.

3. RESULTS AND DISCUSSION

The proposed organisational and pedagogic conditions and methods of special competence development needed an experimental verification. With this aim we had conducted a pedagogical experiment during 2017-2018. Experiment was conducted under the auspice of courses for qualification improvement of military lecturers in Ivan Cherniakhovskiy National Defence University of Ukraine. There were formed control (23 lecturers) and experimental (24 lecturers) relevant groups. There were defined two control groups (CG1 and CG2) and two experimental groups (EG1 and EG2) (one CG and EG at courses lasting up to one month and one CG and one EG at ones lasting up to three months). Experimental groups' studying was held with implementation to the educational process of the proposed organizational and pedagogic conditions on the basis of author's experimental method. The

control group had been studying by a traditional method, no experimental influence was made. There were mentioned no other factors that could affect the research.

For diagnosing the levels of special competence development we have used a system of criteria adhering the structure and content of competence and their concretizing indexes. According to these criteria and indexes there were selected and elaborated the diagnostic instruments [6].

Evaluation of the level of the development of special subjects lecturers competence was conducted by defining of the average level of groups proficiency – \bar{x}), which enables us to define the percent of the achieved result, which was received by the certain group in average from the total needed level (standard).

The development level of a correspondent special competence component was calculated by formula 1:

$$K_i = \left(\sum_{j=1}^n P_{ij} k_{ij} \right) 100 \quad (1).$$

where: K_i is the level of i -st special competence component,

P_{ij} – value \bar{x} of j -st index of the i -st component of special competence,

n – number of indexes of the i -st component of special competence,

k_{ij} – weight coefficient of j -st index of the i -st component of special competence, $\sum k_{ij} = 1$

Weight coefficients (k_{ij}) of each index were defined by the expert evaluation method.

Definition of the integral level of development of special competence of special subjects lecturers was conducted by the formula 2:

$$K_{\Sigma} = \frac{\sum_{i=1}^6 K_i}{6} \quad (2).$$

where K_1 is the results of evaluation of the value-and-motivation component;

K_2 – the results of cognitive component evaluation;

K_3 – the results of emotional-and-will component evaluation;

K_4 – the results of praxeological component evaluation;

K_5 – the results of control-and-evaluation component evaluation;

K_6 – the results of subjective component evaluation.

According to the results of diagnosing it was defined that the differences between EG and CG at the beginning of the formation experiment were not statistically significant if $p \leq 0,05$.

According to the results of final diagnosing there were defined the essential changes of values of an integral index of special competence development in the experimental groups ($p \leq 0,05$), while there were no such changes in the CG. The most essential positive changes were achieved in EG in value-and-motivation (EG1 for 16,7%; EG2 for 25,5%), cognitive (EG2 for 12,5%), emotion-and-will (EG1 for 18,6%) and subjective (EG1 for 15,4%; EG2 for 15,7%) components. Received data shows the significant subjective potential of lecturers of special subjects in their special competence development. The dynamics of integral index change is shown in the table 1

Verification of statistical significance of the received results with the help of Mann-Whitney U-test and Wilcoxon signed-rank test T- allowed us to define statistically significant changes in EG and absence of such changes in CG, that witnesses the influence made on lecturers of special subjects by the proposed organisational and pedagogical conditions, but not the occasional factors.

Table 1 Levels of special competence development

Evaluation results	experiment results							
	CG1		EG1		CG2		EG2	
	at the beginning	in the end	at the beginning	in the end	at the beginning	in the end	at the beginning	in the end
K_1 (%)	63.2	69.0	64.2	80.9	62.3	70.4	63.3	88.8
K_2 (%)	76.5	82.7	77.8	90.6	74.5	79.6	74.8	90.5
K_3 (%)	69.5	73.6	69.5	88.1	75.6	80.6	73.2	85.4
K_4 (%)	78.8	81.0	78.1	86.0	72.3	77.4	73.2	85.7
K_5 (%)	52.7	53.6	53.8	63.4	52.2	57.3	58.0	68.9
K_6 (%)	71.3	76.7	74.6	90.0	71.8	77.9	70.7	86.4
K_7 (%)	68.7	72.8	69.7	83.1	68.1	73.9	68.9	84.3

*the results of our own research

In such a way, during the formation experiment the effectiveness of implementation of substantiated organizational and pedagogic conditions into educational process has been proven.

4. CONCLUSION

So, relying on the results of pedagogical experiment we has defined and substantiated the organizational and pedagogic conditions of special competence development in special subjects lecturers in the postgraduate education system. According to the defined problematic issues the authors' methods was developed and implemented in the educational process of retraining and qualification improvement courses. Relevant methods were aimed to the development of special subjects lecturers idea of the structure of pedagogical activity of higher military school lecturer; development of the positive motivation of pedagogical activity, success achievement and humanistic direction; development of intellectual abilities and getting substantial and systematic psychological and pedagogical knowledge; development of readiness for realisation of all the spectrum of pedagogical functions of higher school lecturer, establishing interaction and organisation of educational activity of the students (cadets); development of the reflexive and predicting abilities, subjective attitude to pedagogue profession; forming of an individual creative style of special subjects lecturer.

Conducted statistical analysis of the results of diagnosing experimental and control groups by describing statistics methods with the help of criteria for defining statistical significance of marks slice in correspondent sampling, gives reason to affirm the effectiveness of the implemented innovations according to all components of special competence.

The results of pedagogical experiment confirmed that the improvement, self-improvement and self-development process formed considering individual requirements and needs of lecturers of special subjects, favours the positive dynamics of their professional growth, provides acquiring of subjective attitude to pedagogical activity.

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INNOVATIVE METHODS FOR TEACHING AND LEARNING IN MACHINE ELEMENTS IN DUAL TRAINING

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Abstract: *In modern school the problem of interest in learning is up to date, since interest can boost the private creative and cognitive activity of students. The teacher who created the enduring interest to a subject, achieved high results in training and provoking the desire of students to the selection, preparation and effective practice of the profession.*

The objective of this study was to showcase some innovative methods to achieve a higher success rate in the educational process. The study will help to understand what is the pedagogical effect of the introduction of the technology project-based learning in the process of mastering the knowledge and skills of the students in the context of the dual training. To outlining the readiness of students to work in an hour, their expectations and their achievements at the end of the school year. Analyse how by building skills and habits for private work in the learning process on machine elements developed mindset for a private creative cognitive activity. The enrichment of the academic practice of this method provides a means to raise interest in the learning process, makes it possible, through private participation in lessons on machine elements, students take control of their education and to gradually switch to the actual workplace. Dual training system provides a real connection of class theory with practice. Create opportunities students directly participate in their education and to gradually switch to professional development.

Keywords: *dual form training, method, training, skills, machine elements*

ИНОВАТИВНИ МЕТОДИ ЗА ПРЕПОДАВАНЕ И УЧЕНЕ ПО МАШИНИ ЕЛЕМЕНТИ ПРИ ДУАЛНА ФОРМА НА ОБУЧЕНИЕ

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Резюме: *В съвременното училище проблемът за интереса към ученето е актуален, тъй като именно интереса може да даде тласък на самостоятелната творческа и когнитивна дейност на учениците. Учителят, създава трайни интереси към своя предмет, постига високи резултати в обучението и провокира желанието на учениците за избора, подготовката и ефективно практикуване на професията.*

Целта *на настоящото изследване е да се покажат някои иновативни методи за постигане на по-висока успеваемост в учебния процес. Изследването ще помогне да се разбере какъв е педагогическият ефект от въвеждането на технологията проектно-базираното обучение в процеса на овладяване на знания и умения от учениците в контекста на дуалното обучение. Да се очертаят готовността на учениците за работа в час, техните очаквания и постижения им в края на учебната годината. Анализира се как чрез изграждане на умения и навици за самостоятелна работа в процеса на обучение по машинни елементи се развива нагласа за самостоятелна творческо-познавателна дейност. Обогащаването на учебната практика с този метод предоставя средства за повишаване на интереса към учебния процес, дава възможност, чрез лично участие в часовете по Машинни елементи, учениците*

да поемат контрол върху обучението си и постепенно да преминат към реалното работно място. Дуалната система на обучение предоставя една реална връзка на часовете по теория с практиката. Създават се възможности учениците пряко да участват в обучението си и постепенно да преминат към професионална реализация.

Ключови думи: дуална форма на обучение, метод, обучение, умения, машинни елементи

1. ВЪВЕДЕНИЕ

Правилното използване на съвременни образователни технологии повишава ефективността на преподаването и ученето. За тази цел е необходимо използване на иновативни педагогически подходи и технологии, които позволяват съвместна работа, общуване и мобилност. Промените в държаните образователни стандарти и учебната програма по машинни елементи се отнасят не само до учебното съдържание, но и до характера на организацията на обучението. Въвежда се дуална система на обучение /обучение чрез работа/. Новите изисквания за структуриране на програмата включват визирано и препоръчителното разпределение на часовете по теми от учителя съвместно с наставниците от фирмата-партньор за организиране и провеждане на обучение чрез работа[8].

Изследователският интерес е насочен към актуалния въпрос за използване на проектно-базираното обучение на преподаване и учене при дуалната система.

От това как се чувстват в определена ситуация учениците, зависи какви усилията ще вложат в ученето. Ето защо е важно целият процес на обучение да предизвиква у обучаемия интензивно вътрешно влечение към знания и напрегнат умствен и физически труд. Интересът към знанието може да се съсредоточи и към отделен учебен предмет [1]. Преподавателят трябва да стимулира високо равнище на интереса на учениците не само към конкретната учебна дисциплина, но и към останалите. Учителят, създал трайни интереси към своя предмет, постига високи резултати в обучението и провокира желанието на учениците за избора, подготовката и ефективно практикуване на професията [7].

Главната задача на професионалното обучение в съвременните условия е да създаде и подготви специалисти с висока образователна и широко профилна професионална квалификация с гарантирани знания, умения и навици в специалността. Повишаването на образователните компетентности води до повишаване на професионалните възможности.

2. ТЕОРЕТИЧНА ПОСТАНОВКА

Професионалното образование и професионалното обучение може да се осъществяват и по пътя на обучение чрез работа (чл. 5, ал. 4 ЗПОО) [6].

Професионалното обучение чрез работа на средно образователно равнище е средство за овладяване на специалност във фирма заедно с наставник и учител-методик. Обучението чрез работа (дуална система на обучение) включва:

1. практическо обучение в реална работна среда, и
2. обучение в училище [7].

В този процес педагозите се стремят да постигнат набелязаните пред тях цели. А очаквания положителен резултат е предпоставка за успеха на учебната дейност, познаване на спецификата и прилагане в работна среда.

Обучението по предмета „Машинни елементи“ има за цел чрез усвояване на предвидените в програмата знания и умения учениците да постигнат компетентности за [8]:

- Хармонизиране на стандартите.

- Оптимален вариант за създаване на нови машини с използването на стандартизирани машинни елементи.
- Избиране на сглобки.
- Натоварващи сили и условия при експлоатацията на новопроектирани изделия за изпълнение на функционалното им предназначение.
- Якостни проверки.
- Оформяне на обяснително-изчислителна записка към новопроектирано изделие.
- Избор на стандартизирани машинни елементи.
- Подход и методи за разрешаване на противоречиви изисквания при проектиране на конкретни машинни елементи и механизми.
- Избор на подходящ материал за произвеждане на нови изделия.
- Провежда предварителни и проверочни якостни изчисления.
- Подбира търкалящи лагери от таблици.
- Избира от таблици геометрични параметри на стандартни резби, стандартизирани съединения, модул на зъбни предавки и допустими напрежения.
- Избор на сглобките.
- Разрешава конкретни технически ситуации.
- Създава пакет от изчислително-обяснителна записка, конструктивна и технологична документация на съоръжение или механизми [8].

Професионалното обучение създава, подготвя и обучава специалисти с висока професионална квалификация с гарантирани знания, умения и навици в специалността. За постигането на високи резултати при усвояването на различна научна информация е необходимо да съществува утвърден интерес на учащите се към учебното съдържание, потвърден от ежедневния допир с практиката.

Учителят използва подходящи образователни техники и различни методи за преподаване в зависимост от методичната единица, като планира и избира подходящи нагледни средства и материали. Броят на учебните часове по определените теми се разпределя от него съвместно с наставниците от фирмата партньор [8], в зависимост от възможностите и интересите на учениците и технологиите на обучение [1].

Проектно-базираното обучение е метод на преподаване и учене обучителна технология, при която учебното съдържание не се поднася на готово от преподавателя, а учениците самостоятелно търсят, подбират, структурират и представят информацията. Те активно овладяват учебното съдържание в конкретен контекст, което прави знания им личностно значими и трайни. Преподавателят изпълнява роля на съветник и партньор, насочващ учениците в търсенето на отговор на въпросите “защо?”, “какво?” и “как?” [4].

Чрез използването на тази технология в дуалното обучение се реализират основни дидактически принципи като активност, гъвкавост, достъпност, нагледност, последователност, системност, свързване на теорията с практиката, възможност за индивидуален подход [5]. Така се подобрява нагледността и се предоставя възможност за по-добро възприемане, усвояване и приложение на учебното съдържание. Учебният материал се упражнява и повтаря съобразно интересите и възможностите на обучаемите.

В основата на ефективното учене е положителната мотивация за участие, личностния принос се основава на позитивни емоции [3]. Те са силни фактори за създаване и поддържане на траен интерес на обучаемите към учебния процес. Повишената мотивация за усвояване на учебния материал води към целенасочено възприемане,

мислене и дейности, към формиране на позитивно отношение към изучавания предмет.

Учителят се стреми да развие това качество в своите ученици чрез:

- акцентирание върху новото, яркото в учебния материал;
- проблемни въпроси, казуси, задачи;
- използване на активно участие, като се предложи на учениците сами да представят темите от новия учебен материал;
- комбиниране на разказ, презентация, демонстрация на учениците с учебен филм, клип, нагледни и разнообразни материали, схеми, табла, чертежи, таблици, макети, детайли и т.н.
- работа със справочна, учебно-техническа литература и фирмени каталози;

Да се използва рефлексията и жизнения опит на учениците, като се стимулират да дадат примери от своята практика. Да се свързва с техния житейски опит, училищния живот, уменията и знанията, които имат. За засилване на желанието и мотивацията към обучението е необходимо да се търсят най-новите технологии.

3. ИЗСЛЕДОВАТЕЛСКИ МЕТОДИ И РЕЗУЛТАТИ

Целта на настоящото изследване е да се покажат някои методи и обучителни технологии за постигане на по-висока успеваемост в учебния процес.

Изследването ще помогне да се разбере какъв е педагогическият ефект от въвеждането на технологията проектно базираното обучение в процеса на овладяване на знания и умения от учениците в контекста на Дуалното обучение.

Предмет на изследването е влиянието на технологията проектно базирано обучение върху знанията, уменията и отношението на учениците към процеса на обучение.

Задачи за постигането на целта са:

-да се разработи въпросник с учениците, като резултатите да очертаят готовността на учениците за работа в час по технологията, техните очаквания и постижения им в края на учебната годината;

-да се направи анализ и оценка на получените резултати и оформят изводи, даващи възможност за повишаване ефективността от използването на метода.

За постигане на поставената цел и задачи се използват следните основни изследователски методи [2]:

1.Изготвяне на въпросник за изследване симбиозата между теоретичното и практическото обучение.

2.Педагогическо наблюдение на работата на учениците.

3.Беседи с учениците.

4.Проучване на индивидуалните самостоятелни задачи и проектното задание на всеки обучаем.

5.Анализ, сравнение и обобщение.

Учителите използват и изработват иновативни, отговарящи на очакванията и стила на работа на учениците методи, подходи и технологии, с които да им представят учебния материал. Тогава те може да очакват положителна промяна в нагласата на учениците към дадения предмет. Проектно-базираното обучение акцентира върху отношението на учениците, към учебното съдържание чрез активното им участие в подготовка и представяне на индивидуални задачи от учебния материал. Ако хипотезата се потвърди, може да се очаква промяна на нагласата и отношението на учениците към учебния предмет и повишаване качеството на индивидуалната подготовка в търсенето на научна информация. Подобряване подготовката, систематизирането и изнасянето пред групата на презентации и други по поставени групови задачи за подготовка по теми от учебната програма. Дава се възможност за използването и прилагането на



придобити знания от индивидуалните задачи в работната среда в часовете по практика, проведени във фирмата.

Изследването се проведе в рамките на учебната 2018-2019г. в специалност: „Машинен техник“ – 11 ученика на Професионална техническа гимназия "Иван Райнов" – гр. Ямбол. Всичките са момчета от дигитално поколение Z. Учебната дисциплина „Машинни елементи „ са два часа седмично задължителна подготовка. Няма ученици със специални образователни потребности, нуждаещи се от по-специализирано внимание и грижи. Може да се предположи, че резултатите, които ще бъдат получени ще са същите в произволен клас в друго училище.

За провеждане на изследването е разработен план, в който темите от учебното съдържание се разпределят предварително между учениците. Всеки от тях е свободен в избора си на презентирание, използване на мултимедия, представяне на нагледни материали, изработване на макети, схеми, табла. Учениците извършват предварителна подготовка на материали по своята тема, по зададен от преподавателя план, а останалите в края на предходния час се информират за следващата тема, кой ще я представи и се подготвят да задават въпроси. След представянето на подготвената информация от ученика, преподавателят прави обобщение на казаното, насочва вниманието към съществени моменти/проблеми от чутото, прави нужните корекции и дава възможност за въпроси и разяснения, допълнителна информация от групата. Възниква дискусия, дебат по между им. Така се проследява каква част от съдържанието на темата е предизвикала интерес, намира ли се веднага аналогия с практиката, има ли неясен момент – термин или постановка. В последните минути преподавателят прави анализ на проведения урок. Оценява изложението и участието в дискусията, поставя оценки. След приключване на всеки раздел се попълва карта от преподавателя и наставника с насочваща информация – към успеваемостта, връзката между теория и практика, разликата в интереса, постигнатата задълбоченост в индивидуалната подготовка, груповата оценка към всеки урок.

Прилагането на технологията стартира с началото на учебната година. Първоначалните представяния на учениците не бяха на нужното ниво. Постепенно се забелязва повишаване на увереността в изложенията, липса на интерес към маркера и бялата дъска, за сметка на презентациите и мултимедийните филми. Събирането на информация от интернет се пренасочи към търсения по темата и в часовете по практика. Учениците се обръщаха за помощ в подготовката и към наставника. Имаше и прояви на креативност под формата на заснети практически филми с мобилни устройства. Подготовката на урок за тях е нещо ново, търсят помощ от съученици, съмишленици, съавтори в презентациите. Дискусиите след представения урок частично се превърнаха и в минути за допълнителна информация от останалите, впечатления от практиката, приложимост на новите технологии. Теоретичната подготовка от базов минимум, се измести в пряка приложимост, лична заинтересованост от проява на компетентност и мнение.

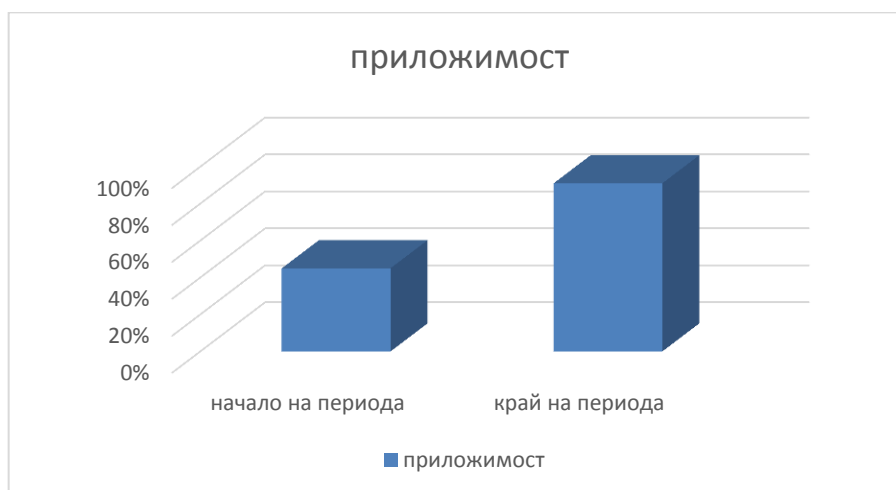
При технологията се наблюдава различно отношение към присъствието в час – навреме, без закъснения и с нагласа за участие. С течение на времето се повишава активността, вниманието, слушането, участието, реакциите по време на урок. Взаимодействието между учениците се променя, организират се неформални групи помежду им за подготовка. Наблюдава се желание за демонстриране на знания, практически опит, компетентност. Подготовката на проекти провокира постепенното налагане употребата на технически език в час. Проектно-базираното обучение поставя учениците в различна среда за действие, мислене и анализиране. По този начин се провокира въображението им, засилва се активността.



Фиг.1 Готовност за работа в час

Изводите при обобщаване на резултатите от първа изследователска задача са:

- ✓ В началото на учебната година по-малко от половината -45% от учениците проявяват инициатива и положително отношение към новия материал, в края на изследвания период всички ученици с готовност взимат участие и търсят одобрението на учителя и наставника си.
- ✓ Отдават голямо значение на професионалната си теоретична подготовка.
- ✓ Разглеждат я като необходима предпоставка за постигане на високи резултати.
- ✓ Наученото е практически приложимо и го приемат като част от професията.



Фиг. 2 Внедряване на наученото в практиката

От фигурата ясно личи, че в резултат на различния начин на провеждане на урока, процентът на тези които смятат, че наученото има приложение е висок - 92% в края на учебната година. Те са усвоили значително по-добре учебния материал и са намерили връзката с часовете по практика, техниката, дори в бита им. Някой започнаха да обясняват със свои лични примери. Всичко това ни показва, че сме на прав път.

4. ЗАКЛЮЧЕНИЕ

В проведеното изследване с учениците от ПТГ "Иван Райнов" - Ямбол се установи по-добро усвояване на знания, чрез използване на технологията на проектно-базираното обучение. Въпросът за ролята на повишаването на мотивацията и стимула за учене е актуален и днес. Изправени пред новите предизвикателства на новото време, със съвременните дигитални поколения ние все повече търсим иновативни методи за преподаване и учене.

След направения анализ на резултатите могат да се направят следните изводи:

1. Използването на проектно-базираното обучение помага да се визуализират идеите, да се създадат интересни неща от учениците. Да се създаде интерес у аудиторията.

2. Чрез различни типове табла, макети, схеми, презентации, учебният материал може да бъде представен по редица различни начини, даващи възможност на учениците да станат активни участници в учебния процес.

3. Във връзка с нарастване ролята на стратегията за учене през целия живот, от голямо значение за професионалното обучение е прякото участие на учениците в подготовката и представянето на учебното съдържание.

Обогатяването на учебната практика с новата технология предоставя средства за повишаване на интереса към учебния процес, дава възможност, чрез лично участие в часовете по Машинни елементи, учениците да поемат контрол върху обучението си и постепенно да преминат към реалното работно място.

Невъзможно е да искаме учениците да работят съвместно, да преживяват, да споделят, да се учат един от друг и да използваме традиционните дидактически методи. Технологиите вече преминаха периода, в който бяха недостъпни и вече са част всяка работна среда. Работодателите са заинтересовани учениците да бъдат обучавани на най-съвременни техники. Чрез дуалната система на обучение образованието предоставя една реална връзка на теорията с практиката.

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COGNITIVE-BEHAVIORAL SCHEMES AND THEIR REPERCUSSION IN ANXIETY PERSONALITY EDUCATION

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Abstract: *This scientific work addresses two important aspects of personality with anxiety disorders - cognitive-behavioral patterns and the ability of the anxious person to deal with them. The specific research objective is focused on clarifying the substantive dimensions of negative automatic thoughts, positive thoughts such as the contraversion of negative thoughts and coping strategies in persons with anxiety disorders (panic disorder and generalized anxiety disorder) and in subjects studied without or with mild anxiety. Identifying relationships between automatic thoughts, anxiety, self-efficacy, and coping strategies. The results obtained are entirely oriented towards consultative practice and training technologies.*

Based on theoretical analysis and empirical research, the main goal is to: study the influence and interconnections between negative automatic thoughts, the influence of positive thoughts such as the contraversion of negative thoughts, anxiety, coping assessment - strategies for coping with unwanted thoughts in teens with anxiety disorders and in persons without anxiety or mild anxiety. This would lead to a better understanding of the problematic of cognitive-behavioral schemes and the identification of individual strategies to deal with unwanted negative thoughts and the creation of more appropriate individual and group therapeutic interventions to assist learners.

In support of the accepted hypothesis, there is an association between personal inability and desire for change and the negative self-concept in students. The low self-esteem and powerlessness of teenagers in new conditions has been confirmed. A statistically significant correlation between these factors was found in the subjects with anxiety disorders.

Keywords: *anxiety disorders in teens; cognitive-behavioral patterns of personality; personal disability; helplessness.*

КОГНИТИВНО-ПОВЕДЕНЧЕСКИ СХЕМИ И ОТРАЖЕНИЕТО ИМ В ОБУЧЕНИЕТО НА ЛИЧНОСТТА ПРИ ТРЕВОЖНОСТ

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6. ВЪВЕДЕНИЕ

Един феномен „тревожност“, съпътства открай време човешкия опит. Няма човек, който да не е преживял тревожност в определен етап от живота си. Преживяванията на тревожни и депресивни състояния в съвременния живот най-често се отдава на разминаването между доста бързо променящите се изисквания към нас и сравнително бавно еволюиращите биологични и психологични механизми на адаптация. Тревожно

и/или депресивно състояние „може да бъде симптом или клинична изява на психично разстройство; може да съпътства телесно заболяване (коморбидност); да представлява емоционална реакция към соматична болест и/или инвалидност; да е израз на бремето, което психичната болест оказва върху най-близките на страдация“ (Картър, Р., С. Голант, 2002).

Данните от международното сравнително епидемиологично проучване EPIBUL 2003-2007 (по инициатива на Световна здравна организация, 2006 г.), публикувани в доклада на Министерството на здравеопазването на Република България, най-разпространеното психично разстройство е тревожността – 11,4%. Най-засегната от тревожност е групата на възрастните между 50 и 65 годишни – 3.2%. Разстройствата от нарушение на настроението е 6,2%, като най-често се среща при хора над 65 години – 9,1%. Разстройствата на хора, дължащи се на употреба на психоактивни вещества е 3,3%, която е третата по разпространение група.

Личността с тревожни разстройства, нейните когнитивни изкривявания и чувства е широко дискутиран и изследван феномен в съвременната психология, тъй като пряко се отразява върху здравето и субективното благополучие. А. Beck, 1975 в „Cognitive Therapy and the Emotional Disorders“ обяснява, че „когнитивната терапия е основана на съществената теоретична парадигма, че чувствата и поведението на индивида са детерминирани в голяма степен от начина, по който той структурира света. Структурирането на света от отделната личност се основава на нейните когниции (вербални или образни идеи, достъпни до съзнанието), като тези когниции се базират на дисфункционалните допускания и когнитивните схеми, развити в предишния опит“. От друга страна, стратегиите за справяне с негативни мисли и тревожност, при нормален и с патологичен характер са комплексни и важна част от когнитивното, емоционалното и социалното функциониране на индивида.

Последното десетилетие бележи значителен напредък по отношение на изследването и справянето с тревожните разстройства в научно и на практическо равнище. Независимо от това, този проблем продължава да съпътства недостатъчните изследвания на автоматичните мисли, дисфункционалните допускания и когнитивните схеми на личността с тревожни разстройства.

Настоящата научна работа се отнася до тези два важни аспекта от личността с тревожни разстройства – когнитивно-поведенческите схеми и способността на индивида да се справя с тревожността. Изследователската цел фокусираме върху изясняване съдържателните измерения на негативните автоматични мисли, позитивните мисли като контраверсия на негативните мисли и стратегиите при лица с тревожни разстройства - паническо и генерализирано тревожно разстройство. Изследваме и лица с ниска и/или липсваща тревожност. Анализираме взаимовръзките между автоматичните мисли, тревожността, самооценката и копинг – стратегиите. Получените резултати са ориентирани към консултативната и терапевтична практика на юноши в процес на обучение.

Идентифицирането на факторите пораждащи тревожност в годините на обучение, могат да бъдат разгледани като превантивни спрямо психопатологичните симптоми по време на юношеството. В научното изследване разглеждаме следните психопатологични симптоми - психотизъм, тревожност, враждебност, обесивност-компулсивност, депресия, параноидни идеи, междуличностна чувствителност.

Според Уотсън (Watson, 1998), „личностните разстройства и психопатологични симптоми са силен предиктор за ниската самооценка“. Съществуват и други изследвания, които показват положителната връзка между психичното здраве и самооценка (Dowd, 2002).

7. ЦЕЛ НА ИЗСЛЕДВАНЕТО

На базата на теоретичните анализи и емпиричните изследвания, които разгледахме, поставяме за цел да проучим и изследваме влиянието и взаимовръзките между негативните автоматични мисли, влиянието на позитивните мисли като контраверсия на негативните мисли, тревожността, самооценка за ефективност и копинг-стратегии за справяне с негативните мисли при юношите с тревожни разстройства - паническо и генерализирано тревожно разстройство, и при изследвани лица без тревожност или с лека тревожност. Това би довело до по-доброто разбиране на проблематиката на когнитивно-поведенческите схеми, откриване на индивидуални стратегии за справяне с нежеланите негативни мисли и създаването на по-адекватни индивидуални и групови терапевтични интервенции.

8. МЕТОДИ НА ИЗСЛЕДВАНЕТО

Представеното изследване има характер на психолого-диагностично проучване. То си поставя за цел чрез научни методи да изследва особеностите и взаимовръзката между изследваните явления (автоматичните мисли, себе-ефикасност и копинг-стратегии). Разгледаните ключови аспекти на негативните автоматичните мисли, позитивните мисли като контраверсия и стиловете за контрол. Те са изведени по теоретичен път. От огромно значение е да бъдат потвърдени в емпирични изследвания. Тази необходимост се определя от практико-приложния характер на научното изследване. Проучването на проблема се извършва в изследователски план.

Концептуалните основания се извеждат чрез използването на теоретично-аналитично проучване на научната литература по проблематиката, свързана с когнитивните схеми и автоматичните мисли. Във връзка с по-обхватното изясняване на изследвания проблем е извършено проучване и интегриране на широк кръг въпроси, от областта на общо психологическото познание, клинична психология, консултативна психология, както и теоретични постановки от медицината.

Приемаме следните изследователски хипотези:

Хипотеза 1: Допускаме, че ще се наблюдава значимо различие във влиянието на демографските характеристики (пол, възраст, образование) при лицата с тревожни разстройства и лицата без тревожност, по отношение на изследваните параметри: импулсивност, дисфункционални убеждения, самооценка, себе-ефикасност, очакванията за бъдещето и копинг-стратегии за справяне с негативни мисли.

Хипотеза 2: Допускаме, че умерената и изразена степен на паническа и генерализирана тревожност влияе негативно върху личностовата неприспособимост, аз-концепцията и самооценката, което е значимо различие спрямо лицата от контролната група (без тревожност)

Хипотеза 3 Допускаме, че има значимо различие между лицата с изразена тревожност и тези без тревожност по отношение на личностната неприспособимост аз-концепцията, самооценката и копинг-стратегии за справяне с дисфункционалните вярвания и безпомощност.

Обект на изследването са юноши (момчета и момичета) във възрастовата група 14–18 години, обучаващи се средно училище в град Бургас. Разпределени са в две извадки експериментарната група с поставена диагноза от психиатър „тревожно разстройство – паническо или генерализирано”. Броят на изследваните лица в тази група е 8, разпределени по пол – 5 момчета и 3 момичета. Втората извадка е съставена от лица без тревожност или с лека тревожност е събрана на случаен принцип. Броят на изследваните лица е 22 – 8 момчета и 14 момичета.

Общо в двете групи разпределението по възраст е: група:

А. 14–16 години попадат 5 момчета и 6 момичета;

В. 17–18 години - 5 момчета и 6 момичета;

С. над 18 години – 3 момчета и 5 момичета.

Предмет на настоящата разработка са психодиагностична оценка и анализ на негативните автоматични мисли, самооценката към ефикасността, импулсивността и копинг-стратегии за контрол върху негативните и нежелани мисли.

Основни принципи в емпиричното психологично изследване са: принципът на детерминизма; принципът на обективността; принципът на единството на анализа и синтеза; принципът за единство на дейност и психика, принципът за единство между структура и функция. При провеждането на настоящото изследване са спазени изградените етични и професионални стандарти за работа с деца в юношеска възраст, които кореспондират с етичните норми и законодателни разпоредби на психологическата практика в нашата страна и установените етични стандарти в европейската и световна практика.

Психологически инструментариум

В психодиагностичната практика се използват огромен брой методи, които измерват общи или отделни личностни характеристики. „Личностните въпросници са клас психодиагностични методи, разкриващи типологията на личността с нейните крайни дименсии. По-голямата част от разработените и проверени методи, т.нар. личностни инвентари, обхващат няколко отделни измерения на личността в т.ч. нагласи, мотиви, интереси и поведенчески характеристики. Принципът на тестовете е ясен, което ги причислява към „субективните“, съответно към „директните“ тестове“. (Стефанова, С., 2012).

1. *Въпросник за автоматични мисли – Automatic Thoughts Questionnaire (ATQ) на Kendall & S. D. Hollon (1980)*. 30-те елемента на ATQ измерват честотата на отрицателните автоматични мисли. Респондентите оценява честотата на 30-те отрицателни мисли по скала от 1 до 5. Например колко често се появяват негативни автоматични мисли като „Аз съм губещ“ през последната седмица; по-високите резултати показват повишена тежест на негативните мисли. Въпросникът притежава следните четири фактора: А. Личностова неприспособимост и желание за промяна; В. Негативна Аз-концепция и негативни очаквания; С. Ниска самооценка; D. Безпомощност. Въпросникът има надеждност, алфа на Кронбах 0,95.

2. *Въпросник за позитивни автоматични мисли на Rick Ingram и Kathleen Wisnicki (1988)* – създаден да оцени появата на позитивни автоматични когниции, като контраверсия на негативните автоматични мисли. Въпросникът се състои от 30 айтема, които се разделят в четири фактора както следва: А. позитивно ежедневно функциониране, В. позитивна самооценка, С. други оценки на Аза; D. позитивни очаквания за бъдещето. Надеждността на въпросника измерена с алфа на Кронбах 0,90.

3. *Скала за клинична тревожност (CAS), създадена от Bruce A. Thyer (1984)*. Скалата се състои от 25 айтема, които измерват нивото на клиничната тревожност, изпитвана от респонденти - по-високи резултати показват по-високи нива на тревожност. Психометричните качества на скалата са добри – алфа на Кронбах е 0,88.

4. *Скалата за оценка на себе-ефикасността на M. Sheree, J. Maddux, B. Mercandante, (1982)*, измерва основните личностни вярвания в собствената компетентност. Скалата за оценка на себе-ефикасността е инструмент от 30 твърдения, който измерва очакванията относно себе-ефикасността, които не са свързани със специфични ситуации или поведение. Скалата за оценка на себе-ефикасност демонстрира добра надеждност - $\alpha = 0,79$. Тази скала се състои от два фактора: А. Базисна себе-ефикасност; В. Социална себе-ефикасност.

9. АНАЛИЗ И ИНТЕРПРЕТАЦИЯ НА РЕЗУЛТАТИТЕ

По хипотеза 1: При проведеният дисперсионен анализ и на двете извадки се достигна до следните заключения:

- при първата извадка полът води до различия единствено при показател - други оценки на Аза, като по-често момчетата имат позитивни мисли за другите хора, отколкото момичетата.
- За разлика от първата, при втората извадка полът повлиява върху копинг-стратегията Тревога, която най-често се прилага при момичетата, отколкото при мъжете.
- Възрастта оказва влияние върху избора на стратегия за справяне с негативните и нежелани мисли и при двете извадки тази копинг-стратегия е Тревога, но при извадката от лица с тревожни разстройства тя е най-приложима при възраст от 16-17 г., докато при втората извадка - при възраст за групата на лицата над 18 години.
- При лица с тревожни разстройства, образованието повлиява върху показателите: позитивно ежедневно функциониране; позитивната самооценка; другите оценки на Аза и позитивните очаквания за бъдещето. При тези субскали се установи, че лицата с добра успеваемост в училище са по-склонни да заменят негативните мисли с позитивни, отколкото тези със средна и лоша. За разлика от първата извадка, при втората извадка успеваемостта влияе единствено върху позитивните очаквания за бъдещето.

По хипотеза 2: При проведеният корелационен анализ при извадката на лица с тревожни разстройства се установи, че факторът личностна неприспособимост и желание за промяна има силни положителни корелационни връзки и с трите субскали: ниска самооценка; негативна Аз-концепция и безпомощност. Най- високата корелация се наблюдава при негативна Аз-концепция; личностна неприспособимост и желание за промяна. При нарастване на негативната Аз-концепция на учащите, безпомощност и ниската самооценка, повишава се личностната неприспособимост и негативните очаквания. (Табл.1)

Табл.1. Корелации на Pearson (r) между личностната неприспособимост и желание за промяна и негативна Аз- концепция, ниска самооценка и безпомощност.

	Личностна неприспособимост	Негативна Аз-концепция	Ниска самооценка	Безпомощност
Личностна неприспособимост		0,844	0,735	0,689
Негативна Аз-концепция			0,805	0,715

Забележка: Корелацията е значима на ниво 0,01

Така достигнатите изводи са повлияни от твърденията на автори като, Sanderson, W. С., DiNardo, P. A., Raper, R. M., & Barlow, D. H. (1990), според които много често за хората с тревожни разстройства се „хващат“ здраво за своите ужасяващи преживявания. Поради това, те имат по-малка възможност да променят мисловните си модели. „Хващането“ за тези спомени е това, което прави тревожните разстройства толкова мощни. Юношите, които се тревожат и имат страх, се опитват упорито да предотвратят ситуацията, които провокират тяхната тревожност, но не виждат възможен начин да избегнат ситуацията и да спрат да мислят за нея. Страдащите от тревожни разстройства са склонни да вярват, че нищо няма да се промени за тях. Вярвайки в това, те изключват психологичната помощ, ползват от медицината и подкрепата на семейството. Такива личности считат, че проблемът е постоянното им място в живота

и не позволяват на нищо да се промени. От друга страна, според D. A. Fennell., (2004г.) ниската самооценка може да бъде следствие от съществуващ проблем - индивид с тревожно разстройство може постепенно цялостно да загуби увереността в себе си дори и при човек, който първоначално е имал доста реалистично и изразено положително възприятие за себе си. Този факт се обяснява с това, че личността с ниска самооценка имат склонност да притежава високи нива на тревожност, тъй като те очакват да бъдат осъдени негативно от другите хора. Тези личности имат склонност да очакват повече негативни неща да им се случат, което също се свързва с ниската самооценка и тревожността. Т.е. съществува връзка между ниската самооценка и тревожните разстройства. Напр. човек с паническо разстройство ще има усещането, че се намира изцяло в капана на събитията и няма контрол над тях.

Невротичният човек има различна гледна точка. „Невротичният „Аз“ е разделен на „Презрян Аз“ и „Идеален Аз“, където „Идеалният Аз“ не е позитивна цел, защото е нереален и в крайна сметка, недостижим. Така че невротичният човек се лута между това да мрази себе си и да се преструва, че е съвършен. Това разтягане между „Презрения Аз“ и „Идеалния Аз“ се описва като тиранията на „трябва“ и невротичния стремеж за слава. И докато се лута между тези два невъзможни Аз-а, невротичният човек се отчуждава от истинската си същност и така възпрепятства осъществяването на потенциала си“. (Стефанова, С., 2012).

По хипотеза 3: Таблица 2. Колкото повече нарастват мислите на личността с тревожно разстройство за безпомощност, за несправяне с поставените задачи, липсата на мотивация, толкова повече тя се опитва да се справи с тези нежелани мисли като се опитва да се тревожи по-малко или се самообвинява, че имат негативни, нежелани мисли. От таблицата се вижда факта, по отношение на стратегиите за справяне - отвлечане на вниманието и преоценка. Не са установени значими корелационни връзки с факторите личностна неприспособимост, негативна Аз-концепция, ниска самооценка и безпомощност.

Табл.2. Корелации на Pearson (r) между личностна неприспособимост, негативна Аз-концепция, ниска самооценка, безпомощност и петте копинг-стратегии за справяне с нежеланите мисли.

	Отвлечане на внимание	Социален контрол	Тревога	Наказание	Преоценка
Личностна неприспособимост			0,495	0,432	
Негативна Аз-концепция			0,546	0,509	
Ниска самооценка			0,495	0,445	
Безпомощност			0,606	0,578	

Забележка: Корелацията е значима на ниво 0,01

10. ЗАКЛЮЧЕНИЕ

От посочените резултати се установява, че при извадката на лица с тревожни разстройства, субскалата личностна неприспособимост се свързва умерено, положително с копинг-стратегии за контрол на негативните мисли - тревога, наказание, докато при извадката на лица без или с лека тревожност същата зависимост е слаба. Може да се направи следното заключение: колкото повече тревожната личност желае да се освободи от негативните мисли, опитвайки се да се тревожи по-малко или първоначално да потисне тези натрапливи тревожни мисли и да се упреква, че постоянно мисли за тях, толкова повече нараства неговата негативна представа за самия себе си.

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NEUROTIC SYMPTOMATICS RELATED TO PERSONAL CHARACTERISTICS IN YOUTH

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Abstract: *The present study traces the dynamics of personal characteristics in youth and the manifested neurotic symptoms in the training process. These facts are the reason for the low levels of school results in the context of the existing theoretical statements of the problem and the empirical research conducted among the trained teenagers. We suggest that the indicators of neurotic symptomatology in youth – aggression, anxiety, and neuroticism, are the most demonstrated, compared to the other studied indicators of neurotic symptomatology. Studies have proved that there is a difference in the act of neurotic symptoms when tested in different situations, both in terms of expression and content. At the beginning of the school year, neurotic symptoms, more demonstrated in some aspects of aggressiveness, while at the end of school year, psychotism is more demonstrated. The presented summarized results indicate that at the beginning of the school year, neurotic symptoms are strongly associated with aggression. There is a tendency towards a lower level of social responsiveness, both in the self-assessment of real behavior and in the ideal "I"-image of students in the last year of their studies. The neurotic symptomatology, more demonstrated due to specific conditions in the life of young people and in relation to the characteristics of age.*

Key words: *personal characteristics in youth; school success; neurotic symptomatology.*

1. INTRODUCTION

An important prerequisite for adequately assisting adolescents in the transition to adulthood is knowledge of the dynamics in the development of personality traits and the prerequisites for the occurrence of mental problems during secondary school age. According to contemporary psychological research, in recent years, both in Bulgaria and in other countries, neurotic symptoms have been very pronounced at the end of adolescence. According to a study by Ts. Popivanova, Ts. Antonova and R. Ruskova, (2007) at this age the neurotic reactions increase two to three times, compared to the previous periods. This is sufficient reason to study the dynamics of personality traits related to neurotic symptomatology in students enrolled in general and specialized secondary schools in the country [2,8,10].

The term "neuroticism", as refined by H. Yu. Eysenck, is used to refer to a personality trait in a hierarchical model of personality, representing a continuum from normal affective stability to pronounced lability and being a basic proposition for the development of neurosis. According to H. Eysenck (1999), neuroticism is a condition characterized by increased emotional arousal, triggered by certain objects and situations, and in almost all cases characterized by maladaptation. H. Hristozov (1990) includes in the concept of "neuroticism" all neurotic manifestations from short neurotic reactions to too high neurotic development [3,4,9].

"The anxiety, fears and inability to participate fully in social situations often give the adolescent a sense of helplessness. Traumatic events are often blamed as early as childhood, and it is true that they often cause the onset of the disorder even at adolescence, but should not be considered as a major cause of its occurrence" [1,7].

2. SPECIFICITY OF PERSONAL NEUROTIC SYMPTOMS IN ADOLESCENTS

Summarizing the leading psychological theories related to the study of neurotic symptoms in secondary school age, we derive characteristics specific to this period of development.

The family environment plays a major role in the development of neurotic symptomatology in adolescence (Jung, K., 1997; Adler, A., 2010; Adler, A., 1998; Freud, A., 2000; Erickson, E., 1996; Künkler, F., 2008; Fromm, E., 1998; Delarosh, P., 2008; Zakharov, A. I., 1996; Shishkov, A., 2000; H. Hristozov, H., M. Achkov, A. Bozhanov, M. Galabova, N. Dashinova, S. Zaimova, V. Yonchev, R. Kostova, S. Nikolova, R. Penushlieva and K. Tsafarov, 1976).

The manifestations of neurotic symptomatology in childhood from development are the basis for deepening and expanding the process of neuroticism at the end of adolescence (Freud, A., 2000; Künkler, F., 2008; Eriksson, E., 1996).

The presence of neurotic symptoms in adolescence is a prerequisite for the emergence of mental health disorders in adulthood (Erikson, E., 1996; Alexandrova, B., Bogdanova, E. and Dimitrova, E., 2011).

Neurotic symptomatology in childhood and adolescence in secondary school age, related to the adaptive capacity of the individual (Hristozov, H., 1990; Mutafov, S. and Ivanov, I., 1996).

The lack of a sense of well-established control over instincts and attraction is the cause of fear, anxiety, helplessness and neurotic symptoms. (Jung, K., 1997; Freud, A., 2000; Petrov, R., 2001).

There is a relationship between adolescent risk behavior and neurotic symptoms, both in adolescence and in adulthood (Valon, A., 1988; Petrova, K., 2015; Shishkov, A., 2000; Compton et al., 2010).

In adolescence, neurotic symptoms are strongly associated with conditions in the extra-marital social environment, and in particular school. (Mutafov, S. and Ivanov, I., 1996; Burns, R., 1986; Vasilev, V., Hristova, D., Hristov, J. and Ivanova, N., 2007; Hristozov, H., 1990; Alexandrova, B., Bogdanova, E. and Dimitrova, E., 2011).

The lack of a well-formed self-concept and inadequate self-assessment are the basis for the development of neurotic symptoms (Delaros, P., 2004; Petrova, K., 2015).

3. A MODEL FOR STUDYING NEUROTIC SYMPTOMS IN YOUTH

The review aimed at the theoretical concepts of the nature of neurotic symptomatology in secondary school age, the formation and structure of personality in ontogenetic development, during the considered age period, aimed at the study of neurotic symptomatology, give reason to propose a model for the study of neuropathic symptomatology, containing the following psychological constructs:

- ✓ Neuroticism;
- ✓ Psychotism;
- ✓ Extraversion / Introversion;
- ✓ Indirect aggressiveness;
- ✓ Overall aggressive;
- ✓ Inadequate self-esteem based on the big difference between I-real and I-ideal.

The aim of the research is to study the dynamics of the psychological constructs of personality associated with neurotic symptoms in students from secondary schools in the country.

Main hypothesis: We assume that there are dynamics in the manifestations of personality traits and neurotic symptoms in adolescence during the school year and throughout the period of study from 9th to 12th grade.

Organization of the survey. A twofold survey was conducted during the 2017-2018 academic year. (October - May of the school year). Respondents are students from three general education schools in the big city and three schools in the small town. The survey was

conducted among students from 9th, 10th, 11th and 12th grades of the listed schools, who are in secondary education in Bulgarian schools.

Respondents. 347 students were surveyed. Due to incomplete data, 27 students did not participate later. The final number of respondents is 320 adolescent students, divided by gender: 125 adolescents (39.1%) and 195 girls (60.9%).

The following standardized tests are used:

- ✓ **H. J. Eysenck's personal questionnaire.** The adaptation and standardization of H. Eysenck's questionnaire were carried out by Paspalanov, I., Szczecinski, D. and Eysenck, S. B. (1984) on his latest version, published in 1975, entitled Eysenck Personality Questionnaire (EPQ). . As the average age of the students studied is 16.5 years and the majority of students 16 years and older, the variant of the adult methodology was used in order to be able to compare results on all scales of the methodology;
- ✓ **W. Zung Self-Assessment Scale for Diagnosis of Anxiety.** The W. Zung Self-Assessment Questionnaire (SAS-Self Rating Anxiety Scale) was created in 1976. for clinical practice and is aimed at diagnosing fear and anxiety (Kokoshkarova, A., 1984). In the present study, with W. Zung's test, we interpret anxiety levels as maladaptive anxiety or as adaptive anxiety, in line with the use of these terms by authors such as Stanley, Norman & Burrows (2001), Zeidner & Matthews (2011);
- ✓ **W. Zung Self-Assessment Scale for Depression Diagnosis.** The W. Zung Depression Scale (SDS) is used to detect depressive states, to dynamically track their changes, to determine their level of depression. In the present study, Cronbach's alpha is 0.69, which shows acceptable internal consistency.

The survey also used a questionnaire to address the following personality traits: relationships with peers and teachers at school; attitude towards the school; family relationships; health condition; purposefulness, vision for the future; frustration tolerance; helplessness.

4. RESULTS ANALYSIS

The results of the study show that many of the students are not abnormally anxious and depressed. Throughout the secondary education period, most of the adolescents studied had adaptive anxiety and normality. At the beginning and end of the school year, approximately 16% of respondents were mal-adaptively anxious, and 35% had a level of depression above normal.

The majority of the studied students are ambivertes, and among the pure types there is a predominance of the extrovert over the introvert. There is a slight preponderance of the group of emotionally unstable students over those of emotionally stable students at the beginning and end of the school year. Persons with a moderate level of neuroticism predominate. Most students at the beginning of the school year are middle-aged and at the end - with a high degree of psychoticism.

The adaptive type of interpersonal relationships are significantly more pronounced than maladaptive, both at the beginning and at the end of the school year, in self-assessment for "I am real" and "I am ideal" - for students in grades 11 and 12. Throughout the school year, both in "I-real" and "I-ideal", maladaptive types of interpersonal relationships correlate more strongly with each other than adaptive ones. The leading type of interpersonal communication is interrelated with the largest number of other adaptive types. According to E. Khokhlova, secondary school education is a favorable period for the formation of purposefulness, persistence, independence and initiative (according to Peneva, I., Kidikov, G. and Yordzhev, K., 2014).

N. Koleva [6] defines "destructive behavior is defined as purposeful inappropriate behavior in classes (getting up and walking during a lecture or exercise; speaking when the teacher explains...). Students with destructive behaviors lag behind in the learning process and



interfere with the learning process. They reduce discipline and the classroom climate is characterized by poor interpersonal relationships".

The maladaptation in each of the studied trends in social interactions signals a complete maladaptation in interpersonal communication. In both tests, self-esteem for "I-real" is higher than "I-ideal" for the adaptive and maladaptive types of interpersonal communication, which clearly indicates that there is a high self-esteem in the subjects studied, as well as a desire to form of adaptability in interpersonal relationships [1].

In maladaptive types, interpersonal relationships have a significant difference between "I-real" and "I-ideal". The "I-real" characteristics are more pronounced than the "I-ideal" characteristics. The greatest discrepancy between self-esteem on "over-friendliness" and the authoritarian type of maladaptive types of interpersonal relationships, and at the suspected type of maladaptive types of interpersonal relationships - at the end of the school year.

There is a good level of adaptability in interpersonal relationships, high self-esteem associated with social interactions among the students studied.

The majority of students maintain satisfactory relationships with their peers, parents, and teachers (according to a survey). The majority of students with a negative attitude towards the school, which, in comparison with the previous result, points to the conclusion that it is conditioned not by the interpersonal relations, but by the peculiarities of the process of education in secondary education. The majority of the students studied are anxious in exam situations, blocking the expression of their abilities and finding no way out of the tensions in school life, feeling helpless.

The survey data shows that at the end of adolescence, students have a clear and stable vision of their future. A significant proportion of them have low frustration tolerance and are closely associated with increased sensitivity to even life phenomena that they themselves consider to be not particularly significant.

5. DYNAMICS IN NEUROTIC SYMPTOMS IN PERIOD IX-XII CLASS

Psychotism is highest in students in grade IX and gradually decreases. There is an increase in adolescents in XI class again.

Table 1. Psychotism mean values for students in grades - beginning and end of the school year

Psychotic scores	Classes	Number	Mean values	Standard deviations
Psychotism at the beginning of the school year	IX	80	6,55	3,92
	X	85	5,75	4,25
	XI	90	5,70	3,25
	XII	65	4,85	3,05
Psychotism at the end of the school year	IX	80	8,00	3,58
	X	85	5,74	4,25
	XI	90	7,55	3,33
	XII	65	5,08	3,55

Indirect aggressiveness - decreases gradually from the beginning to the end of the period. There are statistically significant differences between students of different classes in terms of their indirect aggression.

Table 2. Mean values and standard deviations by indirect aggressiveness of students at the cash registers - beginning and end of the school year

Indirect aggressiveness	Classes	Number	Mean values	Standard deviations
Indirect aggression at the beginning of the school year	IX	80	15,22	8,12
	X	85	14,55	6,55
	XI	90	13,51	6,32
	XII	65	12,13	6,67
Indirect aggression at the end of the school year	IX	80	16,72	6,65
	X	85	14,03	6,45
	XI	90	14,22	6,66
	XII	65	12,44	6,54

The overall aggressiveness decreased from the beginning to the end of the period, being most pronounced in the students in grades IX and XI. It is the least pronounced in adolescents in the X class. There are statistically significant differences between students of different grades in their overall aggression at the beginning and end of the school year.

Table 3. Mean values and standard deviations by Total aggressiveness of students in cash - beginning and end of the school year

Overall aggressiveness	Classes	Number	Mean values	Standard deviations
Total aggressiveness at the beginning of the school year	IX	80	112,92	34,12
	X	85	108,95	31,45
	XI	90	118,31	32,89
	XII	65	108,83	31,90
Total aggressiveness at the end of the school year	IX	80	116,87	33,05
	X	85	106,93	31,05
	XI	90	114,22	31,65
	XII	65	109,45	32,04

6. CONCLUSION

"The personality adapts to the surrounding external environment, building up a corresponding internal psychic structure that shows the directional influence on the overall behavior. Mental adaptation can be defined as the process of establishing the optimum correspondence between the individual and the environment in the course of carrying out the activities that are peculiar to the person, which allow him to satisfy current needs and to fulfill the related goals, while ensuring the correspondence between the activity of the individual. The individual, his behavior and the requirements of the environment" [5].

The results of our psychological research among students in secondary school age confirm the concept that during this period of human ontogenetic development is extremely dynamic and dependent on the characteristics of the social environment. The importance of the school environment as a leader in the process of forming the psychosocial identity of young people are highlighted. Based on the analysis of the data, we find that there is a specificity in the manifestation of neurotic symptoms at the end of adolescence, in which psychoticism, neuroticism and aggression in interpersonal relationships in adolescents occupy leading positions. Throughout the years we have studied, anxiety, depression, and neuroticism are interrelated, and a positive correlation between them shows resilience within one school year.

The manifestation of maladaptation in each of the studied trends in social interactions leads to the assumption that there is a general maladaptation in interpersonal relations.

On the basis of empirical data obtained in this study, we can draw the following conclusion:

- ✓ The basic hypothesis is confirmed, - the presence of dynamics in the manifestations of personality traits and neurotic symptoms in secondary school age within the school year and during the whole period of study IX - XII grade. From the beginning to the end of the school year decreases the severity personal characteristics;
- ✓ The presence of crisis subperiods - IX-XII class, for the development of neurotic symptoms at the end of adolescence, implies a systematic and in-depth study of the changes in the factors "aggressiveness" and "psychotism" in the students in these classes, as well as the characteristics of interpersonal communication related to the reduction of social responsiveness in XI class students and the maladaptive level of friendliness of XII class students;
- ✓ Conducting a questionnaire survey upon enrollment of the student in the respective secondary school - in order to inform about the main characteristics of family relationships: conflict, sequence of birth of the child in the family, relationships with parents, allows for adequacy in the applied psychoprophylactic measures for students in secondary school educational school degree.

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SOCIO-PSYCHOLOGICAL ASPECTS THE MOTIVATION PROCESS IN THE ORGANIZATION. MOTIVATION APPROACHES TOOLS TO STIMULATE STAFF

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Abstract. *The focus of this report is on the socio-psychological aspects of the motivation process within an organization, as well as on motivational approaches and tools for staff incentives. Because motivation deals with the questions "why" of behavior, it refers to the internal states of the body that lead to provocation, perseverance, energy provision, and direction of behavior. In this sense, first of all, in understanding the level of employee motivation, it is important to know the basic theoretical assumptions related to motivation and some aspects related to human behavior, as well as the values and beliefs that mediate behavior (i.e., the constructs that sit on the path between need and satisfaction). Knowledge of staff motivation helps the manager to navigate its complex nature, to trace the way and the reasons for its occurrence or absence, as well as to understand its strong points. Consideration of motivation, as a relatively distinct system, would allow to identify and relatively accurately evaluate its elements, to trace the relationships between them, and finally to learn the manager to recognize and manage the complex relationships between the overall behavior of the individual and his or her parts.*

Keywords: *motivation, organization, behavior, approaches, tools, staff*

СОЦИАЛНО-ПСИХОЛОГИЧНИ АСПЕКТИ НА МОТИВАЦИОННИЯ ПРОЦЕС В ОРГАНИЗАЦИЯТА. МОТИВАЦИОННИ ПОДХОДИ И ИНСТРУМЕНТАРИУМ ЗА СТИМУЛИРАНЕ НА ПЕРСОНАЛА

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Акцентът в настоящия доклад е поставен върху социално-психологични аспекти на мотивационния процес в дадена организация, както и върху мотивационните подходи и инструментариума за стимулиране на персонала. Тъй като мотивацията се занимава с въпросите „защо“ на поведението, тя се отнася до вътрешните състояния на организма, които водят до провокиране, упорство, осигуряване на енергия и насока на поведението. В този смисъл на първо място за разбирането нивото на мотивация на служителите е важно да се знаят основните теоретични постановки свързани с мотивацията и някои аспекти свързани с човешкото поведение, както и ценностите и убежденията които опосредстват поведението (т.е. конструктите, които седят на пътя между потребността и нейното задоволяване).

Познанията за мотивацията на персонала помагат на мениджъра да се ориентира в сложната ѝ същност, да проследи начина и причините за нейното възникване или

отсъствие, както и да осмисли опорните ѝ точки. Разглеждането на мотивацията, като относително обособена система, би позволило да се идентифицират и сравнително точно да се оценят елементите ѝ, да се проследят връзките между тях и в крайна сметка мениджъра да се научи да отчита и управлява сложните зависимости между цялостното поведение на индивида и неговите части.

Етимологично терминът „мотивация“ произлиза от думата „мотив“, която означава потребности, желаня, или стимули на отделните хора. Това е процесът на стимулиране на хората към действия за постигане на конкретни цели. В контекста на изложението психологичните фактори, стимулиращи поведението на хората, могат да бъдат: желание за пари; успех; признаване; удовлетворение; работа в екип и т.н.

Една от най-важните функции на мениджмънта е да създава желание сред служителите да изпълняват работата, като мобилизират своите най-добри възможности. Затова за разбирането нивото на мотивация на служителите е важно да се знаят основните теоретични постановки, свързани с мотивацията, както и някои аспекти на човешкото поведение.

Н. Колева, следствие на направените изследвания, отбелязва, че „вниманието трябва да се фокусира върху мотивационната основа на самореализацията на личността, както и проблемите свързани със самооценката, нивото на аспирациите и др.“ [1]

Известни са голям брой теории за човешките потребности, които се опитват да обяснят мотивацията на хората, както на работните им места, така и по принцип – в живота. Сред някои от популярните теории са тези на Маслоу, Алдърфър, Макклилгънд, Хърцбърг и Мъри. Когато се говори за потребности и мотивация, на тези теории отдавна се гледа като на класика по темата.

Основната теза в *теорията на Ейбрахам Маслоу* е, че човекът е „искащо животно“. Хората непрекъснато желаят нещо, като тези техни желаня са подредени в определена йерархия на потребностите. Според Маслоу природата на човек е като цяло търсеца. Налице е една непрестанна неудовлетвореност – винаги съществуват незадоволени потребности, към които човек се стреми. Погледнато реално, почти всяка състояние на организма е мотивиращо само по себе си. Следователно, мотивацията може да се приеме като перманентна. Тя е постоянна и неспирна и рядко води до момент на пълно задоволяване. Маслоу набляга на факта за приемането на човешката личност в нейната цялостност, отчитайки въздействията на средата, културата, множествената мотивация, немотивираното поведение, здравословната мотивация. Индивидът е интегрирано организирано цяло. В този смисъл мотивиран е цялостният индивид, а не само части от него. Когато доминира определена потребност, човек е способен да промени цялата си философия за бъдещето. [8]

Теорията на Клейтън Алдерфър е известна още и като „Теория ERG“, което е абревиатура от първите букви на трите потребности: Съществуване (Existence); Обвързване (Relatedness); Растеж (Growth). Алдерфър доразвива теорията за потребностите на Маслоу, като я олекотява и същевременно добавя собствени акценти. В нея авторът обосновава теза, според която човешката мотивация се изгражда на база на тристепенна йерархия от потребности, групирайки ги в три нива – потребност от съществуване; потребност от обвързване; потребност от растеж.

Според Алдерфър четирите компонента на мотивацията са: удовлетвореност, прогрес, фрустрация и регрес, където: удовлетвореността е състояние на постигане на потребността; прогресът е преход към друга потребност в резултат на това, че вече е удовлетворена предишна потребност, към която се е стремил човекът; фрустрацията – преодоляване на бариери по пътя на постигане на потребността; регресът – състояние, към което човек преминава, когато не се справи с бариерите, не постигне определена потребност, откаже се от нея и започне да се стреми към друга потребност. Двата процеса, които текат са „удовлетворение-прогрес“ и „фрустрация-регрес“.

Една интересна идея от теорията за трите потребности на Алдерфер е, че поведението на хората в дадена организация е функция от два компонента – удовлетворение и фрустрация. Ако един служител има добра заплата, ако е удовлетворен от условията на труд и т.н., той ще започне да се стреми към такива действия, които биха удовлетворили потребността му от обвързване. Ще търси признание, ще търси оценка, ще иска да участва в социални събития и т.н. Мотивацията на такъв човек следователно би могла да се извършва от ръководителя на база на потребността от обвързване. Ако организацията или мениджърът на въпросния служител не работят именно в тази посока, човекът с неудовлетворена потребност от обвързване ще попадне в състояние на фрустрация. Оттук нататък са налице следните възможности:

Първата е да се продължи мотивацията на служителя на основа на потребността му от съществуване – работна заплата, условия на труд и т.н. Тази мотивация обаче може да се окаже краткосрочна, а служителят ще бъде в процес на постоянна фрустрация. Втората е организацията да преосмисли своята политика за удовлетворяване на потребностите от обвързване. Ако не го стори, тя просто ще губи персонал в дългосрочен план.

Като цяло тази теория е полезна отправна точка за разглеждане на човешката мотивация и може да се използва от всеки ръководител в търсене на убедителни начини за дългосрочна мотивация на служителите на работните им места. [10]

Теорията за трите потребности на Дейвид МакКлелънд, известна още и като „Теория на придобитите (заучените) потребности” има пряко отношение към мотивацията на хората на работните места и към работата на ръководителите.

Основната теза на тази теория се заключава в твърдението, че хората имат три важни висши потребности, а именно:

1. Потребност от постижения.
2. Потребност от афилиация и свързаност.
3. Потребност от власт и влияние.

Потребността от постижения се характеризира на индивидуално равнище със стремежа към по-високо ниво на изпълнение, т.е. потребност на индивида да доведе нещата, с които се е захванал до успешен край.

Потребността от афилиация и свързаност основно се изразява в силното желание за социална, интимна и лична близост. Това е не само потребност от установяване и поддържане на благоприятни отношения, оказване на помощ и съпричастност към определена група от хора, но и потребност от любов, интимност, колегиалност, приятелство, дружба.

Потребността от власт е потребност от оказване на влияние върху други хора с цел постигане на определен резултат. Важно е да се отбележи, че потребността от власт и влияние не е представена в качеството на „диктаторско” поведение, а в смисъла на личностното желание за сила; въздействие с цел самоусъвършенстване.

МакКлелънд счита, че всеки човек в определен етап от живота си се стреми да задоволи една от тези три потребности. Те не са наследствено вродени, а се придобиват и заучават, когато хората виждат в заобикалящата ги среда възможности за тяхното удовлетворяване. Културата и придобитият жизнен опит също опосредстват тяхното развитие.

Тази теория е привлекателна и полезна за практиката, тъй като предлага само три потребности. Те се запомнят лесно и очертават основните параметри на мотивацията. Същевременно мениджърите откриват прости, но ефективни начини да прилагат теорията в своята практика. Достатъчно е да се анализират длъжностите във фирмата, за да се разбере дали работните места ориентират хората към постижения. Или да се прецени доколко системата за възнаграждения ориентира поведението на хората към постижения. Самият МакКлелънд е убеден в това, че хората са в

състояние да променят потребностите си, като биват научавани на трите потребности. По този начин организацията може „да получи“ такава мотивация от своите служители, каквато желае да получи, а навиците и уменията на хората в работата могат да се развият в желаната организационна посока, като за целта са нужни преди всичко оптимални организационни условия (среда).

Поведението в определени моменти е мотивирано от една или повече потребности. Независимо от начина, по който потребността се превръща в мотив за действие, ефективността му се определя от насочеността на тези мотиви. [9]

„Субектността е качество на личността, което определя специфичността на външната поведението на човека. В резултат на това вътрешните количествени изменения предизвиква новата способност - съзнателно човек да прави промени на обкръжаващата реалност и варианти на изменения в зависимост от неговата потребност.“[6].

Двуфакторната мотивационна теория на Фредерик Хърцбърг оказва мощно влияние върху реорганизацията на труд и трудовите отношения през 60-те и 70-те години на XX век и към момента все още се прилага успешно в практиката на много компании по света.

Според Хърцбърг мотивацията се предизвиква от два фактора – хигиенни и мотивиращи.

Хигиенните фактори влияят на чувството на неудовлетвореност, свързани са с условията на труд, работната заплата, техническия контрол, безопасността на труда, междуличностните връзки, работните условия и пр. и са външни по отношение на същината им, т.е. създават своеобразен фон. Отразяват се пряко върху мотивацията на хората – ако отсъстват, се създава неудовлетворение, но ако са налице, водят само до отсъствие на неудовлетвореността. Хърцбърг счита, че работникът започва да обръща по-голямо внимание на хигиенните фактори, които удовлетворяват физиологически потребности, само когато разбере, че те са неадекватни и несправедливи и пояснява, че неудовлетворението се поражда в следствие на работа в организация със слаба политика към персонала, недобре функционираща администрация, малък (или никакъв) технически контрол, ниско заплащане, лоши междуличностни отношения с ръководителите и пр. Неудовлетворението липсва в организации, които поддържат различни от по-горните условия, а именно: добра политика за персонала, силно ръководство, редовен технически контрол, добро заплащане и добри междуличностни отношения с ръководителите.

Мотивиращите фактори са същинските или т.нар. фактори на растежа. Те водят до дългосрочни позитивни изменения в поведението на работниците. Липсата на условия за неговата изява не води до чувство на неудовлетвореност, но неговото наличие предизвиква чувство на удовлетвореност.

Липсва удовлетворение при работа, която не предлага постижения, признания, стимули, отговорност, растеж. И обратно – има удовлетворение при работа, която предлага постижения, признание, стимули, отговорност, растеж. Процесът „удовлетворение – липса на удовлетворение“ е свързан със съдържанието на работата, т.е. с вътрешни, по отношение на работата, фактори (или мотивиращи). Процесът „неудовлетворение – липса на неудовлетворение“ се определя от факторите, свързани със средата. Те са външни (хигиенни) и не са мотивиращи, а се разглеждат като потребности на човека за отстраняване на трудностите.

Съвременното управление на човешките ресурси се характеризира с направляване на поведението на хората в труда по начин, чрез който това, от което се нуждае фирмата, да го могат, искат и правят възможно най-добре членовете на нейния персонал. В този смисъл идеите на Фредерик Хърцбърг в голяма степен способстват за развитието на движения за реорганизация на труда в компаниите на много държави и за промени в трудовите отношения. Теорията му е пряко приложима в управлението на

организацията, тъй като, ако ръководството създава условия за позитивна мотивация, тогава и вниманието на работниците в предприятието няма да е заето единствено с хигиенните фактори. Въз основа на това са предприети и внедрени множество подобрения в работната среда, като: обогатяване на работата с повече възможности за постижения и предизвикателни цели, подобряване на организацията и управлението на човешките ресурси, осигуряване на добри и безопасни условия на труд, разширяване на работните задължения, ротация, конкурентни и справедливи за бранша възнаграждения, подобряване (или премахване) на неясните и/или несправедливи организационни правила и процедури, прилагане на подкрепящ стил на управление и контрол, създаване на условия за реализиране на потенциала на работниците и възможности за кариерно израстване на способните служители, делегиране на повече доверие и отговорност на по-компетентните кадри, предлагане на възможности за обучение и развитие и предоставяне на реални шансове за кариерно израстване в рамките на организацията.

Логично е да се допусне, че тези техники няма да работят еднакво добре при всички служители, тъй като хората се мотивират от различни неща. Затова препоръката е да се поддържа активна интеракция с персонала, за да могат да се изведат ключовите мотивиращи фактори. [5]

Теорията за човешките потребности на Хенри Мъри не само предхожда всички споменати теории, но и значително е повлияла на развитието им.

Основната теза на теорията на Мъри е, че само разнообразието от потребности може да мотивира поведението на човека за определено време. Потребностите се променят в резултат на опита и познанието на хората.

Хенри Мъри разделя потребностите на две основни групи:

Първични потребности – най-базисните потребности въз основа на биологичните нужди на човека (потребност от кислород, вода, храна и др.).

Вторични потребности – това са психологическите потребности, които не са от критично значение за непосредственото физическо оцеляване, но са изключително важни за човешкото благоденствие.

В труда си „Explorations in Personality” Мъри разделя вторичните (психологически) потребности на шест основни области: 1. Потребности от амбиция; 2. Материалистични потребности; 3. Потребности от власт; 4. Потребности от защита на статуса; 5. Потребности от привързаност; 6. Потребности от информация

За всяка от шестте области по-горе Мъри предлага определен брой човешки потребности, което оформя и теорията му за човешките потребности. Първоначално авторът насочва вниманието си към дефиниране на потребностите, към извеждане на критерии за класификацията им, както и към описание на потребностите, регистрирани от него и предлага една доста широка дефиниция, която включва различни аспекти на конструкта.

Мъри използва термина „тенденция” като синоним на „потребност”. Потребността, според автора, е появила се аперцепция на пречка, като например липса или вреда, която води до желание.

Мъри работи в продължение на много години върху потребностният потенциал, често назовавайки го „мотив или тенденция в поведението”. Според него, на базата на „диадичното взаимодействие”, те имат противоречив характер и включват в себе си два полюса. В зависимост от спецификите на случващите се събития и отношенията между тях у конкретния човек се актуализира ту един, ту друг полюс потребности, като в своето поведение индивидът се ръководи от по-напрегнатата потребност.

Според него всяка потребност има два аспекта: какво е направлението ѝ и каква е силата ѝ. Авторът отбелязва, че само тези потребности, които са специфични и много значими за личността, биха могли да подсилят енергийния дисбаланс на човека (да увеличат дефицита) и да породят потребността. Това може да се използва в

множество ситуации. Нужно е да открием какви са актуалните потребности на определен човек и да му помогнем да ги удовлетвори, като в замяна получим от него онова, което искаме.

Теорията за човешките потребности на Мъри е сред първите по рода си, която описва човешките потребности, синтезира ги в основни групи и по този начин служи за отправна точка, в т.ч. и за по-нататъшни изследвания на човешката мотивация. [11]

Теорията за самодетерминацията (Self-determination theory, SDT) е разработената от Едуард Деси и Ричард Райън. Според нея в основата на вътрешната мотивация са три вродени базови потребности, а именно за автономност (самодетерминация), свързаност и компетентност. Автономността е стремеж да възприемаме себе си като притежаващи свободна воля, че контролираме собствения си живот и действаме в хармония с разбиранията си.

Свързаността е потребност от обвързаност и взаимодействия с останалите, която се изразява в стремеж към изграждане на надеждни отношения, основани на чувствата за привързаност и принадлежност.

Компетентността е вяра в собствените възможности за ефективно действие и способност за постигане на желаните резултати.

Съзнателно или несъзнателно, всеки се стреми към удовлетворяването им, като прави избори, които счита, че създават такива възможности. За поддържането и повишаването на вътрешната мотивация най-голямо значение има удовлетворяването на потребността от автономия. Тя ни кара да възприемаме поведението си като резултат от собствена инициатива и като преследващо собствените ни интереси и разбирания. Макар че не е в състояние самостоятелно да поддържа вътрешната мотивация, удовлетворяването на потребността от компетентност също е важна. Позволява ни да сме любознателни и изследователски настроени личности. Ролята на потребността от свързаност е да създава благоприятни условия за разгръщането на автономността. При тази структура на потребностите, вътрешната мотивация се измества от външната в два основни случая.

1. Всяко външно въздействие подсказващо, че източник или първопричина за дейността са външни фактори, създава усещане за загуба на контрол. Потребността от автономност остава неудовлетворена и това намалява вътрешната мотивация.
2. Вътрешната мотивация намалява и ако външните фактори потискат усещането за компетентност и създават впечатление, че индивидът не се справя добре.

Трите основни психологически потребности са налице и трябва да бъдат удовлетворени на всички нива на човешкото функциониране: на ниво определена задача (дадена работна задача), на лично ниво (работа или семейство) и на глобално ниво (личност). [4]

В обобщение може да се каже, че психологичната нужда от удовлетворение на потребностите е от решаващо значение за благополучието и трябва да бъде един от водещите приоритети в социалния живот. Междукulturните изследвания показват, че задоволяването на тези потребности е необходимо за здравословното развитие, ангажираност, мотивация и благосъстояние на всички хора. Освен това удовлетворяването на потребностите се свързва с по-висока трудоспособност и повече устойчивост на стрес.

Когато се знае повече за естеството на психологичните потребности, е значително по-лесно да се намерят начини за тяхното удовлетворяване, което от своя страна оказва съществено въздействие върху благосъстоянието.

Потребност, която не е удовлетворена, поражда неравновесие у индивида и той е този, който има за цел да намали това състояние, посредством своето поведение. Когато тази потребност бъде удовлетворена, на нейно място се появява друга за удовлетворение и именно поради това субектът е в постоянно състояние на

неравновесие и едновременно с това в постоянен стремеж към намаляване на това положение.

Личността е устроена така, че винаги има нужда да задоволява потребности, независимо в какъв период от своето развитие се намира. Следва да отбележим, че въз основа на историческия преглед са представени и анализирани редица виждания, свързани с мотивацията на човешкото поведение. Следователно може да отчетем и няколко основни момента:

1. Повечето автори поставят акцент върху потребностите и тяхното разнообразие като основен мотиватор на поведение.
2. При всеки човек, както и в обществото като цяло, съществува йерархия на потребностите – тяхната подреденост по степен на значимост. Този ред се формира от човек самостоятелно и може да се променя многократно през целия му живот в зависимост от социалната среда и нивото на развитие. Най-важната потребност, обаче, обикновено се свързва с целта и смисъла на човешкия живот.
3. Пред всяка една личност застава нуждата от това да удовлетворява потребности, независимо в какъв етап от своето развитие се намира и в зависимост от избора на поведение и възможностите, които се влагат, се определя степента на нейното задоволяване.
4. В основата на всяка човешка дейност винаги се намира някаква потребност, която намира своето проявление в мотивите и именно потребностите се явяват движещата сила, която тласка човека към социална активност и развитие.

Познанията за мотивацията помагат на мениджъра да се ориентира в сложната й същност, да проследи начина и причините за нейното възникване или отсъствие, както и да осмисли опорните й точки. Разглеждането на мотивацията, като относително обособена система, би позволило да се идентифицират и сравнително точно да се оценят елементите й, да се проследят връзките между тях и в крайна сметка мениджъра да се научи да отчита и управлява сложните зависимости между цялостното поведение на индивида и неговите части.

МОТИВАЦИОННИ ПОДХОДИ И ИНСТРУМЕНТАРИУМ ЗА СТИМУЛИРАНЕ НА ПЕРСОНАЛА

Мотивирането за високи постижения в работата трябва да разчита не само на възнаграждението, а и на редица други много по-важни фактори. Тоест, трябва да се подходи към изграждането и прилагането на „пакет“ от мотивиращи въздействия за високи резултати, съчетани с висока удовлетвореност, положителна нагласа и съпричастност към организацията. Мотивацията изисква обединяването на усилия, способности, резултати, възнаграждение, удовлетворение и възприятие в една взаимосвързана система, а управлението изисква от мениджърите да търсят качествено нови системи за мотивация и контрол.

Добър способ може да бъде създаването на чувство за личен принос в някаква социално значима или важна за компанията дейност. Не е за пренебрегване и управлението чрез ценности, като се делегират права и отговорности на лица, които в ежедневната си дейност са лишени от такива, но желаят да имат власт, да носят отговорност и да упражняват контрол, като се предоставят възможности на персонала за натрупване на нов опит и знания от работата.

Необходими са практически подходи за изграждане на правила и процедури за оценка на дейността на персонала и за повишаване на удовлетвореността от труда, които да повишат ефективността, конкурентноспособността и качеството на обслужване на клиентите. За тази цел мениджърското внимание трябва да се акцентира върху следните важни въпроси:

1. Съществуват ли в организацията работещи системи за текуща оценка на дейността на персонала?

2. Налице ли са действащи системи за цялостна оценка на дейността на персонала?
3. Системите за атестация и мотивация имат ли подкрепата на преките ръководители?
4. Ползват ли се тези системи с подкрепата на служителите?
5. Настъпили ли са промени в начина на заплащане и растеж в йерархията?
6. Повиши ли се лоялността на служителите към организацията?
7. Повиши ли се удовлетвореността от труда?
8. Как се формира заплащането – за щат или за свършена работа?
9. Какви са не-паричните начини за стимулиране на персонала?
10. Познават ли се потребностите и нуждите на служителите?
11. Прилагат ли се методики за изследване удовлетвореността от труда?
12. Съществува ли съмнение, че се предлага добро възнаграждение и условия на труд, а служителите не са достатъчно въввлечени в работата?

За да действа ефективно системата за управление в една организация, е важно хората да са мотивирани за учене, творчество и споделяне. Тази мотивация се поддържа чрез различни средства:

А. Отношение. Организационните цели се постигат чрез обединени, съгласувани усилия на членовете на организацията. Най-важното е създаването на атмосфера на доверие, отвореност и отношения на взаимна подкрепа. Всеки негативизъм не само че разваля екипността, но пречи и на нагласата на хората за споделяне („Имам идея, но щом не ме приемат, няма да я споделям!“). Всеки има нужда да усеща отношението на другите – като разбиране, одобрение, подкрепа. Това засилва мотивацията и прави екипа по-силен и по-сплотен. А това е важно за развитието на организацията. В това се състои и ролята на тимбилдинга – всички да действат заедно в една посока, за да се постигне висока степен на координираност на индивидуалните и групови действия, така че съвкупният ефект да бъде най-голям.

В. Организационна култура. Всички организационни проблеми – структура, производителност, ефикасност, мениджмънт, конкурентоспособност и пр. – са зависими от културата на организацията, т.е. от идеите и ценностите, които споделят техните членове. Организационната култура е лепилото, което „държи“ членовете на организацията заедно чрез споделени ценности, символи и социални идеали. Тя е модел от общи нагласи, убеждения и ценности, изповядвани от организацията (като честност, лоялност, откритост, доверие, професионализъм, екипен дух). Понякога те са отразени в основополагащ текст, изпълняващ ролята на „кодекс“ на организацията. Формирането на организационна култура съдейства за духовното обединяване на персонала.

С. Основна цел на организацията. Мисията е необходима както на голямата, така и на малката организация, тъй като служи за формулиране на техните цели и стратегии. Стратегическите цели посочват основните позиции, към които ще се стреми дадената компания при реализирането на нейната мисия. Тези цели се отличават с такива качества, като важност, йерархичност, сложност и др., но е много важно довеждането им до всички членове на организацията, независимо от мястото им в йерархията. Индивидуалните цели на всеки да се впишат в общата цел на организацията, като самата тя подкрепя и окуражава всеки в постигането на личната му цел. Това вдъхновява хората, мотивира поведението им и ги насочва към сътрудничество. При формулирането на всеобща значима цел се търси и подкрепата на обществото при реализирането ѝ. Колкото по-глобална е основната цел, толкова по-мощен е успехът на организацията.

Д. Визия и мисия на организацията. Визията е описание на образа на бъдещето; тя е едно съкровено желание, но и твърдо, неподлежащо на съмнение решение по отношение на бъдещото положение на организацията. Визията очертава периметъра

на идеята, за чиято реализация е решено да се работи. Тя е обява за прииждащото ново, изказана в сегашно време. Мисията е ролята, която организацията заема в реализацията на визията си. Тя е отражение и следствие на визията и говори в сегашно време и първо лице – аз или ние (правим...). Изказана е не толкова като желание, колкото като факт, произтичащ от взето вече решение. Когато една организация заявява визията и мисията си (или визията и мисията на един проект/ документ/ инициатива), трябва да се придържа към определени стандарти. Защо? Защото от тях произлизат важни неща като например непосредствените цели, и първите стъпки, които трябва да се предприемат. С други думи, разликата между образът на бъдещето, визията, и настоящото положение кара да си проличават очертанията на пътя, който трябва да се измине. Ако заявлението, декларацията на визията и мисията не са достатъчно ясни, най-вероятно организацията не е наясно със смисъла на съществуването си или, в най-добрия случай, няма постоянна пътеводна светлина. А това води до сериозни рискове за успеха на начинанието. Освен това всяка организация или проект въвлеча в делата си повече хора. Съобщаването на визията и мисията са фундаментални, за да могат те (хората) да работят по преследването на същата тази цел (визията) доколкото е по силите им (мисията). Ако тези неща не са заявени ясно, хората, дори и да са добронамерени, не могат да се сговорят, за да свършат нещо хубаво заедно. А съвместната работа в повечето случаи е единствената, която може да произведе желанния резултат. Една организация със споделена обща визия е нещо изключително силно. Когато визията и мисията на организацията са ясно формулирани, всеки може да види своето място, своята роля в нея и да поеме своята отговорност.

Е. Мотивиращ символ. Принадлежността към дадена организация е ценност, въпреки стремежа към индивидуализъм. Много организации имат някакъв символ, някакъв отличителен знак (значка, пръстен, фигурки). Организационните символи трябва да бъдат ясно разпознаваеми. Освен, че са мотивиращи, те действат приобщаващо към каузата на организацията.

Ф. Периодично издание (вестник, бюлетин), предназначено за персонала. Още в средата на миналия век започва да се говори за вътрешнофирмени комуникации. Вътрешнофирмени бюлетини и вестници се появяват в края на 70-те и началото на 80-те години. Въвеждат се т.нар. срещи-брифинги, на които мениджърите предават важни съобщения и информират за промените всички служители. Главната цел на тези периодични издания е да поддържат мотивацията на служителите, като в тях се изтъкват успехите и достиженията на фирмата, дава се информация за актуални събития, насоки и перспективи. Може да се използват и за споделяне на знания и опит. Понякога не могат да бъдат приложени популярните методи за мотивация като повишение на заплатите или привличане към интересен проект. Но премиите не са единственото оръжие в арсенала на мениджърите. Мотивацията на сътрудника се определя от неговата представа за мястото му в организацията. Ако началникът не познава неговите интереси, той едва ли ще може да приложи правилна система за мотивация. От изключително значение е мениджърът да установи отношения на откровено и свободно общуване със сътрудниците, които след това да бъдат използвани в интерес на работата. Неформални и неофициални събирания на колектива могат да се окажат изненадващо полезни. Ръководителите на отдели биха могли периодично да разпращат на подчинените си и информация за новостите в политиката на компанията. За това не са необходими почти никакви усилия, а ефектът си струва – когато сътрудниците са осведомени, те са по-уверени и се чувстват съпричастни към общите цели. Също така е полезно служителите да бъдат привлечени към обсъждането на мерки за повишаване на ефективността в компанията и други подобни теми. Най-обикновеният начин за разкриване на професионалните цели и интереси на даден служител е в директен разговор. За мениджъра е

необходимо да се опита да разбере дали служителят се чувства добре на дадената длъжност, дали не счита, че друга работа е по-интересна и каква позиция в йерархията би искал да заеме след време. Тоест мениджърът трябва да открие движещите сили зад постъпките на хората от неговия екип. Тези, които мислят, че всички се стремят единствено към издигане в служебната йерархия грешат. За някои на първо място е семейството, а работата е на втори план, но за тях още по-лесно могат да се намерят сериозни стимули, които да ги мотивират при изпълнението на служебните задачи.

Познавайки отблизо сътрудниците си мениджърът може да им постави задачи, отговарящи на личните и професионалните им стремежи. На тези, които държат да прекарват свободното си време със семейството може да се възложи съставянето на графика със задачите, а подготовката на план, предназначен да осигури стабилен ръст на компанията, е задача за изпълнените с професионални амбиции.

Основен стимул за онези, които се стремят към успешна кариера е възможността да натрупат допълнителни знания и умения. Според експерти от агенции за подбор на персонал, компаниите трябва да съдействат на своите специалисти в усвояването на интердисциплинарни знания и да финансират тяхното обучение. Когато икономиката е в криза, бюджетът за квалификация силно се намалява. В някои случаи това е приемливо, но в сферата на високите технологии такива стъпки сериозно ограничават възможностите на сътрудниците и на практика слагат кръст на тяхната кариера. Затова, дори и средствата да са ограничени, обучение трябва да се осигури.

Адаптацията на личността към обкръжаващата я външна среда, Н. Колева определя „чрез изграждането на съответстващата ѝ вътрешната психична структура, която показва направляващото въздействие върху цялостното поведение. Психическата адаптация можем да определим като процес на установяване на оптимално съответствие между личността и обкръжаващата среда в хода на осъществяване на свойствените за човека дейности, които му позволяват да удовлетвори актуални потребности и да реализира, свързаните с тях цели, обезпечавайки в това време съответствие между дейността на индивида, неговото поведение и изискванията на средата“.[7]

Когато заслугите на сътрудниците са отчетени, моралният климат съществено се подобрява, а това не струва нито стотинка на компанията. Изразената признателност към служителите в присъствието на колеги и мениджъри печели доброто отношение на подчинените и ги мотивира допълнително за качествено изпълнение на техните задачи.

5 метода за мотивация

1. Мениджърът трябва да поговори със подчинените си за да разбере какво може да се направи за съчетаването на професионалните и личните им интереси;
2. Необходимо е мениджърът да отбелязва заслугите им в присъствието на колегите;
3. Препоръчително е да обсъжда с тях последните тенденции в развитието на технологиите;
4. Редовно да се среща със сътрудниците от различните отдели, като изслушва гледните им точки и систематизира за себе си изводите от различните мнения;
5. Да осигури на персонала достъп до корпоративните отчети, които не съдържат поверителни данни.

В заключение: мотивацията води до изграждане на способности и придобиване на познание. Затова мотивираните хора са тези, които постигат нещо, те са причината нещата да се случват и те се нуждаят от цялото внимание и инвестиция.

За мотивацията може да бъде направено много с минимални или без никакви разходи, което е особено важно при ограничените бюджети. Ключът е в общуването. Ако се

налагат реорганизации, техният смисъл трябва да бъде обяснен. Иначе служителите се чувстват „извън играта“ и не реализират максимално своя потенциал. Истината е, че мотивацията за всеки е различна. Не си струва да се търси универсално решение. Колкото повече са методите за стимулиране, толкова по-добре.

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MOBILE APPLICATIONS FOR EDUCATION – AN INTERACTIVE WAY FOR TEACHING AND LEARNING

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Abstract: Learning and teaching nowadays could be done at a different stage of our lives. Mobile technologies and applications support and facilitate the learning process because they provide easy and fast access to learning resources at any time and place. These applications can be successfully combined and used as a tool for formal and non-formal learning, offering interactive features that activate learners and create a new and familiar learning environment. This article aims to provide examples of educational mobile applications, their main features, as well as ways to be effectively used in the educational process.

Keywords: mobile learning, mobile technologies, applications, education, active learning.

ОБРАЗОВАТЕЛНИ МОБИЛНИ ПРИЛОЖЕНИЯ- ИНТЕРАКТИВЕН НАЧИН ЗА ПРЕПОДАВАНЕ И УЧЕНЕ

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1. ВЪВЕДЕНИЕ

В съвременния свят информационните и комуникационни технологии са неделима част от нашето ежедневие и това поражда необходимостта от трансформация на нас самите като потребители. Новото дигитално поколение, наречено **digital natives**, е свикнало с използването на технологиите и изисква и търси приложимостта им навсякъде, особено в обучението. Тази причина е една от основните за промяна в начина на преподаване и учене, което да е съобразено с потребностите на обучаемите и включването на съвременните технологии в обучителния процес.

Все повече учебни институции използват предимствата на таблети и смарт телефони за обучение, като така осигуряват лесен и бърз достъп до електронни учебни материали по всяко време и място. Мобилното обучение или известно още като **M-learning** е обучение, при което учебните ресурси са достъпни чрез използването на мобилни устройства като таблети, смарт телефони или други преносими устройства (PDAs). То е приложимо, благодарение на бързото развитие на мобилните технологии и добрата интернет инфраструктура, осигуряваща повсеместно интернет покритие и достъп на все по-ниски цени.

За ефективното му приложение е необходимо съчетаването на технологиите с методите на обучение и стиловете на учене, а не просто защото е модерно. Включването на мобилните технологии в обучението трябва да бъде съобразено с целите и задачите, които трябва да се изпълнят в процеса на обучение, възрастта и дигиталните компетенции на обучаемите, спецификата на дисциплината.

Целта на настоящата работа е да се разкрият основните характеристики на мобилното обучение, неговите предимства и недостатъци, както и да се представят примери за образователни мобилни приложения, които могат да бъдат успешно интегрирани в обучение по различни дисциплини.

1.1. Мобилното обучение и стиловете за учене

Мобилното обучение, като вид електронно обучение, може да бъде синхронно и асинхронно. При синхронното има едновременна комуникация и интеракция с останалите участници в учебния процес. За тази цел могат да се използват форуми и дискуссионни групи, където преподавателят задава въпроси, като по този начин е възможно да се включат по-голям брой обучаеми. Мобилните приложения на системите за управление на обучението (LMS) интегрират в себе си множество инструменти за активно участие на обучаемите.

При асинхронното учене няма интерактивност между преподавателя и обучаемия. Обикновено е свързано с предоставяне на учебни ресурси за подготовка, изпълняване на задания и тестове за проверка на знанията.

За да се постигне по-добра ефективност е необходимо форматът на предоставяните учебни ресурси да бъде съобразен с различните стилове на учене. Обикновено, всеки един от нас има предпочитания към определен стил на учене, но често се комбинират с други, за по-добро усвояване на учебния материал. Известни са 4 основни стила на учене според [1], т.нар. модел VARK – Visual, Auditory, Read/Write, Kinesthetic. Съвременното поколение обучаеми предпочитат уроците във видео формат, които да обясняват различни явления, процеси, задачи и термини от различни сфери на живота и преподавани дисциплини. Мобилните устройства са компактни и притежават мощта на компютър, с добра камера и дисплей, на който могат да се възпроизведат видео ресурсите. Камерата позволява на обучаемите също да записват и създават свои видеа по зададена тема и проект, което ги прави активни участници в учебния процес. Друга класификация [2] определя 7 стила на учене – visual, aural, verbal, physical, logical, social, solitary и както се вижда някои от тях се припокриват със стиловете в модела VARK. Всеки един от тези стилове може да бъде използван и интегриран в мобилното обучение чрез различни мобилни приложения, които позволяват участие от страна на обучаемия, решение на задачи и обратна връзка за нивото на усвояния материал.

Установено е, че когато ученето е съобразено с индивидуалните стилове на учене, има много по-голям ефект върху дълготрайното запамятаване на учебния материал и неговото възпроизвеждане. В Таблица 1 са представени възможни начини за приложение на образователни ресурси и стратегии в мобилното обучение, които да подпомагат и да съответстват на седемте стила на учене.

Таблица 1. Силове на учене и начини на приложение при мобилно обучение

Силове на учене	Начин на учене и възприятие	Приложение в мобилното обучение
Визуално	Използване на снимки и картинки	Предоставяне на снимки, видеа и 3D анимации, Виртуална реалност (VR), Добавена реалност (AR)
Слухово	Учение чрез използване на звук и музика	Предоставяне на видео и аудио лекции, аудио записи, приложения за видео-конферентна комуникация

Стилове на учене	Начин на учене и възприятие	Приложение в мобилното обучение
Вербално	Учене чрез използване на думи – писмено и говоримо	Приложения за комуникация, задания за писане на текстове, публикуване на коментари във форуми и чат групи
Физическо	Учене чрез използване на тялото, ръцете и сензори за допир	Приложения, които позволяват създаването на различно по тип дигитално съдържание – снимки, рисунки, програмиране, разработка на софтуерни приложения. По своята същност това не е типично „физическо“ създаване на нещо, което може да се докосне и усети реално, но е начин за учене чрез правене с използване на мобилно устройство
Логическо	Учене чрез използване на логическо мислене, схеми, причини и следствия	Приложения, които насърчават логическото мислене като пъзели, свързване на обекти и концепции, диаграми и схеми
Социално	Учене в група	Приложения за комуникация, социални мрежи, споделяне и съвместна работа
Индивидуално	Самостоятелно учене	Четене на учебни материали, изпълняване на тестове, писмени задания

За постигане на по-голяма ефективност и по-високо ниво на знанието е желателно комбиниране на различни по формат учебни ресурси, които да покриват различни стилове на учене, създавайки персонален път на обучение на всеки един обучаем. Ролята на преподавателя е да съчетае мобилните технологии с подходящи методи на обучение като обръната класна стая, обучение в екип, учене чрез правене, включване на елементи на игровизация и други.

1.2. Предимства и недостатъци на мобилното обучение

Преди да се предприемат действия за включване на мобилното обучение в образователния процес, е необходимо да се анализират положителните и отрицателните му страни, които са представени от [3], [4], [5].

Предимства

- **Учене по всяко време и място.**

Дори да няма постоянна интернет връзка е възможно да се изтеглят учебни ресурси на самия телефон или мобилно устройство. Разстоянията и местоположението на

обучаемия и преподавателя не са проблем. При пътуване на по-дълги разстояние (с влак, метро или кола) е възможно да се оползотвори това време за достъп до учебни материали и самообучение.

- **Повишаване на мотивацията**

Използването на мобилни устройства от малките ученици може да създаде у тях траен интерес към преподавания урок и предмет, защото те са свикнали с използването на технологиите и е един начин да се покаже, че предназначението им не е само за забавление. При обучението на персонала също може да се използват предимствата на мобилното обучение, което осигурява достъп до ресурси за обучение извън работно време и в един компактен формат.

- **Различен формат на учебните ресурси**

Мобилните устройства притежават възможности за визуализиране на различни по тип учебни материали – текст, видео, аудио, които да подпомагат обучаемите с различни стилове на учене. Освен това, почти всички уеб сайтове притежават и мобилна версия, което позволява по-доброто им показване на дисплеите на мобилните телефони.

- **Персонален път на обучение**

Преподаването и обучението може да бъде гъвкаво и съобразено с индивидуалните способности и потребности на обучаемия, с удобно за него време и място.

Все повече училища и университети приемат модела BYOD (Bring Your Own Device) чрез внедряване на мобилните устройства и смартфони в класната стая. Това дава възможност технологиите да се използват по всеки един предмет и се избягва ограничаването с наличие на достатъчно компютърни зали.

Недостатъци

- **Ограничения и проблеми, свързани с устройството**

Тези ограничения са свързани с липса на заряд в батерията, повреда на устройството или недостатъчно добри параметри необходими за съответното мобилно приложение, малко място за инсталиране и др.

- **Интернет връзка**

Това е необходимо условие, за да има достъп до учебните ресурси по всяко време и място и особено, ако се налага онлайн комуникация или съвместна работа по общ проект с колеги или с преподавателя. Възможно е материалите да бъдат изтеглени на самия телефон или устройство, но това също зависи и от мястото за съхранение и капацитета на паметта.

- **Разсейване и работа в многозадачен режим**

Разсейването е един от основните проблеми при използване на мобилни устройства и телефони, особено от децата и малките ученици. Обучаемите могат лесно да изгубят концентрация и да играят игри или да пишат съобщения, а не да изпълняват задачите дадени от преподавателя. Доказано е, че работата в многозадачен режим не е добра за трайно запаметяване и възпроизвеждане на знания. Това налага по-добра дисциплина от страна на самите обучаемите и контрол от страна на преподавателя. В случаите, когато мобилните устройства се използват в класната стая, ролята на преподавателя е така да подбере активностите и задачите за обучаемите, че те да бъдат максимално ангажирани и увлечени от заниманията си, за да се избегне разсейването.

- **Здравословни проблеми**

Използване на мобилни устройства и компютри трябва да бъде съобразено и със здравословния начин на работа, за да се намали вредното облъчване и риска от увреждане на зрението на обучаемите. Това налага създадените учебни ресурси да бъдат в подходяща форма, шрифт и дизайн, за да не напрягат зрението.

2. ПРИМЕРИ ЗА ОБРАЗОВАТЕЛНИ МОБИЛНИ ПРИЛОЖЕНИЯ

Съвременните мобилни технологии позволяват изпълнение на много и различни задачи, благодарение на създадените за целта мобилни приложения.

На пазара на двете основни мобилни операционни системи iOS и Android съществуват множество мобилни приложения, в различни категории, които са достъпни за изтегляне от съответните магазини за приложения.

Според [6] броят на наличните мобилни приложения в маркетите нарастват с всяка година, като за третото тримесечие на 2019 водещ в това отношение е Google Play с 2 470 000, следван от Apple App Store с 1 800 000, Windows Store – 669 000 и Amazon App Store – 487 000.

Това е предпоставка за широкия спектър на мобилни приложения, които следват различен бизнес модел и ценова политика и са насочени към различни категории потребители. Проучването на основните им функционалности и тестването им е важна част от подготовката на преподавателя преди да избере най-подходящото приложение, което да съчетае в учебния процес и чрез което да мотивира и активизира обучаемите.

На сайта [7] са представени образователни мобилни приложения, подредени в пет основни категории - **Curriculum products** – 641, **Teacher needs** – 484, **Educational operations** – 463, **Post-secondary** – 325, **Everything else** – 564, като всяка от тях има по няколко подкатегории.

В категорията **Curriculum products** са подбрани приложения, подходящи за изучавани дисциплини в училище - Engineering, Languages, Math, Science, Social studies. Тази категория съдържа най-много приложения, защото покрива голям аспект от изучаваните предмети за различни възрастови групи.

Някои от образователните приложения, които могат да бъдат използвани за различни предмети в училище са:

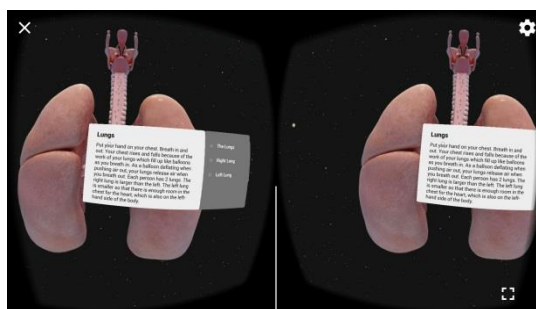
Khan Academy е една от популярните платформи, съдържаща множество видео уроци и практически задачи за изпълнение с различна степен на трудност. Могат да бъдат успешно приложени за модела обърната класна стая и смесено обучение. Подходящи са за използване както от преподавателите, така и от обучаемите.

Aula.bg е мобилно приложение на български език, което предлага видео уроци, трикове и компютърни курсове за различни софтуерни продукти като Excel, Photoshop и други. Има възможност за 20 безплатни урока.

YouTube е приложение, което съдържа не само музикални и развлекателни канали, но и видео ресурси с уроци на различна тематика. Вграждането на видео материали в други приложения, и по-специално в системи за електронно обучение, е улеснение за преподавателите и не натоварва платформите с големи по обем видео файлове. Приложението има и социална функция чрез възможност за споделяне, коментари и обратна връзка.

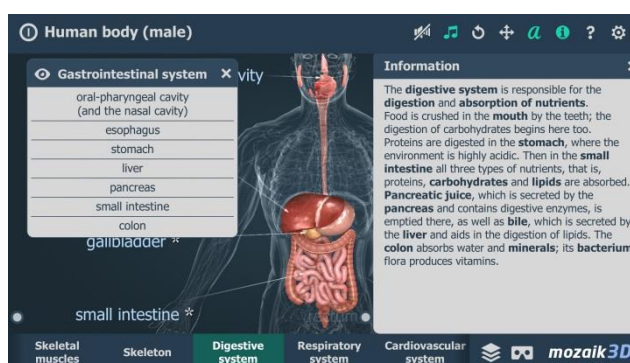
При изучаване на сложни и абстрактни явления е добре да се използват мобилни приложения, които са базирани на VR или AR, като по този начин обучаемите могат да наблюдават, правят опити и химични реакции, да се потопят в един свят, където имат възможност да участват активно, в безопасна среда и без да се притесняват от грешки.

Google Expeditions представят по интересен начин, чрез AR и VR, обиколки на различни места и обекти, пресъздават исторически събития и артефакти. За целта е необходимо да се изтегли съответната обиколка, като за преглед са необходими очила за VR.



Фигура 1. Google Expeditions - Human Anatomy – Respiratory System (VR View)

Human body 3D. Това приложение показва различните системи в човешкото тяло, като има възможност да се избере режима на преглеждане – 3D или VR. Дава се допълнителна информация за отделни органи и системи.



Фигура 2. Human body 3D mobile application – Digestive system

Категорията Teacher needs

Някои от подкатегиите са: Assessment, Classroom efficiency, Lesson planning, Presentation Tools, Special Education, Classroom management и други.

В подкатегиата Assessment tools са предложени предимно мобилни приложения за създаване на тестове с различни по тип въпроси.

Мобилните приложения за обучаеми със специални образователни потребности покриват говорни и зрителни проблеми, образователни ресурси за хора с аутизъм и други.

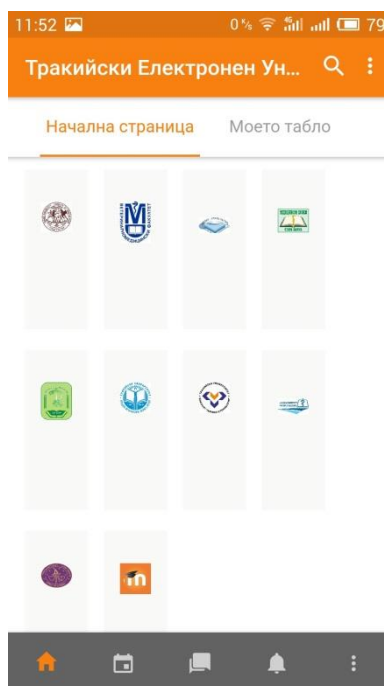
Категорията Educational Operations

Тази категория е разделена на подкатегиите Communications Tools, LMS, Network and hardware, Student Information Systems, Data systems и др.

LMS са основният инструмент, който вгражда в себе си възможности за създаване на учебни ресурси, активно участие на обучаемите и проследяване на техния прогрес и обратна връзка. Много от платформите, които се използват, предлагат и мобилни приложения, които да са удобни за визуализация на дисплеите на смарт телефони и таблети, като **Moodle**, **Docebo**, **Canvas**, **Google Classroom**, **30 Hands Cloud**, **Buzz**, **EasyLMS**, **Cloud 9 Learning** и други.

Тракийски университет използва платформата **Moodle**, където са създадени множество електронни курсове по различни дисциплини. За по-добър достъп и преглед на учебните ресурси е необходимо да се изтегли мобилното приложение **Moodle mobile**, да се зададе URL адресът на сайта и така приложението ще е конфигурирано да зарежда този сайт. Използвайки това приложение всеки студент и преподавател ще

имат достъп до своите курсове по всяко време и място при наличието на мобилно устройство и интернет връзка.



Фигура 3. Изглед на началната страница на Тракийски електронен университет чрез Moodle mobile

3. ЗАКЛЮЧЕНИЕ

Представените примери за образователни мобилни приложения са само една малка част от всички, които могат да бъдат изтеглени от магазините и основните доставчици като Google Play, App Store, Windows Store и др.

Преди да се вземе решение кое е най-подходящото приложение е необходимо да се определи:

- целевата група, която ще го използва – ученици, студенти, преподаватели, служители и др.;
- учебната дисциплина или тематиката на обучението;
- нивото на дигитални компетенции на обучаемите и преподавателите;
- образователните цели, които трябва да се постигнат;
- с какъв модел на обучение ще бъде съчетано мобилното обучение за постигане на по-добра ефективност.

Основна е ролята на преподавателя, който трябва да подбере правилните мобилни приложения, които да ангажират обучаемите и да създаде траен интерес у тях. Това би ги мотивирало те също да потърсят и използват други подобни образователни приложения, а също така и да участват в създаването на нови и подобриенето на съществуващи, като им добавят нови функционалности или усъвършенстват интерфейса им.

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GRID PARITY OF PV – AN ACCESSIBLE OPPORTUNITY TO ACHIEVE BULGARIA'S RENEWABLE TARGETS BY 2030

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Abstract: On the go is the development and adaptation of an individual target for Bulgaria, in order to increase the share of RES energy, according to the EU common vision for leadership in the implementation of renewables to 32% in the gross final consumption by 2030. The technological progress, the easy applicability and feasibility of the projects, as well as the geographic and climatic specifics of Bulgaria, makes photovoltaic Bulgaria's main candidate for leading technology in this process. With net specific production of 1323kWh/annual per installed kWp, price levels of PV technology of €1360kWp and Levelized cost of energy (LCOE) below €0.12kWh for 20 years time frame, households in Bulgaria are at a stage where photovoltaic projects should be developed as an alternative to the grid supply.

Keywords: grid parity, photovoltaic, solar systems, own consumption

1. INTRODUCTION

"I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that" Tomas Edison, 1931.

We are still not out of fossil fuels, but maybe we are at the grid parity stage for the households in Bulgaria – a point where the grid energy mix prices, together with the access, transmission and distribution costs and all fees and taxes – the end price of the energy - is at parity with the Levelized cost of electricity (LCOE) produced by a domestic photovoltaic power plant (PV). We may start using solar energy for our homes, not because we run out of fuels, but because we are at the point, where the PVs are economically feasible and mandatory for the households, in order to achieve better life standard by reducing their electricity expenses.

We witnessed rapid investments in Bulgaria in the period 2010-2015, mainly in grid-scale photovoltaics, as the technology was still expensive for the households. Grid-scale projects were realized, with production feeding to the middle and high voltage network, which still have to be moved and transformed through the transmission and the distribution grid. Incentives like feed-in tariffs (FiT) play a vital role in bringing grid parity. Study of various PV markets revealed that the market giving FiT to solar systems for a specific period achieved the grid parity earlier along with record additions in PV installations. In our study, however, we will focus on 100% self-consumption of the PV production and not using any feed-in tariffs.

Bulgaria achieved its national target of 18.7% by 2020y, but at the most expensive cost, which resulted in heavy society negatives against the PV technology and regulatory changes, focusing on small PV installations for domestic consumption (up to 30kWp). Europe is at the beginning of the new 10 years period 2020 – 2030, with new targets for renewable energy in the gross energy consumption for the member states [2]. The households could be the engine for reaching the new 2030 targets for our country, without the need of any

national subsidies in the form of feed-in tariffs or premium, and by actually providing cheaper electricity price for our homes.

2. METHODS

The Simple method for calculating the LCOE [7] includes evaluation of main components and costs, such as technology (solar modules, mounting structures, inverters, wiring), operation and maintenance and capital costs (interest rate, capital recovery factor, internal rate of return). These calculations are mandatory to be made by any investor or developer when designing large grid-scale project, who often could source the technology directly from the producers. Using the LCOE equation, we will try to give an answer to the obvious question – at what investment cost the domestic PV plant production is at parity with the grid energy prices?

In order to give the answer to the above question, we will start from “up-to-bottom”, by evaluating the regulated energy price for households for 20y timeframe, PV technology production (yield) in Bulgaria and usable life of the PV systems. Finally, we will calculate the maximum total cost of the PV investment to be in grid parity and comparing it to the actual market offerings for “ready-to-use” 5kWp household’s PV systems.

3. CALCULATIONS

3.1 Calculating energy yield based on net specific production

Energy production for the lifetime of the PV installation is a key component in order to evaluate the investment feasibility. In order to make as accurate as possible calculation, we use factors such as installed capacity, module degradation, the efficiency of the modules and solar radiation per sq.2. We also use the producer’s stated degradation factor - 0.2% annually for the widest spread PV modules in Bulgaria - Crystalline silicon (c-Si) modules, together with the net specific production for 1 kWp for our country.

The net specific production of every kWp installed capacity is the net output (in kWh) of the system at the metering or consumption point per calendar year. All the losses in the system’s components (wiring, inverter, etc.) are included in the calculation of the net specific production, together with the degradation factor for the lifetime of the PV power plant. The annual net specific production combines all the information needed for the small investor regarding the output of the PV system for its lifetime. The net specific production is also calculated by the Energy and water regulatory commission (EWRC), based on researches from Bulgarian academic of science in order to calculate feed-in tariffs and premiums for the PV producers. Yearly reports can be found on SEWRC web site.

In order to make our own estimation of the net specific production, based on all installed PV capacities in Bulgaria, we used the publicly available database of the Sustainable Energy Development Agency (SEDA)[5]. As all RES producers are obliged to issue Guarantees for Origin for their production, SEDA register is the most full available database for renewable generation in Bulgaria. The database includes the PV plants’ capacities, productions, year of constructions. We calculated the actual reached net specific production, presented in the summarized table below:

Table 1. Average net specific production

Total capacity of installed PVs, MW	Avg. age of the installed MW, years	Avg. net specific production, kWh
1030	7.6	1323

Our calculations confirm the SERC defined net specific production.

3.2 Defining energy prices for household's during the lifetime of the PV

Energy prices for the households in Bulgaria consist of energy component, grid component, and tax. At the moment, the energy and grid components are regulated by the EWRC. The regulated energy price in Bulgaria is a mix of costs for produced energy by the producers with quotas for the regulated market, and the "obligation to the society fee", which includes all the costs for energy produced by Renewables and High-efficient production at feed-in tariffs and premiums. Discussion regarding liberalization of the households and the price effects are ongoing, but there is no official national strategy for realization. The liberalization of the households was also pointed by the World Bank[8] as needed reform in order to create a fully working electricity market. Even as there are some publicly available forecasts for market energy development in Europe and Bulgaria for the period up to 2050, it is not possible to determine at what point the households will be fully liberalized, so the accurate evaluation of the price effect is difficult to be made. For the needs of our study, we will use linear 1.4% annual price increase for the 20y period, with using EWRC's Decision C-19/1.07.2019[4] electricity price for daily consumption as referent base price.

The grid cost is also a regulated price, as it is a natural monopoly. The grid cost includes transmission, distribution and access price for the households. The European targets for 2030 require the further implementation of renewables in the member states grid system[3], which will require additional investments in transmission capacity as well as in the distribution system. Smart metering and real-time metering are important prerequisites in order to implement decentralized RES production effectively. Electrical cars are the next demanding grid capacity technology that is currently happening. All that technology progress will need investments in the grids, significantly increasing the prices for grid usage, with an even more rapid increase than the electricity prices. For our study, we will use linear 2.0% annual price increase for the first 10y period and linear 1.8% increase for the remaining 10y period[6].

The table below represents the calculated values and costs, if the households procure their electricity needs from the grid, assuming all the production from the PV installation will be own consumed.

Table 2. Energy production and cost calculation

	Grid price (cumulative)	Electricity price	PV production	Grid cost incl. VAT	Electricity cost incl. VAT	Total cost incl. VAT
year	€/kWh	€/kWh	kWh	€	€	€
2020	0.02658	0.05916	6725	178.76	397.86	691.95
2021	0.02695	0.06034	6712	180.90	405.01	703.09
2022	0.02733	0.06155	6698	183.07	412.28	714.42
2023	0.02771	0.06278	6685	185.26	419.69	725.94
2024	0.02810	0.06404	6671	187.48	427.22	737.64
2025	0.02850	0.06532	6658	189.72	434.90	749.54
2026	0.02889	0.06663	6645	192.00	442.71	761.64
2027	0.02930	0.06796	6631	194.29	450.66	773.94
2028	0.02971	0.06932	6618	196.62	458.75	786.45
2029	0.03013	0.07070	6605	198.97	466.99	799.16
2030	0.03055	0.07198	6592	201.36	474.45	810.96
2031	0.03097	0.07327	6579	203.77	482.02	822.94
2032	0.03141	0.07459	6565	206.21	489.72	835.11
2033	0.03185	0.07593	6552	208.68	497.53	847.45
2034	0.03229	0.07730	6539	211.17	505.48	859.98
2035	0.03275	0.07869	6526	213.70	513.54	872.70
2036	0.03320	0.08011	6513	216.26	521.74	885.60
2037	0.03367	0.08155	6500	218.85	530.07	898.71
2038	0.03414	0.08302	6487	221.47	538.53	912.00
2039	0.03462	0.08451	6474	224.12	547.13	925.50
		Total:	131 974.91			16 114.74
		Avg. cost of grid electricity, incl. VAT:				0.12210

3.3 Calculating maximum cost for PV investment for grid parity

In small installations, grid parity will be reached depending on the financial model and the cost of the installation. In order to calculate the maximum investment cost – beyond which the household PV investment becomes more expensive than the consumption from the grid, we will use the LCOE as a benchmark and method for calculating the cost of energy under a certain assumption. LCOE could be used also to determine the maximum investment cost of a PV system, in order to be in parity with the existing source – the grid feeding. We include an interest rate for the whole initial investment cost, assuming the initial investment is covered by 100% by a bank loan.

PV operation and maintenance costs for domestic systems are usually very low, up to 5% of the initial investment cost for the whole life if the system. Modules warranties are usually at least 15y for materials and workmanship and 25y for productivity. Invertors' guarantees are usually 5 to 7y, with the possibility for an extended warranty up to 20y, which is included in the initial investment cost. Therefore, we will use 5% of initial investment as OM cost for 20y lifespan of the PV plant.

$$LCOE = \frac{I + OM}{E}$$

(1)

Where,

I is the investment costs;

OM are the operational and maintenance costs;

E is total energy production for the lifespan of the PV installation.

In order to calculate the actual capital investment, without the cost of the capital, we will use the publicly available statistics of the Bulgarian National Bank[1], the average interest rate for consumer's loans in euros for longer than 5y period is 5.30%. Yearly percentage costs are defined to 5.65% per year.

Total investment costs, including the capital cost (interest) will be the avoided costs of grid electricity supply (Table 1) of €16 114.74 for 20y period. The cost of the capital is €8 549 (interest) and the technology cost (investment costs) is €7 187, with O&M costs of €378 for 20y period.

Grid parity investment cost is calculated at €7 187. If the total investment expenditures are lower than that, the households are actually making savings vs the grid supply. If the investment costs are higher, the households are paying more than the grid supply.

3.4 Comparing market prices for “ready-to-use” 5kWp domestic PV systems and grid parity investment cost

PV business in Bulgaria is well developed, with a wide range of offerings and competition between the engineering and development companies. We collected offers from 5 of the biggest PV distributors and developers in Bulgaria, in order to make an average example offer for a domestic 5kWp system.

Table 3. Cost of 5kWp PV system - offers

	Technology cost (VAT incl.)	Design and execution €	Total cost €
Supplier 1	3 970	2 100	6 070
Supplier 2	3 450	2 400	5 850
Supplier 3	4 550	2 400	6 950
Supplier 4	4 700	2 800	7 500
Supplier 5	4 700	2 900	7 600
Avg. costs	4 274	2 520	6 794

All of the offers were requested for rooftop installment, with extender warranty for the inverter up to 20y. Price differences are mainly due to the different brands of inverters.

The average cost of “ready-to-use” PV system is calculated at €6 794 (Table 3.), which is 5.5% below the grid parity investment cost of €7 187, meaning that the Bulgarian households have the economic motivation to invest in PV systems for own consumption and we are at the point of grid parity of PVs.

4. CONCLUSION

As the grid requirements become more demanding, the cost of the grid becomes higher. Conventional power sources' prices will continue to climb, due to the CO2 prices and the new environmental requirements. Cumulative grid electricity prices have exponentially

growing function while the PV cost trend is exponentially decaying. The intersection of both these trends brings the grid parity, which we have reached for the households in Bulgaria. The PV's technology progress, the easy applicability and feasibility of the projects, as well as the geographic and climatic specifics of Bulgaria, makes photovoltaic Bulgaria's main candidate for leading technology for actual energy savings and reaching EU 2030 targets. Photovoltaics for domestic own consumption is at the intersection point where households could actually make savings by utilizing their rooftops and free plots.

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ALGORITHM FOR MANAGEMENT AND PROTECTION OF SUBMERSIBLE PUMP

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Abstract: Global warming has led to lower levels of the water basins. Groundwater levels also decrease. Sometimes they fall so much so that submersible pumps in the wells remain almost dry and even in short work cycles get damaged. Their repairs are very expensive and labour intensive. An algorithm for management and protection of submersible pump is proposed in the paper. It uses 5 level sensors. It allows full utilization of the wells capacity and protects the pump motors from premature wear due to frequent switching on and off.

Keywords: submersible pump, system for management, level measurement, monitoring the water column level

1. INTRODUCTION

In their daily live, people use different types of pumps in many areas - in agriculture for pumping well water, in the energy industry for pumping oil and natural gas, in the water supply for moving water to high objects, in the automotive industry for water cooling and fuel injection etc.

One of the most common applications of pumps is for irrigation of plantations. Different types of pumps can be used for this activity. Electric submersible pumps are widely used. They are centrifugal pumps operating in a vertical position. They have a hermetically sealed motor connected to the housing. They only work if the whole mechanism is completely submerged in the liquid to be pumped. The submersible pump raises the water to ground level by converting the impeller's rotational energy into kinetic energy of the water. The main advantages of this type of pumps are its high efficiency and that it avoids the big difference in elevation between the pump and the surface of the fluid and the problems arising from this.

In recent years, due to global warming, water basin levels have decreased significantly. Groundwater levels also decrease. Sometimes they fall so that the submersible pumps in the wells remain dry and even in short work cycles get damaged. Their repairs are very expensive and labor intensive.

Different automatic devices are available on the market designed to control the pumps and protect them from various inadmissible operating modes - dry running, overloading, overvoltage, short circuit, etc. They are intended for specific operating conditions of the pumps. They are often designed for a particular brand of pumps and are not suitable for others.

The aim of the paper is to develop and present an algorithm that allows submersible pump control at different water column levels in the well using 5 level sensors. Based on this

algorithm, the design and creation of an automated system for submersible pump control and protection is forthcoming. It is envisaged that the system will constantly monitoring the water level and provide real-time information to the users.

2. METHODS FOR MANAGEMENT AND PROTECTION OF SUBMERSIBLE PUMP

Commercially available submersible pumps protection and control devices are designed in different principles. They are:

- Mechanical
- Electromechanical
- Electronic, with level sensors
- Electronic using the pump as a sensor (without level sensors)

Mechanical devices with the pressure monitoring are suitable for hydrophores and in systems that requires maintaining pressure. They switch on the pump when the set pressure is reached in the system and switch it off when the pressure drops below a certain value in order to prevent the pump from dry running (in the absence of water) [1].

Electromechanical devices include dry run sensors, relays and contactors or other actuators. In [6] is shown a device containing a contactor that turns off the power to the pump, an electromagnetic relay that turns on and off the power of the contactor coil, and a dry run sensor. The sensor consists of 2 plates or 2 tubes between which there is an electrical connection when they are submerged in water and missing electrical connection when they are dry. In the presence of water, this sensor bypasses the circuit in which the relay coil is included. In the absence of water, the relay switches on, activates the contactor and switches off the pump. In this type of sensors contamination of the electrodes is possible and thus reduces their reliability. Other devices are also available where the level sensor is placed in a closed housing [4]. It consists of connected in series magnetic reed switch and a resistor connected between the phase wire and the "earth" (sensor housing). Below them is a magnet fixed on the float. At high water levels, the magnet keeps the relay open and no phase leakage occurs. As the level drops, the float falls down and the relay circuit closes. A leakage occurs and the actuator switches off the power to the pump.

Most commonly offered devices are electronic with level sensors [5]. They are usually made for DIN rail for easy installation in electrical panels. They use the property of the water to conduct electricity. They contain 3 stainless steel electrodes which are connected via 3 wires to the control device in the pump electrical panel. The control device is most often made of transistors, which are blocked by the signals from the electrodes in the well. It manages and protects the pump from dry running. These systems are reliable and have a long life. The algorithm of work and their disadvantages are discussed below.

Electronic systems have also been developed that use the pump as a sensor (without level sensors) [2, 3]. When a pump is running it uses a certain amount of energy. Depending on the load of the pump (pumping more or less fluid), there is a difference in the load of the motor that drives it. If the pump runs dry (without water), the energy consumed and the current in the windings are lower than the nominal. If the pump pumps a lot of water, the energy consumed increases.

The current is increasing and the pump may be damaged. Based on these patterns, devices have been developed that are protecting the pumps by monitoring the motor current. They are usually designed to work with pumps manufactured by the same producers. Some of them have potentiometers that adjust the current and allow them to be used with other brands of pumps.

3. ALGORITHM

Existing electronic devices using level sensors work with 2 sensors. The system contains 3 electrodes marked with +, 1 and 2. The electrode + is placed at the top of the pump. It is connected to the positive pole of a source of constant voltage 12 or 24 V (Figure 1.a). A second electrode 1 is placed near it above the pump level. A third electrode 2 is placed a few meters above the second. When the water level has reached electrode 1 or 2, the resistance between + and this electrode is low because water is a conductor. When the electrode is not reached, the resistance is high because the air is an insulator and no current flows between them. In this way, a signal is sent to a control device that decides to turn the pump on or off. It switches on when the water level is higher than electrode 2. When it falls below electrode level 1, it switches off. After a new filling of the well to electrode 2, the pump starts again, etc.

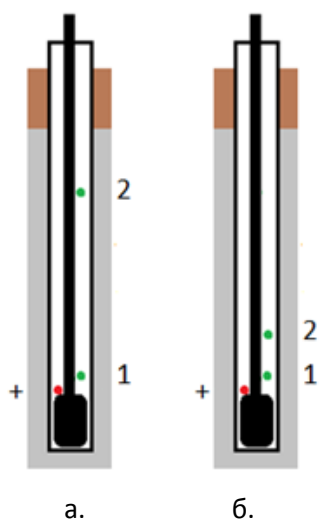


Figure 1. Location of the electrodes in the system with 2 sensors
 a. high (winter) level b. low (summer) level

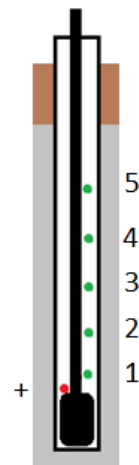


Figure 2. Location of the electrodes in the system with 5 sensors

The distance between electrodes 1 and 2 is determined at the moment of installation of the pump, depending on the water level in the well. The water level is checked and electrode 2 is mounted slightly below the maximum water level. If there are no other deeper wells near the well, with a higher flow rate, and groundwater level is reported at a time when it is low, this system will work well.

If there are other wells with higher flow and depth near the well, it is possible that when they work the water never reaches the level at which the pump turns on. A similar effect can be obtained with large differences in groundwater levels if the pump is installed on a period of more water (Figure 1.a). The power-on sensor will need a reconfiguration that can only be done by removing the pump. On the other hand, if the electrode 2 is placed a short distance from the electrode 1 (Figure 1.b), the capacity of the wells will not be used when the water level is high because the pump will turn on very early and there will be no accumulated water in them. Frequent start-up leads to premature wear of the pump motor, which has a limited number of work cycles.

To avoid these disadvantages, we offer an algorithm for the protection and control of a submersible pump that uses 5 level sensors. It allows the maximum capacity of the well to be

used, regardless of changes in its level, and extends the life of the pump motor. By the same algorithm, a system with more sensors can be developed. The system contains 6 electrodes marked with +, 1, 2, 3, 4 and 5. The + electrode is placed at the top of the pump. It is connected to the positive pole of a 12 V DC source. Electrode 1 is placed above it, so that to ensure complete coverage of the pump. The rest electrodes are spaced on equal distances from one another (Figure 2). The electrode 5 should be slightly below the expected maximum water level.

The algorithm used by the system is as follows:

When the pump is switched on, the water level in the well is checked. It is checking if the water covers electrode 2. If the level is above sensor 2, the pump motor starts. When the water is pumped out and the level drops below electrode 1, the pump automatically shuts off. New filling of the well begins.

Manual shutdown by the operator after completion of the work is also possible.

When the water level again covers electrode 1, a timer which counts down the time t_1 for filling the well to electrode 2 is activated. After the water reaches electrode 2, the time accumulated by the timer t_1 is stored in the memory of the microcontroller. The timer resets and starts counting again.

Continuously (over a short time interval t_m), the stored time t_1 is compared with the current time t_2 reached by the timer. When t_2 equals t_1 , check is made whether the level has reached electrode 3. If the level is not reached (the time required to fill the well between electrodes 1 and 2 is less than the time required to fill the well to electrode 3), the microcontroller waits time t_w and again checks if the water has reached level 3. If after a time t_1+t_w the water has not reached the level 3 again, the pump starts. It will switch off automatically when the water level drops below electrode 1.

However, if the water has reached electrode 3, the time t_2 is saved, the timer is reset and a new time counting for rising water level begins. The current time t_3 is continuously compared to the time t_2 . When the times t_2 and t_3 are equalized, it is checked that electrode 4 is under water. If it is not, the microcontroller waits time t_w and makes a new check if the water has reached level 4. If the level has not been reached again, the pump starts. It works until it automatically shuts off when the level drops below electrode 1.

If at any of the checks the level is reached, the time t_3 is saved, the timer is reset and the current time begins to be compared with t_3 . After time t_3 , it is checked that electrode 5 is reached. If it is not, the microcontroller waits time t_w and again checks. If the electrode is not reached again, the pump starts. If at any of the checks it is found that electrode 5 is reached, the time t_4 is saved and the timer is reset. The pump starts after a time t_5 (water level is above electrode 5).

The same algorithm is repeated every time the pump is switched off due to a drop in water level below electrode 1.

A block diagram of the described algorithm is shown in Figure 3.

4. CONCLUSIONS

An algorithm for management and protection of submersible pump is proposed. It allows full utilization of the wells capacity and protects the pump motors from premature wear due to frequent switching on and off.

In the next stage, according to the proposed algorithm a system for management and protection of submersible pump will be designed, developed and tested.

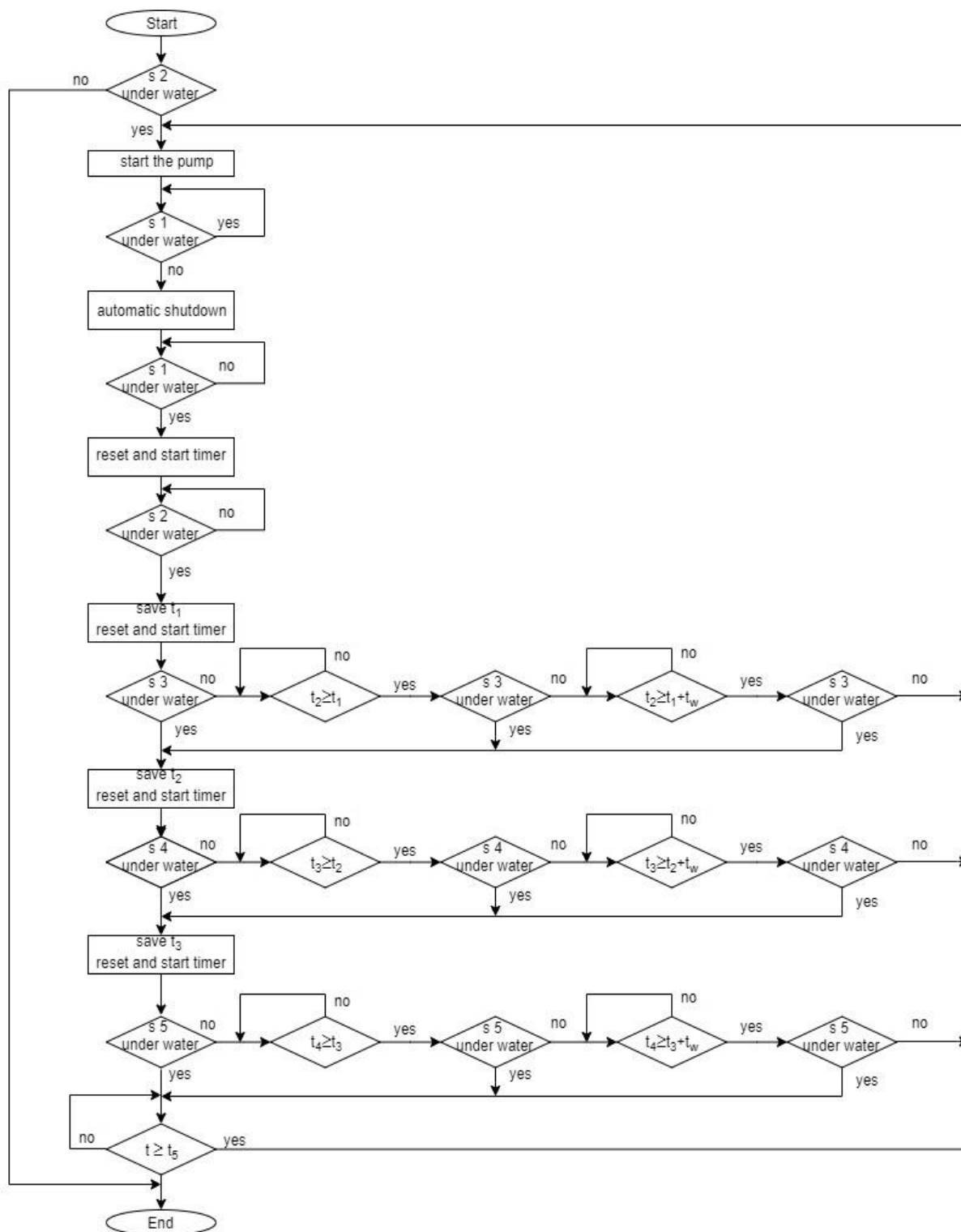


Figure 3. Algorithm for management and protection of submersible pump



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MACHINE LEARNING FOR SOFTWARE

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Abstract: *The study machine learning for software based on Soft Computing technology. It analyzes Soft Computing components. Their use in software, their advantages and challenges are studied. Machine learning and its features are highlighted. The functions and features of neural networks are clarified, and recommendations were given.*

Keywords: *Soft computing, software, machine learning, programming technology, neural networks.*

1. INTRODUCTION

In the modern era, information society is increasing rapidly. Computers affect all processes in society, including scientific research, economy, and generally change the way people operate and penetrate new areas of practice. The study of new information technologies and their application in different areas lead to the creation and development of modern systems and programming languages [1]. The main purpose of automation is to save the civilization from inertia and to free human from deadlines set for the execution of tasks. This is one of the main trends in the evolution of computer technology.

Software products are constantly improving: new features are added, user interface changes, etc. Software performance is an important aspect in developing any software product.

Performance: ability to produce a certain number of products. In other words, it is an ability to release a certain amount of product.

The factors affecting software performance are [2]:

- computer memory volume;
- hard drive access speed;
- maximum frequency of work and processor overload;
- software upgrade and so forth.

Programming technology refers to the development of software tools as a set of technological processes from the idea of creation to software development.

Software development technologies are based on technical tools and modern automated methods used in their lifetime. The high cost of such products also increases the price of software products.

Software system also includes the technical tools. It is also viewed in software and hardware systems environment.

Different technologies and methods are used when developing high quality software systems. One of them is Soft Computing.

The concept of Soft calculations is introduced by Lutfi Zadeh in 1994. It solves the problems of general class through uncertain and nearby methods and is intended for the issues that are beyond the solution. These issues may refer to biology, medicine, management, computer science, etc. [3]. Figure 1 illustrates a list of components for Soft Computing [4, 5].

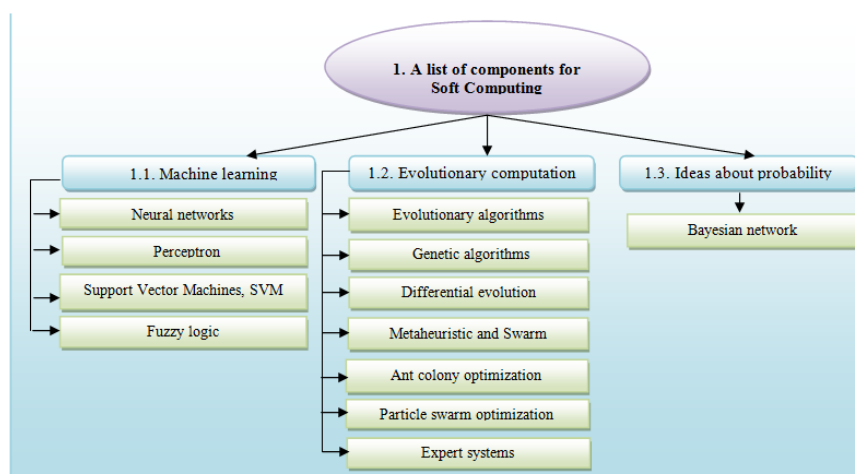


Figure 1. A list of components for Soft Computing

Two types of training are used in this field:

Induction - a method of judgment through producing general conclusions from separate facts or particular coincidences;

Deduction – of Latin origin meaning an acquisition, production and extraction. It is one of the key methods for judgement and research. Deduction differs from induction for its methodological style. Unlike induction, it is capable to draw specific conclusions from the general provisions in the judgement process. It concludes logic from any general idea or proposes a suggestion. The components of machine learning are described in Figure 1. One of them is neural network.

In among them, machine learning and an artificial neuron for software is very important.

2. MACHINE LEARNING FOR SOFTWARE

Machine learning refers to a class of artificial intelligence methods. It is not applied for a direct solution of issues that do not have typical features, and is used as training in solving many similar issues. Optimization of mathematical statistics, probability theory, graph theory and other tools are used for the development of methods.

The notion "machine learning" was first used in 1959 by an American scholar **Arthur Samuel** (1901-1990), one of the pioneers in the field of artificial intelligence and computer games [6, 7].

[8] studies the industrial software systems based on machine learning models, their testing and application.

Organizations try to ensure the expected functionality and quality of the program over the planned timeframe and budget. Although there are numerous advanced techniques to evaluate these efforts, the re-evaluation and evaluation are largely performed and lead to project deficits and significant losses at the organization.

[9] offers a machine-learning based approach to calculate optimized and reliability levels. It evaluates the optimal power for genetically-trained neural network variables. The reliability level is calculated through fuzzy logic and the predicted effort does not exceed the limit.

[10] focus on the webmaster brandmauer (Microsoft Windows) which is an important mechanism for online software systems maintenance. Regarding the constant flow of new types of attacks and their increased complexity, webmaster brandmauer should be regularly updated and tested to prevent the easy access of malevolent. The study focuses on webmaster brandmauer testing for the attacks by using SQL injections. However, the proposed general principles and strategies are adapted to other contexts. An evolution

algorithm, which allows for the attacks by skipping the ML-Driven, a machine-based approach and routine SQL injection tools automatically detected in webmaster brandmauer, is proposed.

The software process comprises a range of activities that end with the software package: specifications, design, implementation, testing, transition to new versions and maintenance. Configuration and Changes Management, Quality Assurance, Project Management, User Experience Evaluation, and other supporting activities are also available. The software warehouse is an infrastructure that supports all of these activities. They may comprise several systems, including code change, management, errors tracking, code checking, setup system, binary files, wikis, forums, etc. [11] provides an overview of research and discussion in the field of intelligent database software in the past decade. It identifies the future challenges in the upgrade of machine learning strategies, existing business topics and company decision-making systems.

System analysts often use software fault prediction models to identify software modules that are vulnerable to failures in the design stage of software life cycle. These models enable to predict improper modules based on the size of the included software. In some studies [12], various machine learning methods are used in this regard. Experiments show that the benefit prediction model performs the following percentages: low: 47.28%, median: 39.24%, high: 25.72%. The best nine function-selection methods are now reviewed to overcome the redundant metrics and to predict failures.

Web applications are crucial in the software industry and are constantly evolving with their new criteria and features. Moreover, the quality is provided through the tests, and the direct development prevents defects. Several factors lead to the defects which are often minimized at high expenses. Thus, it is important to timely detect the defects in the early development stages of the program. Therefore, the use of the accident forecasting model is important for the identification of dangerous classes on the web. [13] compares 14 machine learning methods to reveal the relationship between the object-oriented metrics and error predictions in Web applications. Different editions of Apache Click and Apache Rave groups are used in the research.

Over the past two decades, significant work has been done in the field of traditional and parametric program assessment methods with the application of machine learning algorithms meeting modern requirements for the elimination of the deficiencies in traditional and parametric assessment methods, increasing the level of software projects, and for the project development and management. However, there is no innovation but the indefinite attitudes for inaccurate results and models. The goal of the study [14] is to offer effective and practical approaches to the reduction of gap between the latest research findings in the organizations with the effective use of machine learning and the best research findings and experiences in the industry. One of the components of machine learning is neural network [15].

3. NEURAL NETWORKS

Artificial Neural Networks - includes blended computing systems with biological neural networks that constitute a brain of living beings. These systems "teach" to solve the problem in accordance with the examples. As a rule, it does not program the specific issues with any rules. For example, when recognizing the images, they can teach to recognize the image of a rabbit by analyzing the images. Thus, it is manually recorded as a "rabbit" or "no rabbits". They use other results for the identification of a rabbit. They do it without any information about rabbits, for example, they have fur, tails, whiskers and face. Instead, they automatically generate and process the characteristics from the learning material [16, 17].

The list of the best 20 neuron network software is shown in Figure 2 [18].

The rating of the most commonly used artificial neural networks in 2018 is shown in Figure 3.

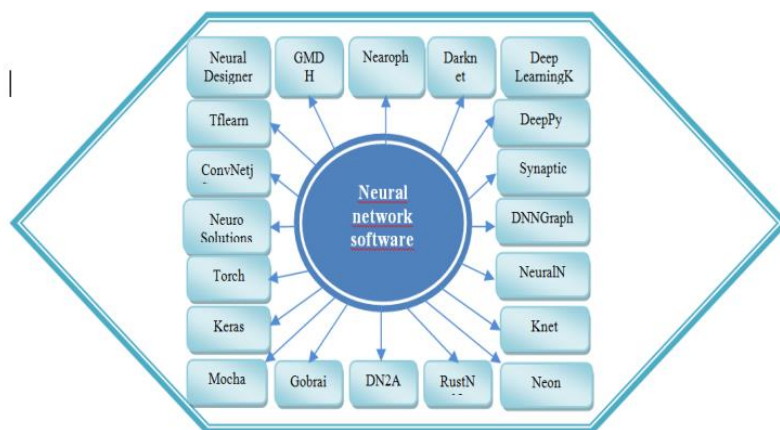


Figure 2. The list of the best 20 Neuron network software

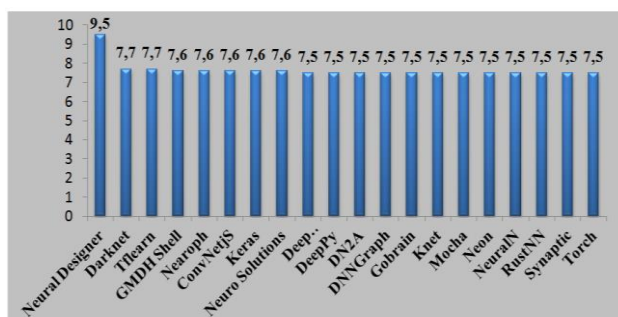


Figure 3. The rating of the most commonly used artificial neural networks in 2018

4. CONCLUSION

Nowadays, computerization and information require high software and tools. In this regard, consumer quality assurance, reliability, speed, conformity to certain capabilities, integrity of documentation, expansion capabilities, development and so forth require a serious utilization of certain technologies.

In this regard, this article examined the methods for increasing software efficiency (efficiency, productivity, mobility, etc.) based on Soft Computing technologies and provided a broad overview of some of them. Taking into account all abovementioned, the use of Soft Computing technologies is predicted to increase the prompt use of software and reduce its costs significantly. In the future, these technologies are estimated to be further improved and widely used.

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DATA ACQUISITION SYSTEM FOR INDUCTION MOTORS WITH ARDUINO

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Abstract:

Data acquisition systems have been used for many years in order to conduct analyses to increase efficiency, measure performance and detect failures in electrical motors. High costs and not being of modular use have prevented these systems from being commonly used. Various methods were developed for data acquisition from electrical machines. This paper presents data acquisition analysing and monitoring system using Arduino platform. Vibration, temperature and current values of a 3 phase induction motor are obtained by this data acquisition system via USB port. A system compatible with all sorts of settings and of low cost was obtained as a result of using Arduino where data processing is conducted on a computer. Values obtained from the data collection system used in this study were found to be supportive to the values shown by the measurement devices from 3 phase induction motor.

Keywords: Data acquisition, Arduino, Temperature Sensor, Vibration Sensor, Current Sensor.

12. INTRODUCTION

Electrical motors are elements that play a major role in production facilities. They are also the elements that consume the largest amount of electricity in industrial applications. In order for production not be disturbed, electrical motors are expected to operate continuously, at high performance and without any failure under any condition. Electrical motors that operate abnormal conditions consume more energy, end up in failures and finally become non operational. Induction motors are of the type that has the largest energy consumption share among all the motors used in industries. Data from past years present 49% of the motors with output power range 0.75 kW and 375 kW are 3-phase induction motors, 30% are 1-phase induction motors and 21% are direct current motors [1]. This indicates that number of failures in induction motors cause increase in downtime in industries and therefore high financial losses. Based on this information, motors must be continuously observed and deviations from normal operating conditions must be detected.

Electrical motors are at times operated under nonideal environmental conditions and abnormal operating conditions. The most common motor failures mentioned in the IEEE-493-1997 standard and statistical data are given in the below Table 1 [2, 3].

The most frequent failures in electrical machines given in the Table 1.1 are mechanical failures of ball bearings, short circuits or breakdowns occurring in stator windings, short circuits occurring in rotor windings [2, 3]. The most frequent failures observed in induction machines are related to ball bearing, stator and armature windings, rotor bar and slip-rings. Mechanical imbalance, spontaneous extreme moment impulses, increase in losses due to various reasons and as a result extreme increase in the temperature of windings are among the reason of these failures [4, 5, 6].

Table 1. The most frequent failures in electrical machines

Type of Failure	Number of Failure				
	Induction Motor	Synchronous Motor	Slip-ring rotor Motor	D.C. Motor	All Motors
Ball bearing	152	2	10	2	166
Winding	75	16	6	-	97
Rotor	8	1	4	-	13
Shaft	19	-	-	-	19
Brush or Slip-ring	-	6	8	2	16
External device	40	7	1	-	18
Other	10	9	-	2	51

Predicting failures beforehand decreases maintenance time and costs. Data acquisition of electrical machines is crucial in order to predict failures. This also helps prevent loss of time and finances caused by failures. A safer working environment in the place of the electrical machine is also provided [3, 8].

Various methods were developed in order to data acquisition from electrical machines. However these data acquisition systems can be complicated, not applicable for every environment, and even costly. The data acquisition system proposed in this study is adaptable to every working place and of quite low cost. In this study vibration, current and temperature data of induction motor are data acquisition via sensors and transmitted to the computer by Arduino.

Being open source makes Arduino a practical software and hardware. Besides being practical, it is also very convenient for low-cost operations. Arduino can be used for inputs from different types of sensors and by control and monitoring applications it can make modifications in surroundings. The Arduino setting is very effortless and easy to understand. On this platform, even non-experienced users can conduct low cost projects. Its software (set of instructions) is also required to program Arduino hardware [9]. This combination of both hardware and software is helpful to sense and control physical world applications. Arduino calls the programs called "sketches"[10]. On top of its software being free of charge, Arduino's hardware can be obtained at the lowest costs. A support group for Arduino is also available in order to communicate about problems. Programs are coded on a computer via the Arduino integrated development environment (Arduino IDE). Arduino hardware operates according to the instructions coded on IDE. This process in which instructions are transferred to Arduino board by IDE is known as uploading [9, 10]. The communication of the parts of the board with the environment is enabled by the Arduino board that can control and respond to power because code execution occurs on it. Electrical power is transmitted from the board to the actuators and converted into a different form that changes the environment while sensors convert physical quantities into electrical values. The Arduino board has USB connector, used to provide power and connectivity to board for uploading software [11].

Physical and electrical data collected from induction motor are measured by sensors in suitable methods and these data will be input to the Arduino UNO platform according to the flow-chart given in Figure 1. Arduino platform is programmed to transmit these data to the computer by serial communication. Besides lower costs, the major difference of this proposed platform from the readily available data acquisition systems is that it can offer adaptable interfaces to every system, instead of fixed and unchangeable interface for every client.

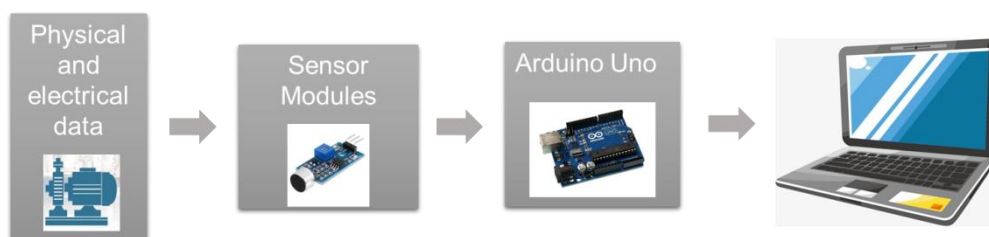


Figure 1. Flow-chart of data acquisition system

13. DATA ACQUISITION SYSTEM FOR INDUCTION MOTOR

Data acquisition systems must have some features in order for electrical motors not to shift to failure state. The primary function of these systems is transmitting the information and a warning when electrical motor deviates from normal operating conditions. The secondary function is acting in order to provide continuity of the operating state, before the system shifts to failure state and as a result increasing the system efficiency.

The data acquisition system generated in this study is based on taking and processing the vibration, current and temperature parameters of the 3 phase induction motor. Suitable sensors transmit values of these parameters from Arduino platform to the computer. Figure 2 shows the general flow diagram of the system.

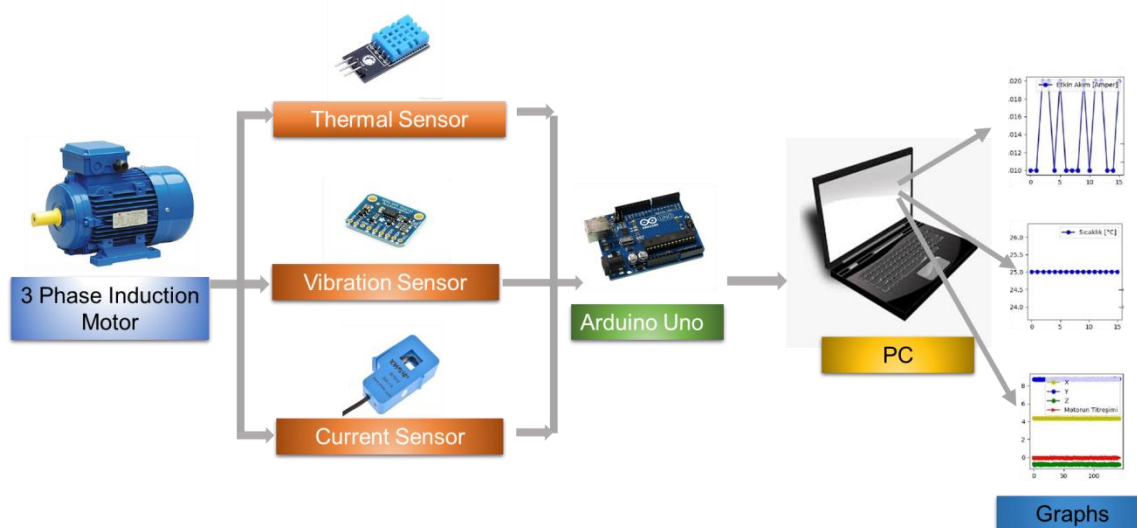


Figure 2. Block diagram of proposed data acquisition system

2.1. Thermal Part of the System

Temperature of windings in electrical motors directly influences the resistance. Increase in temperature also increases the copper losses, and therefore decreases the efficiency, which eventually lowers the performance of the machine. Extreme stress, overloading and power imbalances may increase the temperature. Therefore temperature data is a very important sign of the operating state of an electrical motor.

Nowadays it has become important to use suitable sensors to process analog data obtained from electrical machines and convert them to digital data for storage. Temperature sensors are essentially classified in 4 types: Negative temperature coefficient (NTC) thermistors, whose resistance values change according to increase in temperature, Resistance Temperature Detector (RTD) that measures temperature by resistance correlation, thermocouples that measure the change in voltage between two metal pieces and semiconductor integrated circuits.

In this study the digital temperature sensor shown in Figure 3 was used. It is a composite item with moisture sensor at the same time. This cost-effective sensor also provides long lasting operation and short response time. Another reason to select this sensor is its capability to transmit long-distance signals and digital signal output. Induction motors can be located in various places; therefore this feature plays an important role in order to transmit the data obtained from the machines in various locations of industrial plants, without any loss to a remote data collection point.

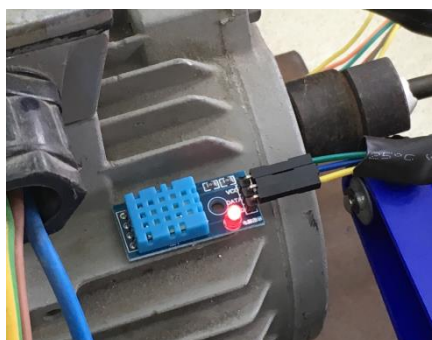


Figure 3. Thermal sensor of proposed data acquisition system

2.2. Vibration Part of the System

Vibration is one of the signs of bearing failure and axial shift in electrical machines. Observing vibration data is important in order to understand that the electrical machine is in a fault-free operating state. Vibration is an oscillation movement and defined by two units; frequency and magnitude. Its frequency is expressed in Hertz and magnitude is expressed in W/cm^2 . Three essential parameters in measurement of vibration are change in location, velocity and acceleration. These parameters can be obtained by various sensors.

In this study vibration sensor SW-420 given in Figure 4 was used. This sensor is used with LM393 comparator chip and can be adjusted according to vibration and provide digital output. According to the size of the electrical motor that will be observed, accuracy of this sensor can also be adjusted by using its internal potentiometer.



Figure 4. Vibration sensor of proposed data acquisition system

2.3. Current Part of the System

Value of current is one of the most important performance indicators of an electrical machine. Observing the current drawn by an electrical motor helps make comments regarding its energy consumption and operating performance. There are essentially 4 methods for measuring current; connecting voltmeter to an infinite low value resistance, which means shunt measurement, measuring by current transformers, measurement by hall sensors and eventually measurement by Rogowski coil.

According to the number of turns in its winding, current transformers gives an output of current measured on its primary circuit as a lower value, on its secondary circuit which

makes it possible to be measured. This method can be applied with shunt measurement principle. By a hall sensor installed in the air gap, a voltage correlated to magnetic flux and therefore current can be obtained. Rogowski coil is a closed coil that does not contain an iron-core, a voltage correlated to current is induced on its ends and this voltage is measured by increasing [43]. In this study a split-core current transformer shown in Figure 5 was used. 1% accuracy of this transformer is crucial to the accurate measurement of the system.



Figure 5. Current sensor of proposed data acquisition system

14. EXPERIMENTAL AND RESULTS

In the scope of this project, the objective of the data acquisition system is obtaining data from induction motors, recording these data and presenting them to clients by the aid of graphics. The data acquisition system consists of essentially 3 sections as shown in Figure 6. The sections are sensors, Arduino Uno platform and computer-software. A microcontroller ATmega328P inside the Arduino platform is used in order to process the data obtained by sensors. The embedded software enables the data obtained from the external environment to work together in compliance, calibrate sensors and transmits the data from all sensors to a single serial communication port. The embedded software has been coded in “C” programming language on the Arduino interface. Arduino is a platform that contains an analog to digital converter, microcontroller, inputs with digital pulse width modulation and analog inputs. Arduino interface reads these unprocessed data from the serial communication port, converts them to formats readable by clients, keeps records and draws graphs.

Data transmitted from the sensors to microprocessor is directed to the serial output port via the embedded software, provides a 8-bit communication with microprocessor and operates at the rate of 9600 baud. Data obtained from the serial port is resolved and a data matrix is obtained. The software of the interface continuously records this matrix and generates real-time graphics based on these data in the matrix.

Temperature and current data are sent to different data matrices, and can be presented in tables or graphics as needed. Vibration interface uses four values from the data matrix. If sensor ADXL345 is stagnant and on a stable surface, then mean square of the acceleration of 3 axes in unit m/s^2 equals to the gravitational acceleration. Interface software aims to determine the value of vibration generated by the induction motor in unit m/s^2 . In order to determine this value, gravitational acceleration is subtracted from the mean square of the data in the columns of the 3 axes where acceleration occurs, the result gives the vibration value of the induction motor. It can be seen 3 axes acceleration as yellow color for X axes, blue color for Y axes and green color for Z axes in Figure 7, also it can be seen vibration of motor as red color in Figure 7.

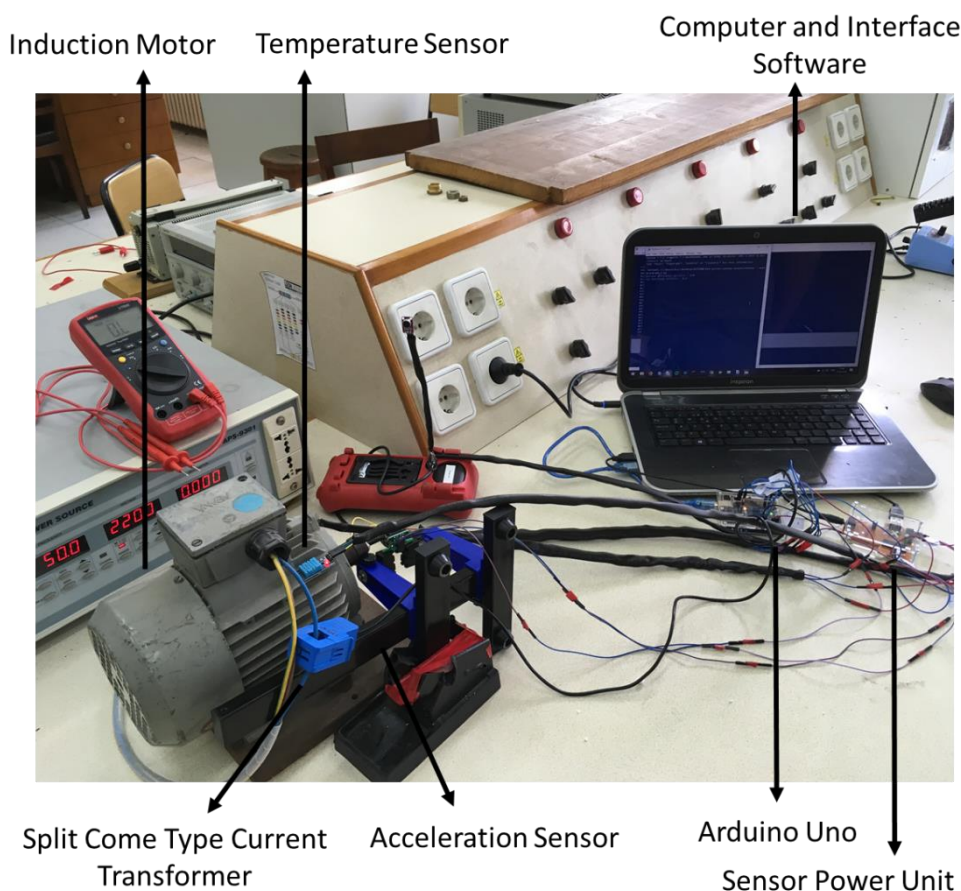


Figure 6. Data acquisition setup

The data acquisition system is tested on the 0.25 kW, 230V, 0.79A, 1330 rpm value 3 phase induction motor shown in Figure 6. The obtained data can be seen in screenshots taken from the computer, presented in Figure 7. Temperature, vibration and current data obtained from the data collection system are compared to the values obtained by the measuring devices. Values obtained from the data collection system generated in this study are observed to be matching to the values obtained from the measuring devices.

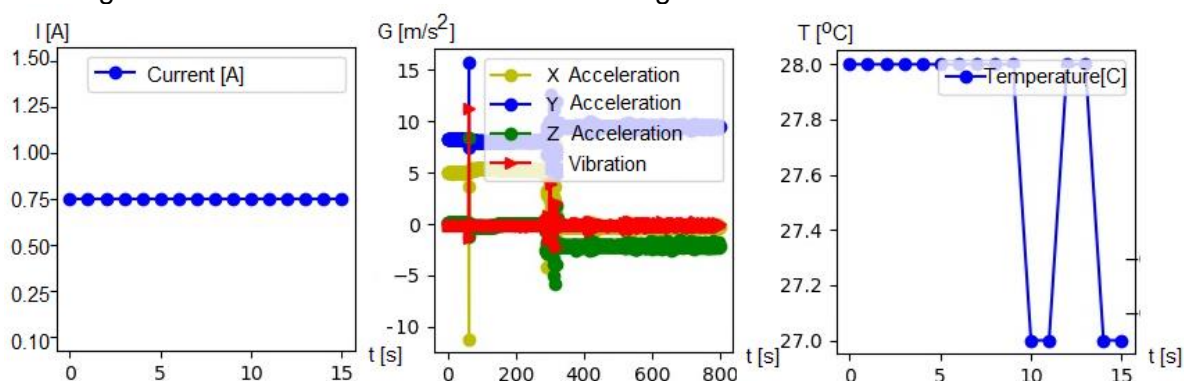


Figure 7. Current, Vibration and Temperature Graphs

15. CONCLUSIONS

In this study a data acquisition system was created for 3 phase induction motors used in industrial applications. This system observes vibration, temperature and current data during the operation of induction motors. Prevention of failure, immediate determination and correction of abnormal operating conditions of electrical machines are very important in production industries. Data acquisition systems that are available in the market are costly and not applicable to every work environment. The cost of the data acquisition system prototype created in this study is quite low compared to similar systems. This system is also modular, which makes it adaptable to any kind of work environment. A traditional data acquisition system stores values on a data logger, which has a limited capacity. In this study data is processed by and stored on a computer, therefore capacity limitation is no longer an issue.

Interface of this prototype system can be improved in order to create a more advanced system in future studies. Further improvement is planned to enable the system not only observe the data but also provide additional functions such as warning.

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ANALYSIS OF THE OPERATION OF PUMPING UNIT UNDER A RANGE OF DIFFERENT LOADS

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Abstract: *The report analyzes the work of a pumping unit from the hot water installation of the Faculty of Technics and Technologies - Yambol, Bulgaria, under different load conditions. Simulation stands have been adapted that are suitable for analyzing the performance of motors of different types and depending on how they are put into the pump unit. It was found that when the energy inefficient electric motor is directly started, the maximum efficiency is 79,63% and is achieved at 100% of its load. When using a frequency converter, at 100% of its load, the efficiency is 86,83%. The proposed energy-efficient electric motor, with direct start-up, has the highest efficiency of 86,7%. The obtained results can be used in the modernization of the hot water installation of the Faculty of technics and Technologies - Yambol, in the part "pumping units".*

Keywords: *pumping units, water heating system, energy efficiency, variable frequency drive*

1. INTRODUCTION

The Clean Energy Package for All Europeans related to building renovation and amendments to the European Union (EU) Building Energy Performance Directive (EPBD), Directive (EU) 2018/844 [3]. This directive gives directions for the renewal of the European Building Fund by 2050. The measures are enshrined in the Energy Efficiency Act of the Republic of Bulgaria [4]. Energy efficiency involves reducing electricity consumption in buildings. Technical and economic analyzes of the existing situation and options for reducing electricity consumption are also needed [6].

Following an audit in 2014, measures were taken to improve the energy efficiency of the main building at the Faculty of Technics and Technologies, Yambol, Bulgaria (FTT) [1,2]. These measures are related to the external thermal insulation of the building, the renewal of the electrical installation and the water heating system. One of the recommendations in the audit is to replace the pumping units of the water heating installation. In this regard, due to the outdated installation and the complexity of the task, it is necessary to carry out numerical studies related to the operation of the pumping unit and to propose a technical solution for the selection of a suitable pumping unit that meets the current requirements for reducing energy consumption and emission reductions [5,7].

The purpose of this report is to analyze the performance of a pumping unit of the FTT-Yambol water heating system under different load conditions.

2. MATERIAL AND METHODS

Analysis of water heating installation of Faculty of Technics and Technologies, Yambol, Bulgaria. The circulation of the coolant is forced and is carried out with circulation pumps mounted in pairs (working and spare). The pump pair is installed in the boiler room. The estimated specific power for pumps and heating is 0.75 W / m². The characteristics of the

pump are $65 \text{ m}^3/\text{h}$, $H = 16 \text{ m}$. The induction motor running at the moment has characteristics of rated power $P_n = 2,2 \text{ kW}$, $U_n = 400 \text{ V}$, $n_n = 1410 \text{ min}^{-1}$, $I_n = 5,2 \text{ A}$, $\cos\varphi = 0,82$.

Based on the scheme proposed by Rahman et al. [8] a calculation procedure and simulation test benches for pump motors have been developed. The schemes and calculations have been modified and adapted to fulfill the tasks set out in this work. The order of the calculations adapted for the purposes of this work is shown in Table 1.

Table 1. Procedure of calculations

Parameter	Formula	Description
Static moment	$M = k \omega^2$	k – proportionality factor; ω – rotor speed $[\text{rad/s}]$,
Angular velocity	$\Omega = 2\pi n/60$	$[\text{rad/s}]$
Nominal torque	$M_n = \frac{P_n}{\Omega}$	P_n - rated power of a three-phase induction motor, [W]
Active power consumption	$P_1 = U_u I_u \cos\varphi_u + U_v I_v \cos\varphi_v + U_w I_w \cos\varphi_w$	U_u, U_v, U_w - voltage of the individual phases, [V]; I_u, I_v, I_w - current of the individual phases, [A]
Useful motor power	$P_2 = M_L \omega_R$	M_L - load moment, [Nm]; ω_R - rotor speed, $[\text{rad/s}]$
Efficiency	$\eta = \frac{P_2}{P_1} \cdot 100$	[%]

Simulation stands have been developed for direct starting of an electric motor and by a frequency inverter.

A simulation stand has been developed to measure the efficiency of an induction motor connected directly to the power supply. This simulation stand is presented in Figure 1.

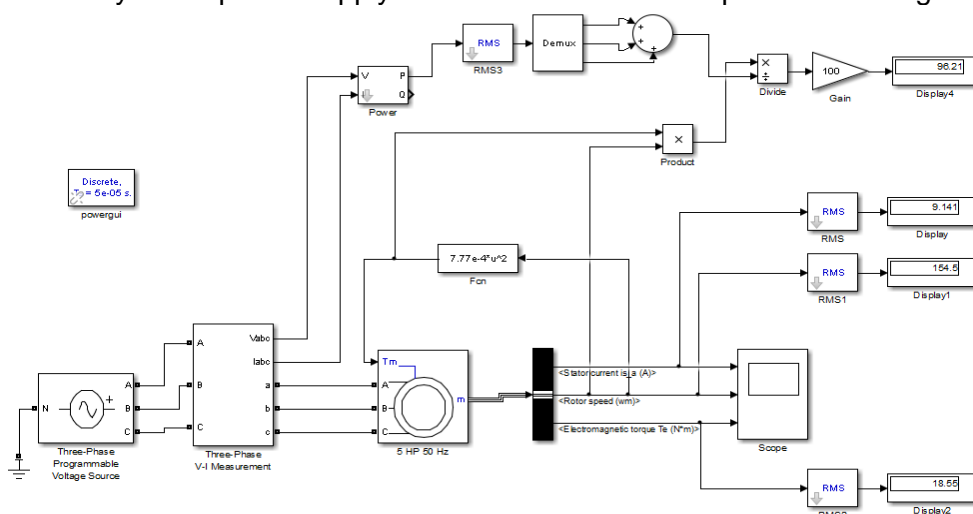


Figure 1. Simulation stand for calculating the efficiency of an asynchronous motor connected directly to the power supply.

A simulation stand has been developed to calculate the efficiency of an induction motor controlled by a frequency inverter. The simulation stand is presented in Figure 2.

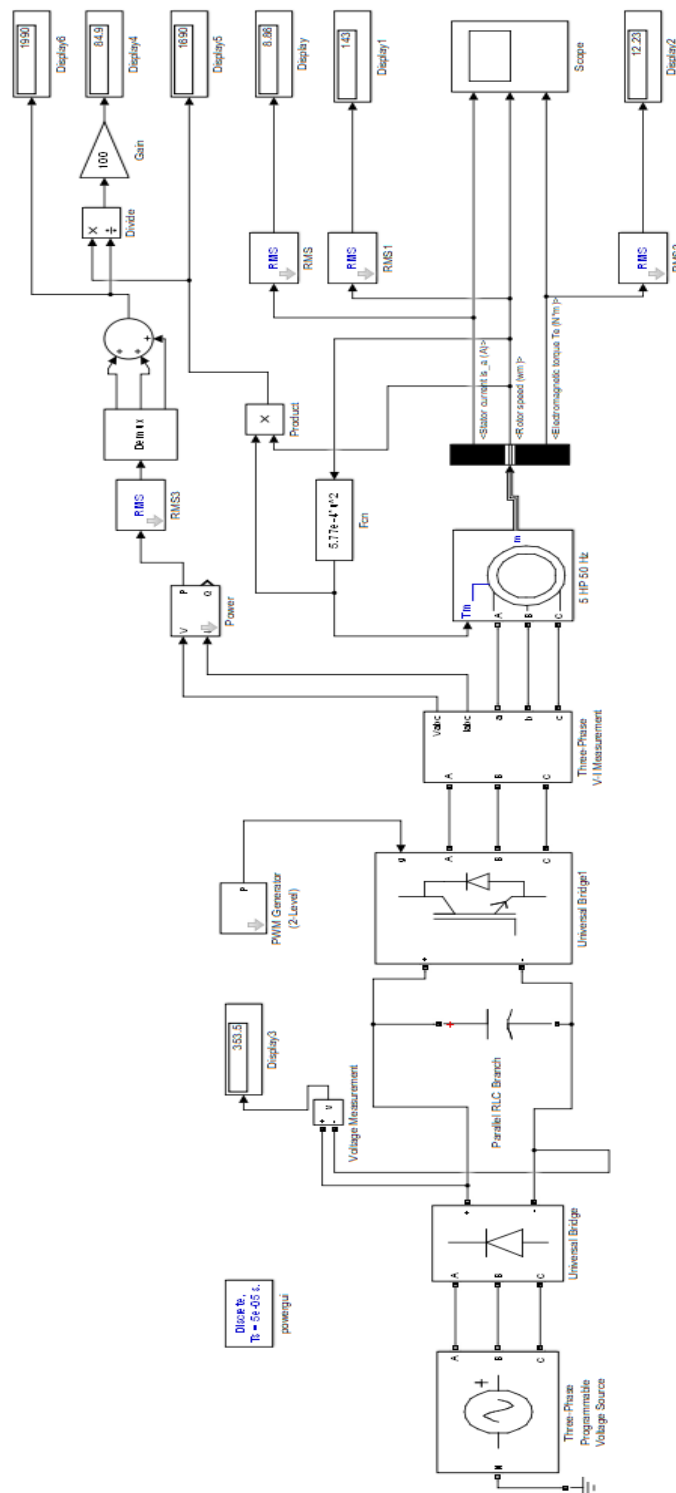


Figure 2. Simulation stand for calculating the efficiency of an induction motor controlled by a frequency inverter.

The measurements in the simulation circuits are made at the input and output of the motor used, regardless of the starting method. At the motor output the following are measured: the stator current; rotor speed, electromagnetic torque. All measurements are at effective values of motor parameters. The efficiency of the motor is obtained by the ratio of its input and output power.

In the frequency inverter circuit, a pulse-width modulation (PWM) unit is added, with two levels for controlling the thyristor unit, as well as a voltage measuring module after the rectifier. This measuring unit is not used in this work. The addition of additional units is related to further studies, for example at starting the motor under reduced voltage, which is the subject of future work.

3. RESULTS AND DISCUSSION

The angular speed of the induction motor produces 147,58 rad/s. The rated torque is 14.9 Nm and the load factor of 100% is $6,84 \cdot 10^{-4} \text{ Nms}^2$.

Simulation tests have been performed on the induction motor, by direct start, by a frequency inverter of speed. An energy efficient induction motor, class IE3 is also selected. The IE3 motor is JM 90 Lc type with a rated output power $P_n = 2,2 \text{ kW}$, $U_n = 400 \text{ V}$, $n_n = 1435 \text{ min}^{-1}$, $I_n = 4,68 \text{ A}$, $\cos\varphi = 0,78$, $\eta_{100\%} = 86,7\%$, $\eta_{75\%} = 86,7\%$, $\eta_{50\%} = 85\%$.

The dependence of the efficiency on the load for the two separate cases - in the case of direct and start-up and by frequency inverter of the energy inefficient motor - has been removed. The values obtained are presented in Table 2. the load is 30-105%; proportionality factor; efficiency depending on startup mode.

Table 2. Results of the analysis of the performance of an energy-efficient electric motor under different start-up modes

Load, %	$k \cdot 10^{-4}$	η VFD, %	η direct, %
30	2,052	72,96	59,14
35	2,394	75,78	62,61
40	2,736	77,91	65,48
45	3,078	79,62	67,85
47	3,215	80,22	68,66
50	3,42	81,02	69,82
55	3,762	82,17	71,47
60	4,104	83,09	72,9
65	4,446	83,89	74,12
70	4,788	84,55	75,18
75	5,13	85,12	76,07
80	5,472	85,58	76,85
85	5,814	85,98	77,54
90	6,156	86,31	78,13
95	6,498	86,6	79,08
100	6,84	86,83	79,63
105	7,82	86,72	79,46

The table shows that as the load increases, the proportionality factor also increases. With a direct start of the energy inefficient motor, the maximum efficiency is achieved at 100% of its load. When using a frequency inverter, the efficiency is at a load of 50% it is 81,02%, at a load of 75% efficiency is 85,12%. Accordingly, when directly loaded with a load of 50%, the efficiency is 69,82%, at a load of 75% efficiency is 76,07%, and at 100% it is 79,63%. The

proposed energy efficient motor has an efficiency of 86,7% at 100% load, with the manufacturer setting at 75% efficiency also at 86,7% and at load 50% efficiency is 85%.

4. CONCLUSION

The report demonstrates the operation of different types and methods of starting of motors in the pumping unit. Simulation stands are adapted that are suitable for analyzing the performance of motors of different types and depending on the way they are started.

From the numerical analyzes made it can be considered that:

- ✓ It has been found that the energy inefficient frequency inverter started motor has a better performance than the energy inefficient, direct-start one;
- ✓ The selected energy efficient motor has the best performance, with an efficiency of 100% being 86,7%, an efficiency of 75% it is also 86,7%, and at load 50% efficiency is 85%.
- ✓ The results obtained can be used to modernize the FTT-Yambol water heating system, in the part of pumping units, which will fulfill the prescribed measures for improving its energy efficiency;
- ✓ Further studies are needed to select the number of pumps for the heating system using the results of this work.

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OPERATIONAL ACTIVITIES FOR ACHIEVING ENERGY EFFICIENCY IN ELECTRICAL NETWORKS

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Abstract: *The energy efficiency improvement actions of the electrical networks are divided into two main groups: operational and technical. Technical events require significant investment. Operating events do not require investment and are limited to optimal solutions in operational conditions that achieve energy efficiency. The report presents a methodology for assessing of the energy efficiency when changing the configuration of distribution electrical power networks. It is summarizing the results of the reconstruction and exploitation of the distribution networks for medium and low voltage under optimized schemes, which achieve energy efficiency. Recommendations are made for the implementation of energy efficiency activities in the exploitation of distribution networks.*

Keywords: *electrical network, configuration, energy efficiency, power losses*

1. INTRODUCTION

Bulgaria's energy policy is oriented towards improving of the energy efficiency [1,2]. In the electric power industry, the energy efficiency can be achieved at all stages of the production, transmission, transformation, distribution and consumption of the electrical energy. Energy efficiency is defined as the minimum loss of power in the power grids [3,4].

In this report is presented a methodology for assessing of the energy efficiency when changing the configuration of the distribution grids. The results from the exploitation of the medium and low voltage distribution networks under optimized schemes are summarized, by which energy efficiency is achieved.

2. ENERGY EFFICIENCY IN THE ELECTRICAL NETWORKS

The energy efficiency improvement activities of the electricity grids are divided into two main groups: constructional and operational.

Constructional activities that require investment are:

- Reconstruction of the existing network by constructing of new power lines and transformers; reinforcement of the existing sections by replacing the conductors with larger cross-section in case of increase of the electrical loads or in integration of decentralized generations (DG) to the electrical grid [5].

- Installation of means for compensating the reactive power of both the low voltage (LV) side and the medium voltage (MV) side of the power transformers, by which an unloading of the electrical grid is achieved [5].
- Establishment of emergency connections between adjacent branches and selection of the optimal location for sectioning in the different schemes of the MV distribution networks by the criterion of minimum power losses [6].
- Maintenance of the voltage within the permissible limits in the nodes of the distribution grid by moving active consumers from the peak hours of the 24-hour load schedule to the less loaded hours in order to achieve energy efficiency [7].

The exploitation activities do not require investments and are reduced to optimal solutions in operational conditions by which energy efficiency is achieved. These include:

- Reconstruction and exploitation of the distribution networks under optimized schemes for achievement of energy efficiency [8].
- Switching-off of the lightly loaded transformers in the hours of minimum load and switching of the loads for reduction of the losses in the steel when operate in idling mode [9].
- Proper organization and reduction of errors of the measurement of the electrical energy, etc.

The constructional activities in most cases are resulting in higher energy efficiency than the operational activities. It is recommended to apply operational activities, although their effectiveness is not always high.

3. METHODOLOGY FOR DETERMINATION OF THE POWER LOSSES IN DISTRIBUTION NETWORKS WHEN CHANGING NETWORK CONFIGURATION

The distribution network for MV and LV is open and branched. Generally, in these networks power losses $\Delta P_k + j\Delta Q_k$ for each section k are determined by the equations [10], [11]:

$$\Delta P_k = \frac{\left(\sum_{i=k}^n P_i\right)^2 + \left(\sum_{i=k}^n Q_i\right)^2}{U_H^2} R_k; \Delta Q_k = \frac{\left(\sum_{i=k}^n P_i\right)^2 + \left(\sum_{i=k}^n Q_i\right)^2}{U_H^2} X_k. \quad (1)$$

where P_i and Q_i are respectively the active and reactive power flowing through the section; U_H – the rated voltage; R_k и X_k - the active and inductive resistance of the k section of the power line; n – the number of sections in the distribution network.

The total power losses $\Delta \dot{S} = \Delta P + j\Delta Q$ for the entire branch are determined by summing the power losses for each section:

$$\Delta \dot{S} = \Delta P + \Delta Q = \sum_{k=1}^n \Delta P_k + \sum_{k=1}^n \Delta Q_k. \quad (2)$$

In order to evaluate the energy efficiency, it is necessary to consider several variants of the distribution network configuration and to calculate for each of them the power loss in regime of maximum load. The calculated values of the power losses for the different variants shall be compared and the optimum one is selected. The calculation procedures are carried out with the simulator for calculating the regime parameters to the power grids [12]. adapted for entering of data for changing the configuration of the electrical network. With modules from the simulator can be predicted the electrical loads for short and long periods [13,14].

This makes it possible to evaluate the energy efficiency not only for existing electrical grids,

but also for their reconstruction and modernization.

For given electrical network for MV five variants have been elaborated. The calculations of power losses for the first variant are given in Fig. 1.

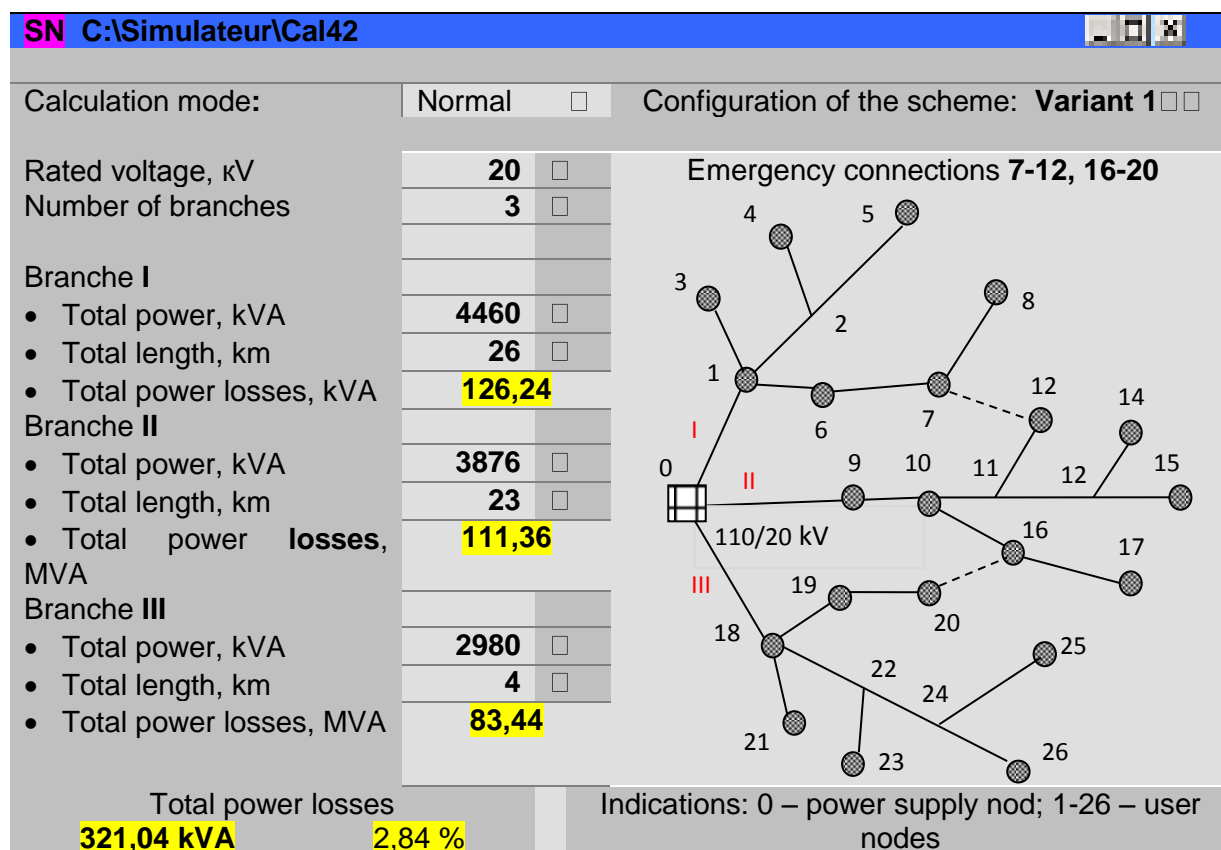


Fig.1. Calculation of power losses in MV electrical grids

By analogy for the variants 2 ÷ 5 respectively from Figures 2 ÷ 5, the calculations are performed by the described algorithm and the results are presented in Table 1.

Table 1. Calculation values in relative units of the power losses for the variants

Variant	Power losses, r.u.	Power losses, kVA	Power losses, %
Variant 1	1,05	321,04	2,84
Variant 2	1,18	360,78	3,19
Variant 3	1	305,75	2,70
Variant 4	1,23	376,07	3,32
Variant 5	1,38	421,94	3,73

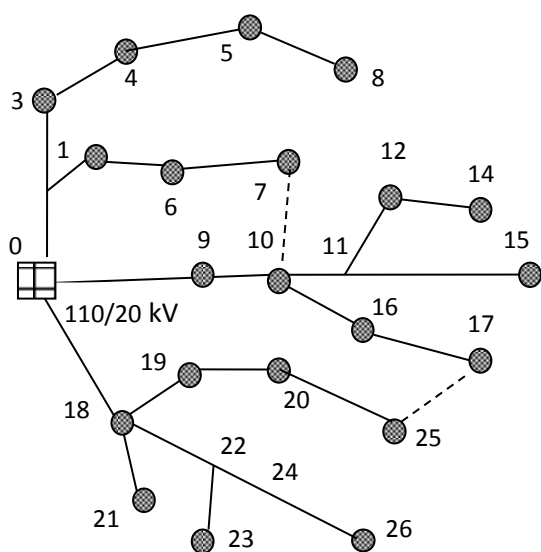


Fig. 2. Variant 2

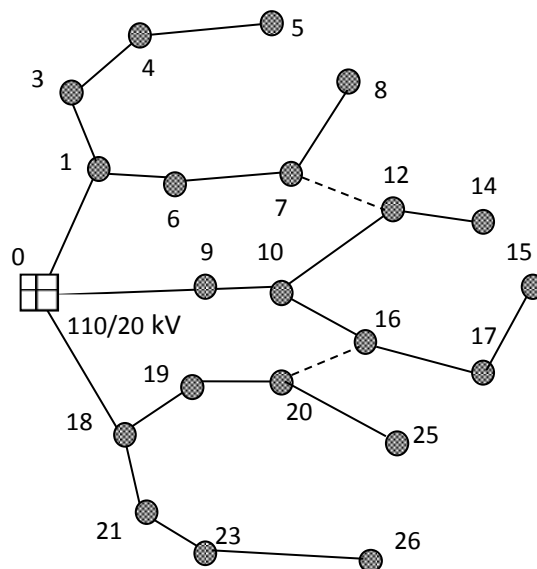


Fig. 3. Variant 3

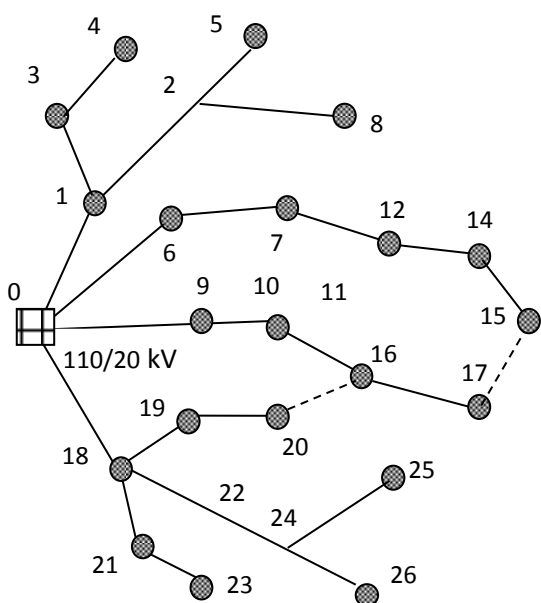


Fig. 4. Variant 4

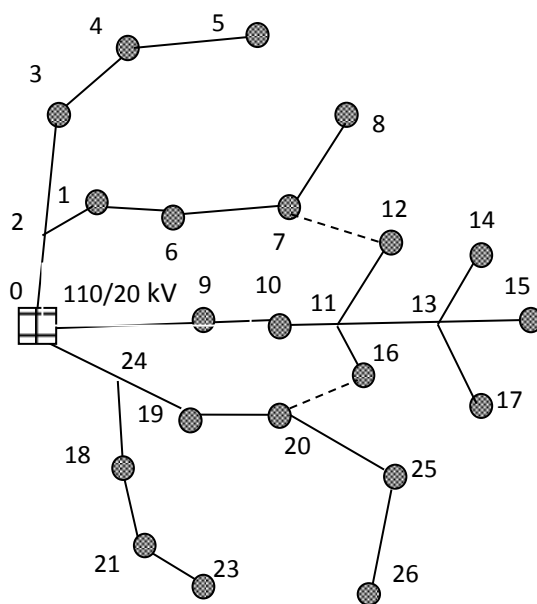


Fig. 5. Variant 5

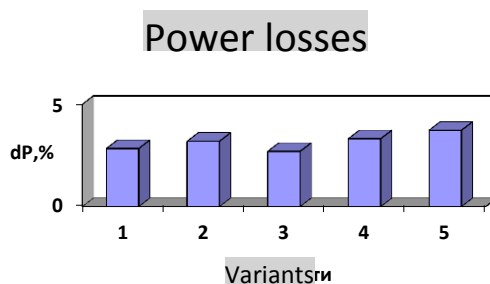


Figure 6. Power losses for the variants of the distribution network in normal regime. The calculations were carried out for the given lengths of the sections and capacities in the nodes of the electrical power grid. The results for the power losses in Table 1 are presented in kVA, in % relative to the transmitted power in regime of maximum load and in relative units (r.u.), as for base value is chosen the minimum calculated value for the respective variant (in this case variant 3).

4. CHANGING THE CONFIGURATION OF MEDIUM VOLTAGE DISTRIBUTION NETWORKS IN POST-EMERGENCY REGIME

With a specially designed software are performed calculations of the power losses for the optimal variant from Table 1 (variant 3) in post-emergency regime. Sub-variants are considered, by which the possible switching of the emergency connections are covered, respectively between I and II branch and also between II and III branch (Table 2).

Table 2. Power losses in post-emergency regimes, %

Sub-variants for variant 1	Emergency connections between branches I and II	Emergency connections between branches II and III	Power losses in post-emergency regime, %
3.1	6- 9	9-19	3,38
3.2	6- 9	10-20	3,29
3.3	6- 9	16-20	3,18
3.4	6- 9	17-25	3,15
3.5	7-10	9-19	3,21
3.6	7-10	10-20	3,27
3.7	7-10	16-20	3,12
3.8	7-10	17-25	3,11
3.9	7-12	9-19	3,36
3.10	7-12	10-20	3,27
3.11	7-12	16-20	3,06
3.12	7-12	17-25	3,15

From Table 2 it is determined that sub-variant 3.11 is with minimal power losses - this is variant 3 with switched-on emergency connections 7-12 and 16-20 between the branches of the distribution network.

5. RECOMMENDATIONS FOR THE IMPLEMENTATION OF ACTIVITIES FOR ENERGY EFFICIENCY IN EXPLOITATION OF THE DISTRIBUTION NETWORKS

The achieving of energy efficiency in the distribution networks with operational activities is recommended because it does not require additional investments.

The optimal configuration from the point of view of energy efficiency should be chosen as early as at the design stage.

In case of reconstruction of the electrical power network, it is necessary to prove with

calculations the optimal scheme for exploitation of the distribution network.

The switching in post-emergency regime under energy efficient schemes shall be performed after calculation of the power losses for different sub-variants of switching-on of post-emergency connections.

6. CONCLUSIONS

- The energy efficiency in the electrical power networks can be achieved through exploitation activities that do not require additional investments. Their implementation is recommendable for proving of the expediency.
- The elaborated algorithm and specially developed software allow to calculate the power losses for different configurations of the distribution electrical networks and to choose the optimal scheme for achieving energy efficiency.
- The algorithm and software are applicable in case of reconstruction and exploitation of the distribution networks under optimized schemes.

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POLICIES FOR INCREASING THE SHARE OF BIOMASS IN ENERGY PRODUCTION

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Abstract: Today, more than ever, the fight against climate change requires a collective effort. Addressing the problems arising from the rapid depletion of resources and the changing environment requires Europe to radically change its approach from rapid resource depletion, climate change, and changing environment requires Europe radically change their approach to production, consumption, processing, storage, recycling and disposal of biological resources.

The promotion of bioeconomy as a key EU policy will lead to a sustainable solution to these problems and improve the economic and environmental situation in Europe. One of the directions in which the bio-economy has to go at a fast pace is energetics. Using the potential of biomass as a resource for the development of bioenergy will have a positive impact on carbon emissions and climate as a whole. The European Union is pursuing a coherent policy in the field of renewable energy and in particular biomass, stimulating international dialogue to reduce environmental pressures, climate change and reduce the environmental impact of human activity. EU legislation on the promotion of renewable energies (RES) has evolved significantly in recent years, with the agreement reached last year for a 32% share of renewable energy in the overall energy mix at European Union level by 2030.

The purpose of this report is to analyze potential opportunities for the implementation of European directives to increase the use of bioenergy resources in the field of energy production. An analysis was made of the state of the Bulgarian energy sector and the current regulatory framework for stimulating the use of renewable energy, in particular biomass for energy production. Conclusions have been formulated for the necessary measures for the future development of the sector.

Keywords: European Policies, bioeconomy, energetics, bioresources, circular economy.

1. INTRODUCTION

Challenges facing the world and EU in the field of energy include issues such as increasing import dependency, limited diversification, high and volatile energy prices, growing global energy demand, security risks, the growing threats of climate change, slow progress in energy efficiency, challenges posed by the increasing share of renewables, further integration and interconnection in energy markets. The EU's energy policy is based on a variety of measures aiming to achieve an integrated energy market [4], the security of energy supply and a sustainable energy sector are at the core.

Between 1990 and 2017, electricity consumption in the EU increased by an average of 1% annually - from below 2.2 billion GWh to almost 2.8 billion GWh annually. For the period up to 2020, it is projected that consumption will increase by less than 0.3% annually if specific energy efficiency measures are implemented and by 0.7% annually if no new efficiency policies are implemented in the period 2020-2050 [2].

Following a consistent policy on carbon footprint, the European Commission proposed on 30 November 2016 a Clean Energy Package for all Europeans (COM (2016) 0860), which includes legislative proposals targeting energy efficiency and renewable energy.

As a result of this action, a Directive on the promotion of the use of energy from renewable sources was adopted on 11 December 2018, where a 32% share of energy from renewable sources at EU level is set as a leading target for 2030.



The adopted targets are financially supported by climate spending, including in support of the transition to clean energy in recent years, received an unprecedented amount of attention in the EU budget by proposing to increase the share of climate-related expenditure to 25%. Bringing together individual countries, industries and research institutes, the SET Plan brings together public and private investment to pursue clean energy activities. The SET integrated plan reflects the new European energy research and innovation program, which covers the entire energy system and puts Europe at the forefront of the next generation of low carbon energy technologies, while creating jobs, economic growth and benefits for all. SET-Plan countries and industry have committed a total of € 20 billion. These funds will be invested in specific cooperation activities in addition to the research and innovation actions undertaken by countries or industry on their own initiative.

2. INTERNATIONALLY STATE OF BIOENERGETICS

According to Eurostat data, the percentage of renewable energy in the total energy mix of the Member States for the period 2008-2017 is steadily increasing (Figure 1) as of 2017, eleven of them have achieved the objectives set for 2020.

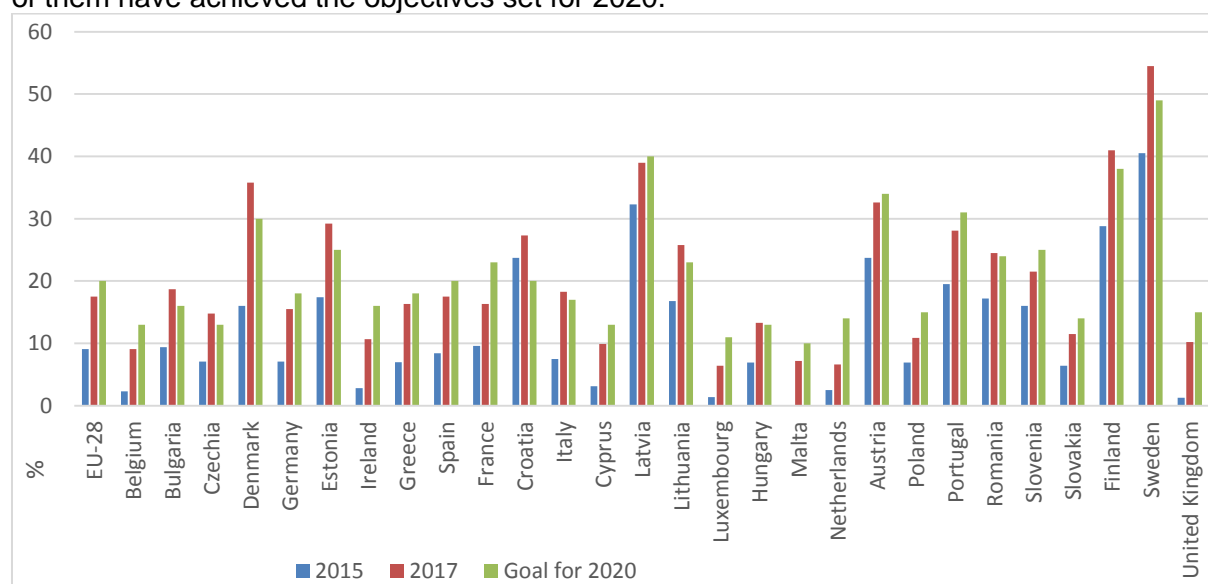


Fig.1. Share of energy from renewable sources Source: Eurostat ([nrg_ind_ren](#))

In 2017, more than half (54.5%) of Sweden's gross final energy consumption is from renewable sources and this share is highest among EU Member States, followed by Finland (41.0 %), Latvia (39.0%), Denmark (35.8%) and Austria (32.6%). At the opposite end of the spectrum, the lowest share of renewable energy was recorded in Luxembourg (6.4%), the Netherlands (6.6%), Malta (7.2%), Belgium (9.1%), Cyprus (9.9%) and the United Kingdom (10.2%). Compared to the latest available data for 2017, the targets for the Netherlands, France and Ireland require each of these Member States to increase their share of renewable energy in gross final energy consumption by at least 5.0 percentage points.

The primary production of renewable energy within the EU-28 in 2017 was 226.5 million tonnes of oil equivalent (toe) and accounted for a 13.9 % share of the EU-28 countries gross inland energy consumption.

The quantity of renewable energy produced within the EU-28 increased overall by 64.0 % between 2007 and 2017, equivalent to an average increase of 5.1 % per year.

Among renewable energies, the most important source in the EU-28 was wood and other solid biofuels, accounting for 42.0% of primary renewables production in 2017 (see Figure 2).



Wind power was, for the first time, the second most important contributor to the renewable energy mix (13.8% of the total), followed by hydropower (11.4%). Although their levels of production remained relatively low, there was a particularly rapid expansion in the output of biogas, liquid biofuels and solar energy, which accounted respectively for a 7.4%, 6.7 % and 6.4% share of the EU-28's renewable energy produced in 2017. Ambient heat (captured by heat pumps) and geothermal energy accounted for 5.0% and 3.0% of the total, respectively, while renewable wastes increased to reach 4.4%. There are currently very low levels of tide, wave and ocean energy production, with these technologies principally found in France and the United Kingdom.

In retrospect, hydropower and wood as a representative of traditional biomass accounted for 91.3% in 1990. Since then, their combined relative growth rate has been much lower than that of other sources. During the period, there has been an increase in the share of wind and solar energy, as well as biogas, liquid biofuels and renewable waste.

From the presented data, it can be concluded that the EU's long-term policy on increasing the share of RES in the energy sector is effective and there is a constant positive upward trend. The analysis also shows that the main sources of renewable energy are solar and wind, which are developing at a rapid pace, thanks to investment in the development of innovations in their field of production.

With regard to the use of biomass as a source of energy, it can be noted that it has not yet been sufficiently evaluated. Although according to statistics by 2017 this is the third most important energy source, the main share comes from the so-called traditional biomass - solid wood. Waste energy use is growing at a much slower pace.

Although methanogenesis as a process for biogas extraction from biomass has been known to humanity for centuries, most of urban bio-waste is landfilled and landfill biomass remains undrawn.

According to IRENA [3], in 2017, the cost of electricity produced from renewable sources was often comparable to that of fossil fuels (fig. 3). It is evident that the costs of extracting energy from biomass over the period considered remain constant and are significantly lower than those for fossil fuels.

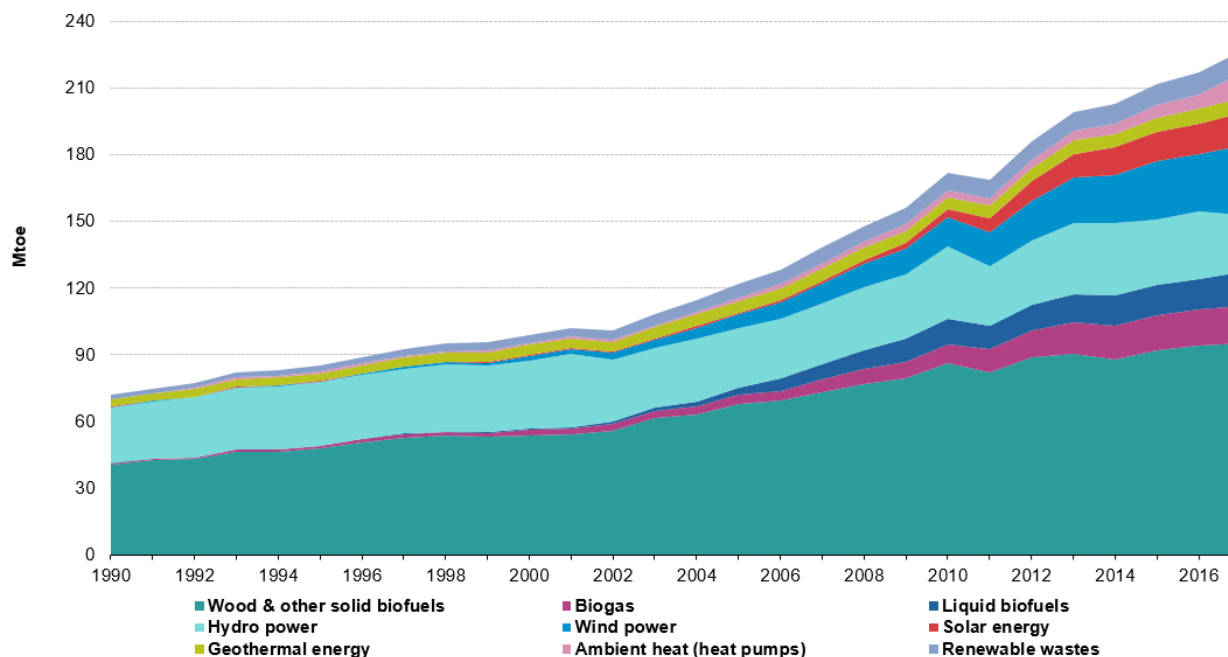


Fig. 2. Primary production of energy from renewable sources EU-28 1990-2017, Source: Eurostat ([nrg_bal_c](#))

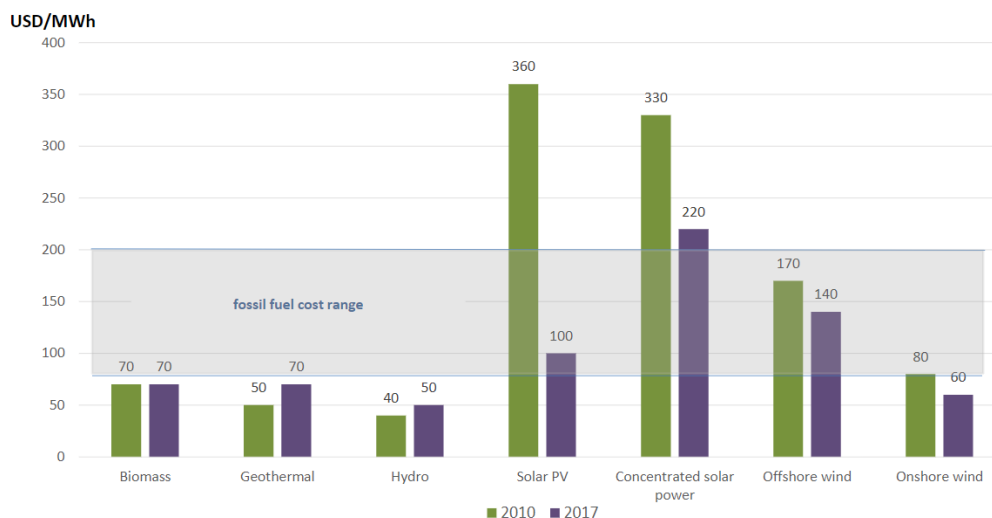


Fig. 3. Global levelised cost of electricity from renewable power generation technologies, 2010-2017 (in US dollars/MWh)

This shows that biomass as an energy resource has good performance and can successfully replace fossil fuels. Excluding the use of traditional biomass, which has a significant share, a major problem facing in front a more efficient use of biomass is the lack of summary information on the available resource. According to a study carried out in conjunction with the implementation of the National Science Program "Healthy Foods for a Strong Bioeconomy and Quality of Life", information on biomass from the agricultural sector and waste biomass can only be found by economic activities. This creates significant difficulties for analysis because of the many sectoral policies related to biomass exploration, its impact and its use, and sometimes very diverse and contrasting perspectives are available.

Recognizing the need for a balanced and scientifically sustainable approach to assessing the state and trends of biomass, the European Commission has commissioned the Joint Research Center (JRC) to prepare a European and global analysis model on the availability of biomass and its sustainability (environmental, social and economic) in the long term [2]. The project started in 2015 and aims to cover all sources of biomass - agricultural, forestry, fishing, aquaculture, algae. It will include an assessment of the impact of biomass production and use, competition and synergies between the biomass resource sectors. This evaluation is intended to support the implementation of policy measures and to develop and analyze scenarios for the supply and supply of biomass with short-term (2020), medium-term (2030) and long-term (2050) perspectives. In the framework of this project, the Joint Research Center of the Knowledge Center of the European Commission for Bioeconomy has developed cross-sectoral biomass flow diagrams (Sankey diagrams) that uniquely represent biomass flows from different sectors of the bioeconomy, from supply to use, including trade. The diagrams to be further refined and expanded link the supply data with the application and integrate biomass flows into agriculture, forestry, aquaculture and fisheries. Biomass flow diagrams will provide the basis for future analysis of cross-sector programs and synergies. Fig. 4 represents the flows of biomass between supply and uses in the EU-28 in

the form of a Sankey diagram.

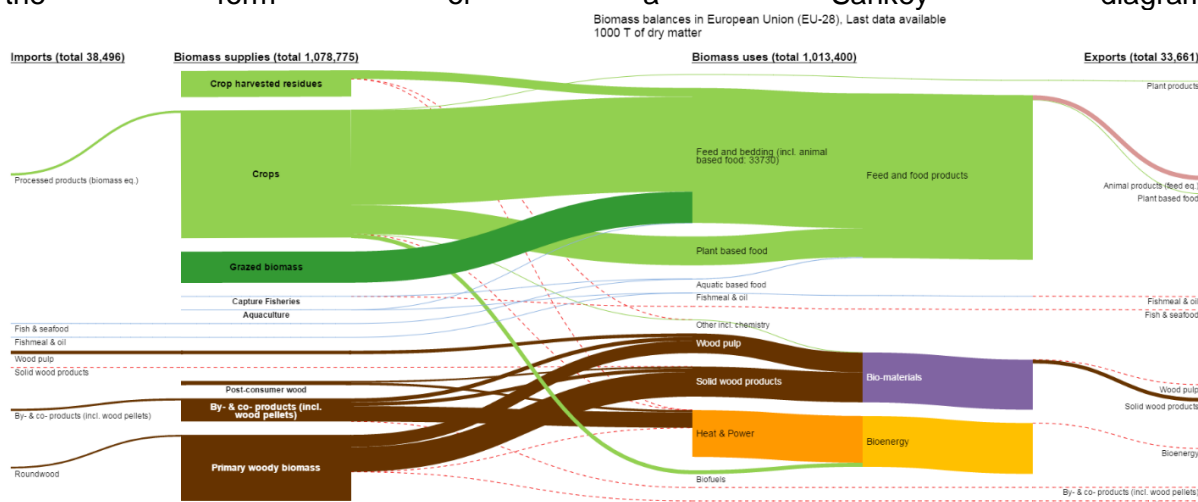


Fig. 4. Sankey biomass flow charts for EU-28 developed by Joint Research Center of the Knowledge Center of the European Commission for Bioeconomy for 2009 - 2015

This representation highlights the relative weight of the different sectors in the bioeconomy. While supply has been split in the traditional sectors (agriculture, forestry and fisheries and aquaculture), the uses have been distributed in different categories because their sources are diverse (e.g. biomaterials are sourced from both forestry and agriculture). Sankey diagrams are being developed for each type of biomass and will be subject to future refinement and expansion. They will provide the basis for future analysis of cross-sector programs and synergies.

3. STATE OF BIOENERGY AT NATIONAL LEVEL

The bioenergy sector in Bulgaria was influenced by the country's accession to the EU ten years and some program documents that were adopted in according European politic for stimulating RES [5, 7]. Since then, numerous RES projects have been implemented. Hydro, solar and wind are the main pillars of meeting the EU's targets. Several thermoelectric and cogeneration plants have been built, operating on biogas from manure, wood residues and household waste, but at present most of them are functioning as pilot projects.

The target set for Bulgaria - by 2020, 16% of the energy produced from RES was achieved in 2012. The main method for stimulating the use of RES in the energy sector was by introducing preferential prices for the purchase of renewable energy, already from photovoltaic and hydropower plants, which have led to an increase in the cost of electricity. This has led to a negative response among the population and certain political consequences.

Currently, there are still preferential tariffs for the purchase of electricity produced from biomass plants (including wood biomass), but there is also greater dissatisfaction because it is assumed that high electricity prices are due to these preferential tariffs.

In 2015, in the Energy Act was adopted changes aimed at reducing greenhouse gas premiums from large producers, as prices of the "green" energy from solar and wind has fallen globally thanks to technological developments. Unfortunately, only in July 2019, the State Energy and Water Regulatory Commission reduced the burden on small producers with its decision of 11.07.2019 [6]. This delay proved to be detrimental to some small producers, which is evident from the annual RES production for the period 2013-2017 after Bulgaria has met the EU's targets for the programming period [8] (Fig.5).

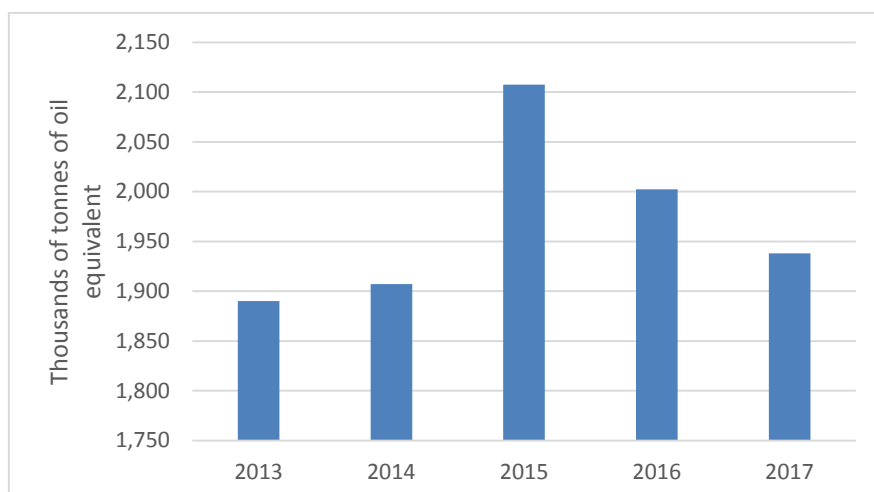


Fig. 5. Production of primary energy from RES for the period 2013-2017

From the analysis by RES types (Fig.6), it is obvious that mainly the energy from RES in Bulgaria comes from the burning of wood. The use of photovoltaic and wind installations is much lower than in Europe. It is noteworthy that in general there are no statistics on the availability and use of waste biomass.

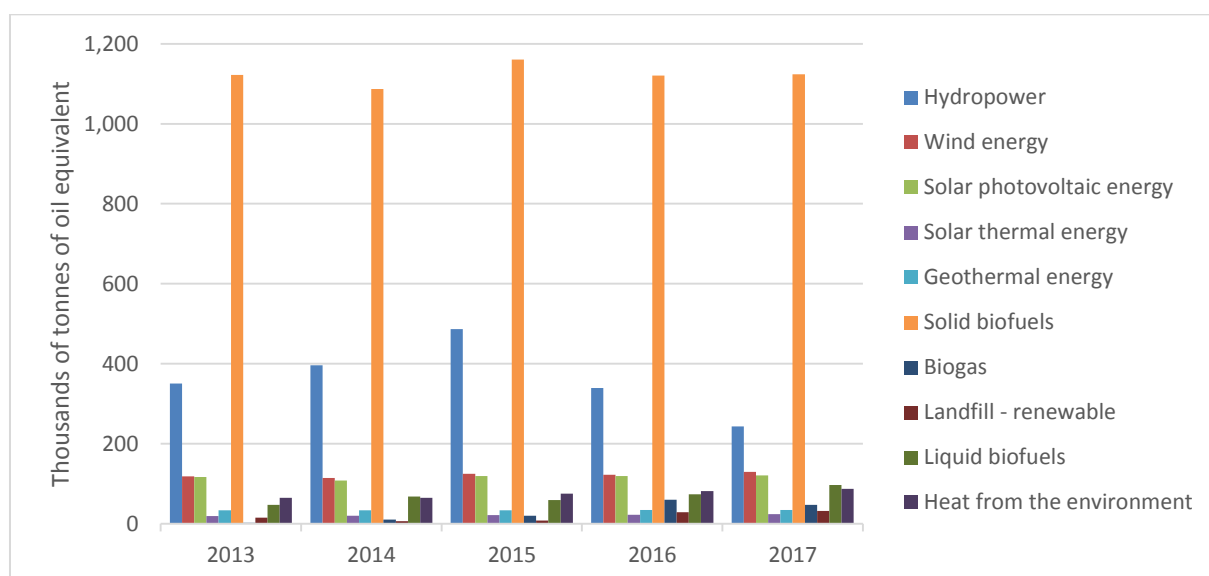


Fig. 6. Production of primary energy by RES types for the period 2013-2017

4. CONCLUSION

In conclusion, we can formulate the following conclusions:

- measures taken by the EU to stimulate bioenergy are yielding results, but in recent years the expected growth rate has not been observed, which casts doubt on the 2020 targets;
- thanks to innovations in renewable energy technologies, the prices of the energy they receive can compete with the prices of energy from traditional fuels, which increases their attractiveness;
- the EU provides the necessary funding for the development of innovation by supporting climate change mitigation projects;



- - European policy prioritises the use of biomass waste by launching a project through the Joint Research Center for a global analysis model on biomass availability and its sustainability (environmental, social and economic) in the long term;
- after reaching the 2020 target for 20% of RES in the Bulgarian energy mix, a decrease in the share of RES in Production of primary energy is observed;
- in terms of bioenergy in Bulgaria, the main source is solid wood which is burned directly;
- Bulgaria does not maintain statistical information on waste biomass, which is an attractive source of bioenergy with the lowest cost of energy received;
- it is necessary to take measures for monitoring and evaluation of waste biomass in Bulgaria, which will also achieve good environmental impact.

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AIR HEATING IN CENTRIFUGAL FANS – RESEARCH AND ANALYSIS

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Abstract: The work is devoted to the study of a centrifugal fan and the aerodynamic heating of the air in the flow part of the fan. An overview of the basic theoretical and practical approaches to determining the air heating in a fan is made. Studies have been carried out on a medium-pressure centrifugal fan with various methods of regulating it and their effect on air heating.

Keywords: Centrifugal fan exploration, aerodynamic air heating in a fan, fan characteristic.

1. INTRODUCTION

The heating of the air in the process of pumping it into the fans is negligible, in some cases, even registering it is difficult. It depends on the type of fan, the degree of pressure increase in the fan, the way the fan-driven motor is connected and other factors. However, there are cases associated with the heat treatment of the air - especially when it is cooled and the choice of cooling equipment, when this heating needs to be taken into account. In the design of ventilation systems, and in particular of air-conditioning systems, the issue of the temperature of the pumped air (after the fan) is important - it refers to the output parameters of the treated air. The purpose of this work is to review different methodologies and recommendations for taking into account the heating of air in fans, to experimentally test these dependencies and their conditionality, factors of dependence.

2. OVERVIEW OF THEORETICAL AND PRACTICAL APPROACHES FOR DETERMINING THE HEATING OF AIR IN A FAN

Ventilation system issues are being actively and thoroughly investigated [1], [2], [3]. The process of aerodynamic heating of the air in the fan is related to the friction resistance at the air-wall boundaries or to the air flow determined by the viscous friction forces. In essence, this is the conversion of the kinetic energy of the gas into thermal [1], [4].

1. The equation of the first law of thermodynamics for gas flow has the form:

$$dh + d(w^2/2) = c_p dT_i + d(w^2/2) = 0 \quad (1)$$

where h is the enthalpy of the air stream; w - flow velocity;

c_p - the specific heat capacity of the air.

Then the gas temperature is obtained:

$$T_i = T_o + w_o^2 / (2 \cdot c_p) \quad (2)$$

In practice, however, by accepting the process of increasing the pressure in the fan for adiabatic (excluding losses) the air temperature at the outlet of the fan is obtained:

$$T_2 = T_1 \cdot (p_2 / p_1)^{(k-1)/k} \quad (3)$$

where p and T are the pressure and temperature of the gas respectively: 1 - at the inlet and 2 - at the outlet of the fan;
 k - adiabatic index.

2. In fact, the process in the fan is polytropic. In this case too, taking into account the temperature factor, it turns out:

$$T_2 = T_1 (p_2/p_1)^{(k-1)/k} \cdot (1 + T_1/273) \quad (4)$$

where the polytropic index is:

$$n = [1 - (k - 1) \cdot N_f / (\kappa \cdot p_2 \cdot Q_f)]^{-1} \quad (5)$$

3. In practice, a method [5] is also applied in which approximate dependencies are proposed for determining the increase in the gas temperature of the fan:

$$\Delta t = 0,8 \cdot (N_f \cdot 10^{-3} / Q_f) \quad (6)$$

where N_f is the fan power [W];

Q_f - fan volume flow rate [m^3 / s];

0,8 - coefficient taking into account the specific heat capacity of the air.

The power consumed by the fan when neglecting the air compressibility (with an error of up to 1% at a pressure of $p < 3000$ Pa) is defined here as:

$$N_f = Q_f \cdot (p_2 / \eta) \quad (7)$$

η - fan efficiency.

or
$$N_f = \frac{\kappa}{\kappa - 1} \cdot p_{01} \cdot Q_f \cdot \left[\left(\frac{p_{02}}{p_{01}} \right)^{\frac{\kappa - 1}{\kappa}} - 1 \right] \quad (8)$$

p_{01} ; p_{02} - absolute inlet and outlet pressures of the fan.

4. In the practice of ventilation and air-conditioning systems, other standards [6], [7] are recommended, in which the air temperature after the fan is determined by the approximate dependence:

$$t_2 = t_1 + 0,001 \cdot p_v \quad (9)$$

where p_v is the total pressure of the fan, Pa;

t_1 - the air temperature at the fan inlet, $^{\circ}C$.

If the air is pre-treated (heated, cooled) this is taken into account by the specific air temperature at the inlet of the fan – t_1 . Or is the fan heating the air:

$$\Delta t_f = 0,001 \cdot p_v \quad (10)$$

Some other authors directly recommend especially for fan-bought engines:

$$\Delta t_f = 0,5 \dots 1^{\circ}C \quad (11)$$

5. In the Guide [8], the approach is more basic - to determine the increase in the air temperature in the fan (from the fan and the motor), the dependence is given:

$$\Delta t = \Delta p_v / (1000 \cdot \eta_f \cdot \eta_e \cdot \rho_a \cdot c_p) \quad (12)$$

where η_f is the fan efficiency;

η_e - the efficiency of the motor (if the engine is out of flow $\eta_e = 1$);

ρ_a - air density (kg / m^3);

c_p - specific air heat capacity ($kJ / kg.K$).

6. In the manual [9], the air heating in the fan is determined by calculating the increase in the specific enthalpy of the air in the fan - by analytical dependence or nomogram.

7. The location of the fan-driven motor is crucial. There are several options:

- the engine is not directly connected to the fan shaft but through a belt or other gear and is out of the air flow;

- the motor is directly connected to the fan shaft (flange mounting for the fan housing), but is outside the air flow;

- the motor is directly connected to the fan shaft and is located in the air flow - duct fan.

In the third case (and to some extent the second one) the process in the fan is not adiabatic as long as the heat equivalent to the losses in the motor is supplied to the air – $N \cdot (1 - \eta_e)$. Then the additional heating of the air with full absorption of this heat will be:

$$\Delta t_e = N \cdot (1 - \eta_e) / (\rho \cdot c_p \cdot Q_f) \tag{13}$$

3. EXPERIMENTAL RESEARCH ON AIR HEATING IN A CENTRAL VENTILATOR AND ANALYSIS

In the present work, an investigation of the process of ultimate heating of the air in a fan was carried out. The fan is type ART 200/2 ("Tangra"). In particular, it is a centrifugal fan; average pressure; the impeller is with the blades turned in front; the drive motor is coupled directly to the fan on a single shaft.

The test is carried out on a stand with a schematic diagram shown in Fig. 1.

A standard suction nozzle 1 with a Testo 510 differential pressure gauge 6 is used to measure fan volume flow. The total fan pressure is measured with a Testo 510 differential pressure gauge 7.

The system provides two ways to adjust the flow in the system:

- throttle control - with iris aperture 5;
- speed control - by inverter 3.

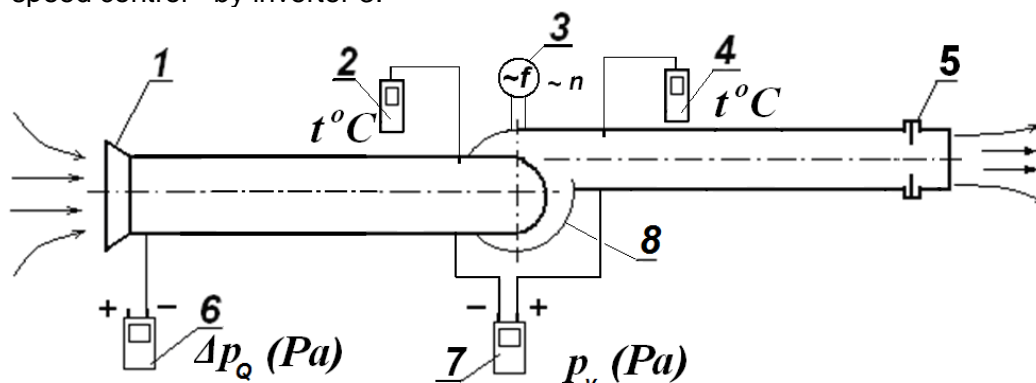


Fig. 1 Schematic diagram of a stand for testing the air heating in a fan: 1 - flowmeter "suction nozzle"; 2, 4 - thermometers; 3 - inverter (frequency adjustment ~ n); 5 - iris aperture; 6, 7 - differential pressure gauges; 8 - centrifugal fan type ART 200/2 ("Tangra").

A.) Several studies have been conducted. With the constant resistance of the pipe network (the position of the adjustable iris aperture 5 is constant) and when the fan speed is changed (by 3), the total pressure created by the fan and the change in air temperature Δt - ie, are examined. the temperature difference after the fan and before the fan, measured by thermometers 4 and 2 respectively. The results of this study are given in Fig. 2. The graph also shows the linear correlation equation describing the dependence $\Delta t = f(p_v)$ and its correlation coefficient ($R^2 = 0.9143$). In this case, the linear nature of the equation agrees well with the recommended dependence (10) on the heating of the air in the fan:

$$\Delta t = 0,001 \cdot p_v - 0,0227 \tag{14}$$

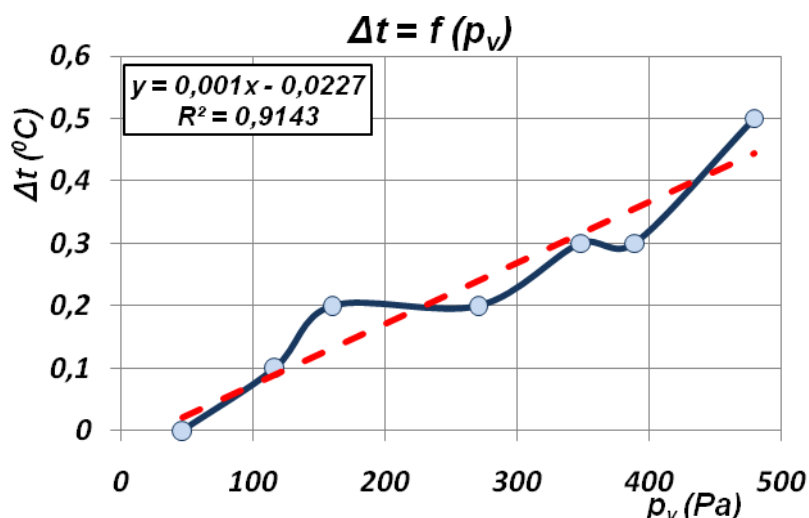


Fig.2 Increase of the fan air temperature depending on the total fan pressure - $\Delta t = f(p_v)$ - at frequency control

B.) In the test, when the speed of the fan-driven motor is constant, the system is adjusted throttle - by changing the position of the iris aperture 5. In Fig. 3 shows the results of the heating of the air in the fan depending on the flow rate - $\Delta t = f(Q)$ in two different studies of the tested fan (curves 1 and 2). Although the characteristic of the tested fan - $p_v = f(Q)$ given in figure 4 shows almost constant full pressure - $p_v = 1000... 1200 Pa$, and the expected increase in air temperature should be about $\Delta t = 1... 1,2^\circ C$ the results are different. In both studies, when the flow rate of the fan is lowered, additional air heating is observed and it reaches $\Delta t = 3... 4^\circ C$ with a minimum flow rate (with a minimum aperture opening). These results show that with throttle regulation of the flow rate in the system, the heating of the air in the fan can be higher than the one determined by the recommended dependences of $\Delta t = f(p_v)$ - simplified practical (10), (11).

In fact, air heating takes into account how much of the energy consumed by the fan is not used effectively to increase hydraulic parameters (pressure and flow). Again, dependencies (6), (12) taking into account the specific flow rate Q or the efficiency of the fan η_w are more true under the specific operating conditions. The papers [10], [11] specify the analytical dependence of $\eta_{em} = f(Q)$ and its maximum at nominal flow.

$$\eta = c \cdot Q^2 + d \cdot Q + e \tag{15}$$

Moving away from the rated fan operating mode - at high or especially low flow rates, η_f decreases significantly, and despite the reduction and the power consumption, the relative share of losses and air heating increase.

The results of the study of air heating in the centrifugal fan shown in Fig. 3 show other features. Although the studies are on a single fan, a noticeable difference in air heating is observed - in the second study the heating is greater by about $0,5^\circ C$ - $\Delta t_2 > \Delta t_1$. The explanation for this fact should be sought in the additional heating of the fan air caused by the heating of the motor directly coupled to the fan - i.e. heating $\Delta t = \Delta t_{em} + \Delta t_{e\theta}$. The warming up of the motor depends on the stage of operation, duration of operation, degree of load and other conditions, in general - difficult to calculate, predict and account for factors.

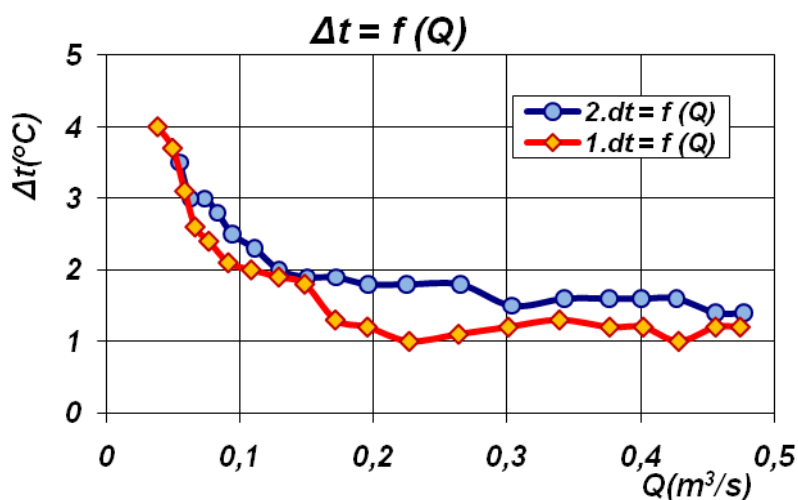


Fig.3 Increase of the fan air temperature depending on the fan volume flow – $\Delta t = f(Q)$ - with throttle control

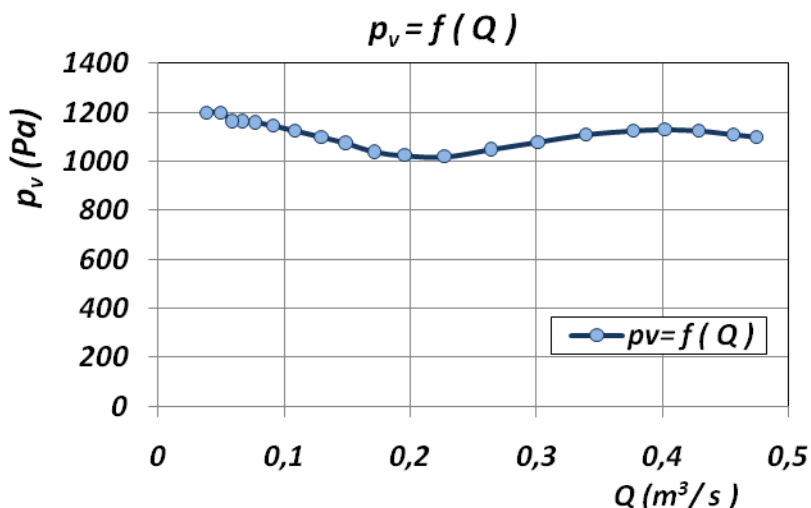


Fig. 4 Characteristics of the tested fan - $p_v = f(Q)$ (full pressure - flow rate) at constant speed

The present studies can serve as a good basis for a deeper and more accurate reading of the air heating in fans. They are needed : very accurate reading of the energy consumed by the motor and the efficiency of the motor, higher accuracy when measuring the air temperature in different sections. Essentially, these studies are at the heart of the complete energy balance of a working gas fan machine.

4. CONCLUSION

This study reviews various dependencies and recommendations for taking into account air heating in fans. Notwithstanding the slight change in air temperature during the operation of most fans, this issue is important, interesting and should be refined: in which cases warming should be taken into account or predicted. The study showed that such cases are:

- operating in medium and high pressure of ventilation systems. Then the recommended dependence on the heating of the air (10) is valid for the frequency regulation of the fan;

- throttle regulation of the ventilation systems and especially for the operation of the fans in the range of their nominal flow rates are far removed. Then the flow rate of the fan and the efficiency of the fan in the given mode should be taken into account - dependencies (6), (12);

- the additional heating of the air by the motor should be taken into account when motors are direct coupled to the fan, and especially when the motors work at their load limit modes for a long period of time

5. ACKNOWLEDGMENTS

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COMPLEX STAND FOR TESTING OF A GEAR PUMPS AND INVESTIGATION OF THE INFLUENCE OF THE HYDRAULIC OIL TEMPERATURE ON THE PUMP CHARACTERISTICS

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Abstract: *The work is devoted to the creation of a test bench for a gear pump with options for adjusting the parameters: operating fluid temperature, engine speed, pump load. An experimental study of the effect of hydraulic oil temperature on the characteristics of a gear pump has been made. An analytical dependence is proposed to determine the characteristic of a gear pump with regard to the temperature and pressure of the hydraulic oil.*

Keywords: *gear pump characteristic, volumetric flow rate, volume losses (leaks), heating of hydraulic oil.*

1. INTRODUCTION

The most common working hydraulic machines in the group of volumetric, rotary hydraulic machines are gear pumps. The reason for this widespread adoption is their manufacturability - easy fabrication, a wide range of structural and relevant hydraulic parameters, relatively low cost. They are used both in stationary pumping stations of metalworking machines and in mobile hydraulic installations - of transport, agricultural, road-building machines. This popularity makes them an interesting object for research and optimization - through field studies, mathematical models, numerical studies [1], [2].

The purpose of the present work is to create a comprehensive test bench for a gear pump capable of examining the influence of hydraulic oil temperature and engine speed on the pump performance, and to determine the analytical dependence of the pump performance on the heat of hydraulic oil.

2. THEORETICAL BASICS - BASIC PROVISIONS, PARAMETERS CHARACTERISTICS OF A TOOL PUMP

Dental pumps are of different types - by classification criteria, but the most common are those with external gearing. Figure 1 shows the construction of such a gear pump.

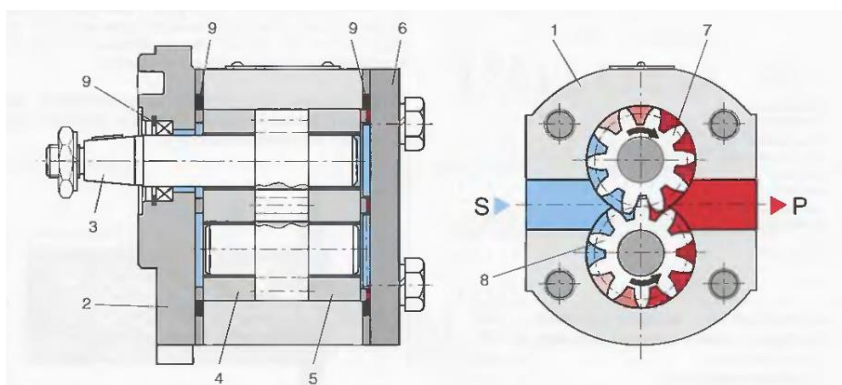


Fig.1 Design of a gear pump: 1- body; 2- front flange; 3 - drive shaft; 4 - front support bushing; 5 - rear support bushing; 6 - rear flange; 7 - a leading gear wheel; 8 - drive the gear wheel; 9 - sealing rings

Important parameters of gear pumps are:

- theoretical volume flow -

$$Q_t = q \cdot n \quad (1)$$

where q is the working (geometric) volume of the pump, cm^3 ;

n - engine speed, s^{-1} .

- volumetric efficiency -

$$\eta_Q = Q / Q_t \quad (2)$$

where Q - actual pump flow;

- volume losses (leaks) -

$$\Delta Q = Q_t - Q \quad (3)$$

-hydraulic (useful) pump power -

$$N_h = p \cdot Q \quad (4)$$

-full efficiency of the gear pump -

$$\eta = N_h / N_i \quad (5)$$

where N_i - input, power input - of the pump shaft.

-Input (drive) power of the pump -

$$N_i = M \cdot \omega \quad (6)$$

where M is the torque of the pump shaft;

ω is the angular velocity of the pump shaft.

The characteristics of the gear pump are:

- pressure - flow characteristic - $p = f(Q)$;

- the pump volume loss characteristic - $\Delta Q = f(p)$;

- the characteristic of the volumetric efficiency - $\eta_Q = f(p)$;

- power characteristic $N_i = f(p)$.

Essential for determining the actual flow rate of the pump Q and its volumetric efficiency η_Q are the internal volume losses (leaks) in the pump - ΔQ . Due to the nature of the flow of leaks in the pump, the working fluid - the hydraulic oil, especially its viscosity - has an important influence. Many studies seek the influence of the working fluid on the characteristics and effectiveness of the gear pumps - [3], [4], [6]. The dynamic viscosity of hydraulic oils depends to a large extent on the temperature and pressure of the liquid - $\mu = f(t; p)$. Many dependencies are known for the change in viscosity as a function of temperature and pressure. In [5], [7] they offer exponential dependencies:



$$\mu = \mu_o \cdot e^{-a(t-t_o)} \tag{7}$$

where μ_o is the dynamic viscosity at temperature t_o ;

a - coefficient for hydraulic oils in the range 0,025... 0,035.

$$\mu = \mu_o \cdot e^{b(p-p_o)} \tag{8}$$

where μ_o is the dynamic coefficient of viscosity at pressure p_o ;

b - coefficient for hydraulic oils in the range 0,02 ... 0,03.

Fig. 2 shows graphical dependences of the dynamic viscosity of the hydraulic oil MHL- 46 ($\nu_{40} = 46 \cdot 10^{-6} \text{ m}^2/\text{s} = 46 \text{ cSt}$; $\rho_{20} = 875 \text{ kg / m}^3$; $\mu_{40} = 0.0378 \text{ Pa.s}$) on temperature and pressure. The two dependencies of each graph correspond to the recommended exponential coefficients. The significantly greater effect of hydraulic oil temperature on viscosity in the relatively wide and practical operating ranges of temperature and pressure can be clearly seen.

For example:

- when the oil is heated from 20...80°C - its viscosity decreases from 0,07... 0,01 Pa.s - 7 times;
- at a pressure rise of 0...14 MPa - its viscosity rises from 0,038... ~ 0,055 Pa.s - 1,5 times.

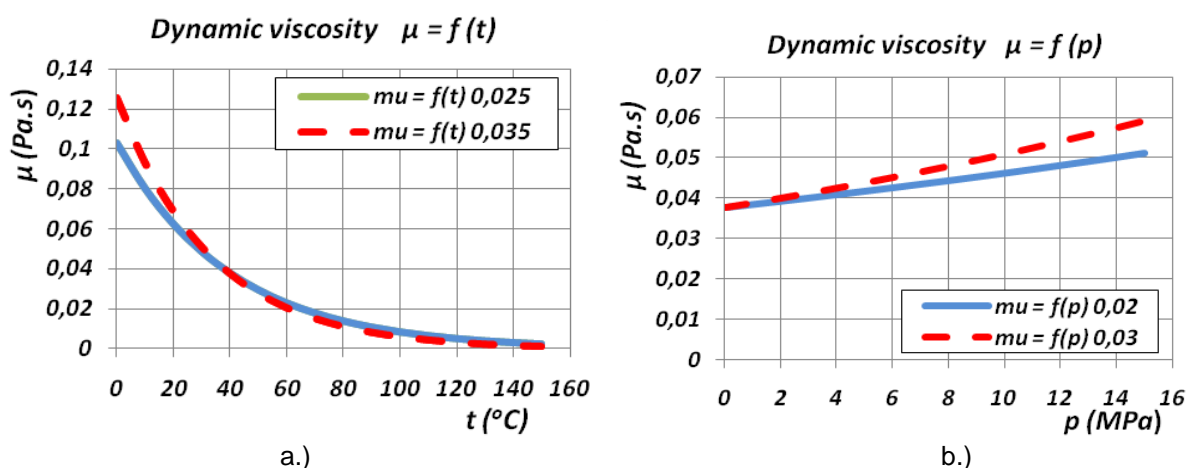


Fig. 2 Dynamic viscosity versus temperature

(a) $\mu = f(t)$ and pressure (b) $\mu = f(p)$

The dependence of the dynamic viscosity coefficient of hydraulic oil ($\mu_{40} = 0,0378 \text{ Pa.s}$ with coefficients $a = 0,025$ and $b = 0,025$) on temperature and pressure given in fig. 3 shows the greater influence of temperature on viscosity. As the oil temperature rises, the relative influence of pressure decreases.

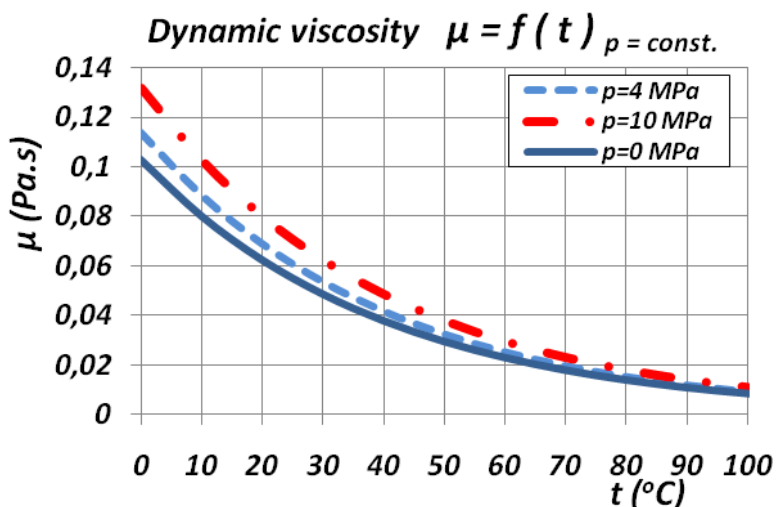


Fig. 3 Dependence of the dynamic viscosity on temperature at constant pressure ($p = 0; 4; 10$ MPa) - $\mu = f(t)$ $p = const.$

3. RESEARCH STAND AND RESULTS OF TOOTH PUMP TEST

In order to study the influence of different parameters on the characteristics of the gear pump, a hydraulic stand was designed and constructed. The complex nature of the stand is determined by the possibilities provided for multi-parameter testing: change of the hydraulic oil temperature, regulation of the system resistance (pressure), change of the speed of the drive motor. The layout of the stand is shown in fig. 4.

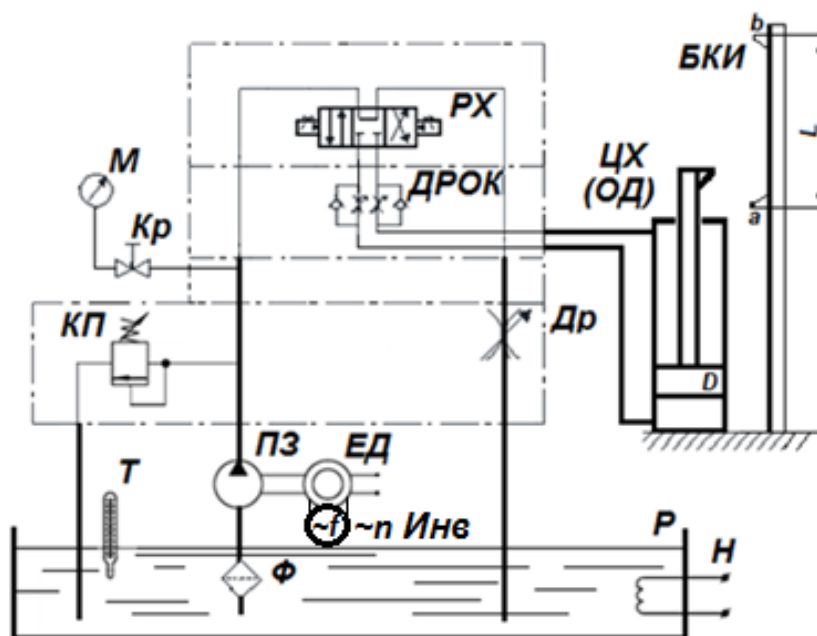


Fig. 4 Schematic diagram of a hydraulic pump test bench:
 Др - adjustable throttle; КП - safety valve; М - pressure gauge; ПЗ - gear pump; ЦХ (ОД) - hydraulic cylinder (volumetric flowmeter); Кр - the crane; ЕД - electric motor; Инв -

inverter (frequency control ~ n); Φ - filter; H - heater; T - thermometer; PX - hydraulic distributor; ДРОК - adjustable throttle with check valve; БКИ - block limit switches

Tested gear pump ПЗ is small size - type 10С1Х302, working volume $q = 1 \text{ cm}^3 / \text{rev}$.

The stand provides hydraulic loaders for the system – ДРОК chokes.

An original device for measuring the volume flow of a gear pump is used - it consists of a hydraulic cylinder ЦХ and a block of limit switches БКИ, by which the exact volume of the hydraulic cylinder and the time for its filling are measured automatically. This volumetric flowmeter enables relatively rapid and accurate measurements of the flow rate of the gear pump under different test conditions.

$$Q = W / \tau \tag{9}$$

where $W = (\pi \cdot D^2 / 4) \cdot L$ - is the volume filled in the hydraulic cylinder;

τ - the time to fill the volume.

The heater H (2.5 kW) built into the stand and the speed controller of the inverter motor Ине allow testing at different temperatures of the hydraulic oil and the speed of the pump. Systems for stabilizing these parameters are also provided.

The hydraulic oil with which the stand is loaded is type MHL- 46, kinematic viscosity $\nu_{40} = 46 \text{ cSt}$ and density $\rho_{20} = 875 \text{ kg} / \text{m}^3$.

Investigation of the volume flow from the pump (at constant speed) at 5 different temperatures of hydraulic oil - $t = 25; 46; 55; 70; 85 \text{ }^\circ\text{C}$. The characteristics of the pressure-flow pump - $p = f(Q)$ given in fig. 5 are for different temperatures of the working fluid.

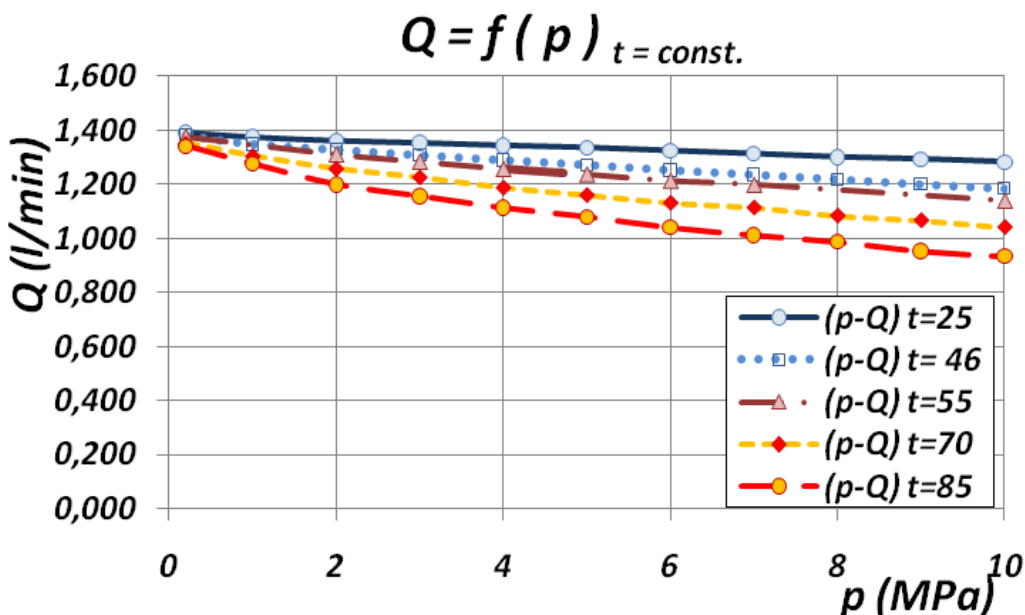


Fig. 5 Characteristics of a pressure - flow gear pump $p = f(Q)$ at a constant temperature of the hydraulic oil

The almost linear nature of the dependence $Q(p)_{t = const.}$ confirms the hypothesis of the laminar mode of the main flow of the gear pump. Even at elevated temperature (curve with $t = 85^\circ\text{C}$) the linear dependence is relatively well defined.

Things are different with the dependence of the volume losses of the pump - the characteristic $\Delta Q = f(p)_{t = const.}$ - fig.6. There, already, the dependence, especially as the temperature rises ($t = 55; 70; 85^\circ\text{C}$), has a more pronounced quadratic character, which proves that the flow in the recesses (albeit small) already passes from laminar to turbulent.

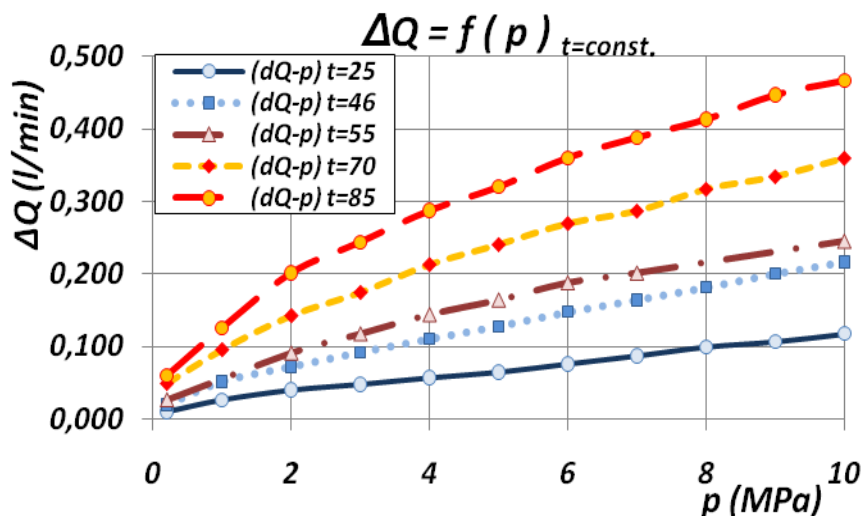


Fig. 6 Characterization of the volume losses of the pump - $\Delta Q = f(p)_{t=const.}$ at constant temperature of the hydraulic oil

4. DETERMINATION OF ANALYTICAL DEPENDENCE OF THE PUMP CHARACTERISTICS

A.) In [8] the linearized pressure-flow experimental characteristic $p = f(Q)$ of the gear pump at different hydraulic oil temperatures is described with the dependence of:

$$Q(p) = Q_0 - A \cdot p \tag{10}$$

where Q_0 is the volume flow rate of the pump at $p = 0 \text{ MPa}$ (corresponds to the theoretical flow rate Q_t);

A - summation coefficient depending on the pump design (geometric parameters - gaps), the type of working fluid, the temperature of the fluid.

By linearizing the characteristics of the pump at different temperatures, the dependence $A(t)$ was obtained from the analytical expressions for the generalized coefficient A according to (10). However, it must be noted that the coefficient A depends on the variable viscosity of the oil, which is a function of temperature and pressure - $\mu = f(t; p)$. The dependence of this coefficient $A(t)$ on the pump under study is shown in fig. 7, where the analytical and approximate dependence of $A(t)$ is of the form:

$$A(t) = c \cdot t^d \tag{11}$$

where c, d are the coefficients of the approximating power function. For our particular case, the coefficient A and the pump characteristic are:

$$A = 0,0003 \cdot t^{1,0772}$$

$$Q(p) = 1,4 - 0,0003 \cdot t^{1,0772} \cdot p \tag{12}$$

The inaccuracy of these conclusions is determined by the conditional nature of the linearized characteristics of the pump. For a more accurate approximation, it should be taken into account that both the dynamic viscosity and the coefficient A are a function not only of temperature but also of pressure - $A(t; p)$. However, the above procedure allows one to determine the characteristic of a gear pump at different operating temperatures of the hydraulic oil.

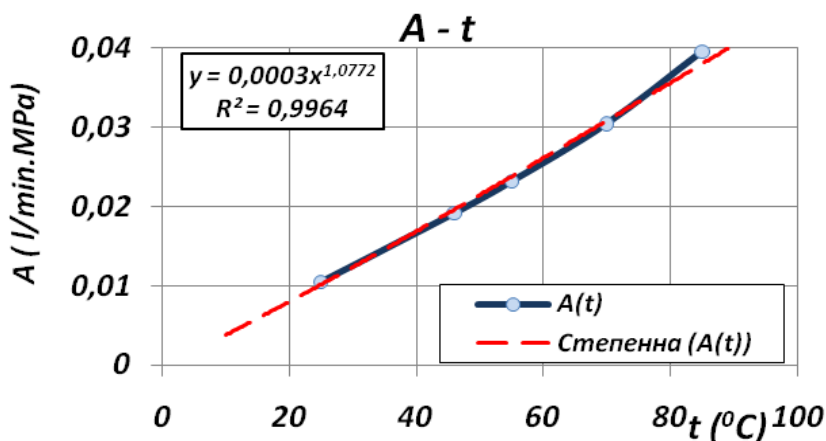


Fig. 7 Analytical processing of the generalized coefficient A (t).

B.) In search of more accurate analytical dependences for the characteristic of a gear pump after a thorough analysis of the volume losses of the pump - $\Delta Q = f(p, t)$ in fig. 6 and the determination of approximation equations of the obtained experimental results, the dependencies are proposed:

$$\Delta Q(p; t) = c \cdot t^d \cdot p^{(-e \cdot t + f)} \quad (13)$$

$$Q(p; t) = Q_0 - c \cdot t^d \cdot p^{(-e \cdot t + f)} \quad (14)$$

where c, d, e, f are coefficients determined experimentally.

In this way volumetric losses are presented as a complex exponential function of pressure where:

- coefficient A before the power function of pressure is the power function of temperature - $A = c \cdot t^d$;

- the degree of pressure is a linear function of temperature - $p^{(-e \cdot t + f)}$.

The determination of all coefficients is shown in fig. 8.

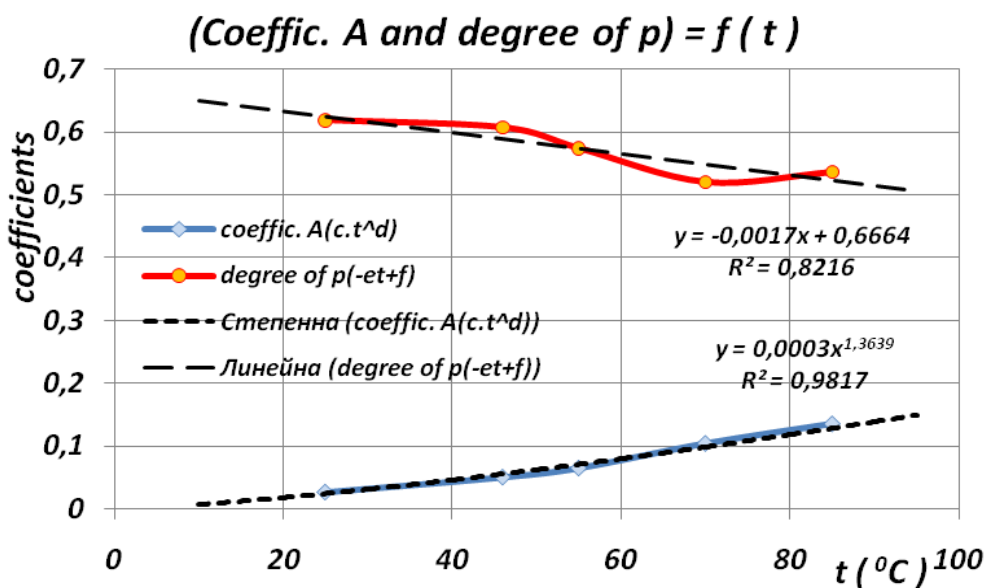


Fig.8 Determination of the coefficients (c, d, e, f) of the analytical dependence of the characteristic of the gear pump

Following the specific solution of the task of determining the analytical expression of the characteristics of the test gear, the following results are obtained:

- for volume losses

$$\Delta Q(p, t) = 0,0003 \cdot t^{1,3639} \cdot p^{(-0,0017 \cdot t + 0,6664)} \quad (15)$$

- for pump flow rate

$$Q(p; t) = 1,4 - 0,0003 \cdot t^{1,3639} \cdot p^{(-0,0017 \cdot t + 0,6664)} \quad (16)$$

5. CONCLUSION

A complex stand has been set up for pump test. The pump was tested at different temperatures of the hydraulic oil.

A method for determining the analytical expression of the characteristic of a pump - $Q(p, t)$ is proposed.

After processing the test results, an analytical expression (14) was obtained to characterize a gear pump depending on the pressure and temperature of the working fluid:

$$Q(p; t) = Q_0 - c \cdot t^d \cdot p^{(-e \cdot t + f)}$$

The coefficients of this analytical expression were also found to determine the specific characteristic of the test gear pump (16) when operating with hydraulic oil at different temperatures.

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IMPORTANCE OF BIOECONOMY TO STIMULATE THE BULGARIAN ECONOMY

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Abstract: *Tackling the problems of world population growth, the rapid depletion of resources, climate change and the growing threat to the environment call for Europe to radically change its approach to the production, consumption, processing, storage, recycling and landfilling biological resources. Strengthening the bio-economy as a key EU policy will lead to a sustainable solution to these problems and will improve the economic and environmental situation in Europe for providing its inhabitants.*

On an international scale, documents relevant to the future of humankind are adopted to stimulate the development of the bio-economy as a basis for the ecological and environmentally sound development of the world economy. Legislative measures are also underway in Bulgaria to stimulate the introduction of sustainable production and consumption patterns that are tailored to the capacity and potential for ecosystem recovery and do not cause environmental degradation.

The purpose of this report is to assess the importance of the measures taken and the results achieved in introducing innovative methods and ideas based on renewable and not exhaustible natural resources so that each region can benefit from its natural capital.)

Keywords: *(Bioeconomics, Renewable energy sources, sustainable production patterns, Effective use of resources.*

1. INTRODUCTION

Global challenges, such as climate change, land degradation and ecosystems, and the growing population puts the need to find new modes of production and consumption that are tailored to our planet's environmental capacity. At the same time, the need for sustainable development is a strong incentive to modernize industry and strengthen Europe's position in a highly competitive global economy, which will ensure its prosperity for its citizens. This drives the transition to a low-carbon, climate-resilient, resource-efficient, low-carbon economy in line with the 17 UN Sustainable Development Goals 2030 adopted. EU economic growth needs to become less dependent from non-renewable resources so as to optimize the use of sustainably managed renewable resources.

In 2015, the European Commission adopted a plan to accelerate Europe's transition to a circular economy, which aims to "close the circle" of the product lifecycle - from production and consumption to waste management and the secondary raw materials market. The plan identifies priority sectors that will accelerate the transition along the value chain (plastics, food waste, critical raw materials, construction and demolition, biomass and bio-based materials). A key point in the plan is the transformation of waste into resources and the closure of the recovered material chain, which substantiates the importance of the bioeconomy as a priority for the development of a sustainable economy.

The bioeconomy covers all sectors and systems that rely on biological resources (biomass from animals, plants, microorganisms, including organic waste), their functions and principles. It includes and interconnects: terrestrial and marine ecosystems and the services they provide; all primary production sectors using and producing biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors

using biological resources and processes for the production of food, feed, organic products, energy and services. For the European bioeconomy to be successful, it must be based on sustainability and circularity.

The purpose of this report is to assess the importance of the measures taken and the results achieved in introducing innovative methods and ideas based on renewable natural resources so that our region benefits from its natural capital.

2. THE IMPORTANCE OF BIOECONOMICS FOR THE SUSTAINABLE DEVELOPMENT OF THE EUROPEAN UNION

On 13 February 2012, the European Commission adopted the Innovation for Sustainable Growth: A Bioeconomy for Europe strategy and a plan for its implementation. The natural resources that Europe and indeed the world are facing today. It sets out the ideas for strengthening and scaling up the biobased sectors, expanding investment and markets, accelerating the development of local bioeconomies in Europe, exploring the environmental aspects of the bioeconomy to ensure food security, sustainable management of natural resources, reducing dependency on non-renewable resources.

Another important document in EU-initiated international policy is the UN 2030 Agenda for Sustainable Development (adopted on 25 September 2015 at the Summit in New York). It aims to improve people's lives by responding to the needs of the current generation without compromising the ability of future generations to meet their own needs. The program is based on a holistic approach that integrates mutually reinforcing economic, social and environmental considerations. It addresses environmental debt issues, ie with over-consumption of resources that ecosystems cannot restore, so-called. an imprint of humanity. It is connected not only with the depletion of resources, but also with the accumulation of waste. Despite the measures taken internationally, energy consumption does not decrease at the projected rate and there is a high risk that the targets for reducing global warming by the limit of 1.5 °C may not be met [6]. Each year, the date from which humanity enters into an ecological debt to nature is shifting ever earlier, for 2019 the date is 29 July.

The analysis [1] of the measures taken to stimulate the bioeconomy shows that in 2015 over 18 miln. people were employed in sectors related to it, mainly in agriculture and the food industry, with the bioeconomy generating 4.2% of EU GDP and accounting for 8.2% of the EU workforce, 2.3 realized EUR 3 trillion or EUR 620 billion in value added (Figure 1) [2].

According to EC estimates, by 2030, the bioindustry can create up to 1 million new jobs. It will make an important contribution to the achievement of the renewable energy targets, increasing their share from 27% in 2020 to 32% in 2030. The aim is to achieve the following bioeconomic parameters:

- annual turnover of € 2 trillion;
- € 621 billion in value added;
- 4.2% of EU GDP;
- over 18 million employed in EU countries.

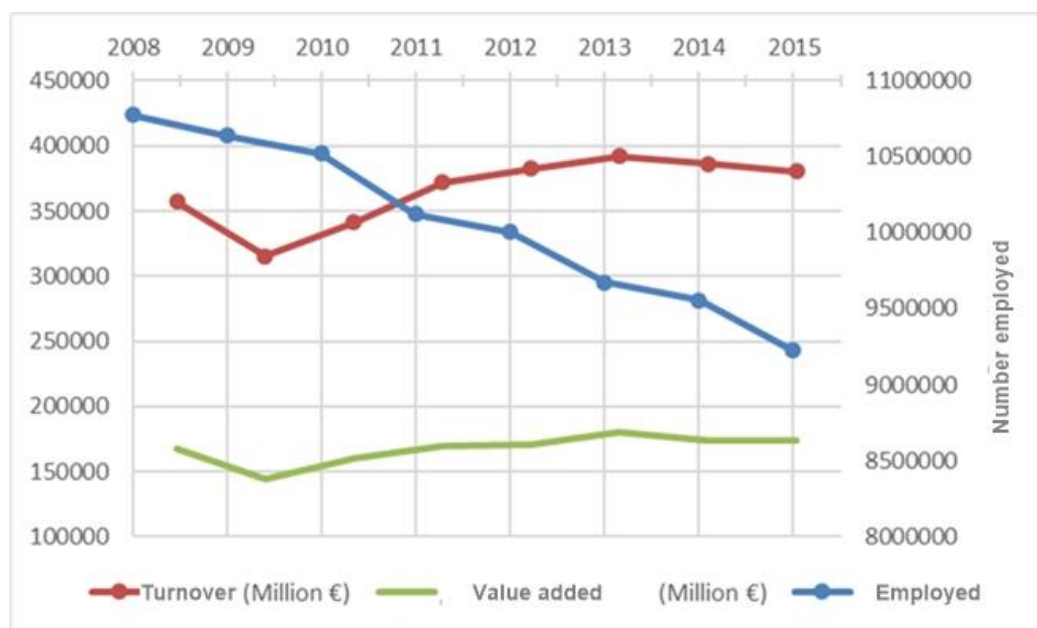


Figure 1. Economic indicators for assessing the impact of the bioeconomy in the period 2008-2015

At the meeting of the Special Committee on Agriculture of 5 February 2018 and the Committee on Agriculture and Fisheries of 19 February 2018, the review of the EU Bioeconomy Strategy of 2012 was discussed, outlining broad agreement on the potential of bio-economy for agriculture and the need for farmers to be better integrated into the bio-economy value chain.

As a result of the analysis of the implementation of the Strategy, on 11 October 2018, the Commission published the Communication on 'A sustainable bioeconomy for Europe: strengthening the link between the economy, society and the environment' [7], updating the EU's 2012 Bioeconomy Strategy and an accompanying action plan is presented. the Action Plan identifies 14 key actions to pave the way for a sustainable and circular bioeconomy, addressing three main priorities:

- Strengthening and expanding organic-based product sectors, expanding investment and markets;
- Rapid implementation of local bioeconomies across Europe;
- Understanding the environmental boundaries of the bioeconomy.

In its Annual Report, the European Parliament [3] underlines the important role of the bioeconomy in tackling climate issues and the role of national governments in the implementation of European policies. Opinion of 15.5.2019 Opinion of the European Economic and Social Committee on the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - A sustainable bioeconomy for Europe: strengthening the link between the economy, society and the environment "Emphasizes the need for a long-term, consistent and effective policy to promote the bioeconomy. Despite the successes achieved, the key to effective bioeconomic policy lies in finding synergies between policy areas in a way that takes into account the goals of sustainable food production, sustainable management of natural resources, balanced territorial development in rural areas and secure and dignified livelihood.

In 2019 in developing the future Common Agricultural Policy (CAP), the European Commission (EC) is actively working on the establishment of national bioeconomic development strategies. Figure 2 presents information on the different degree of attention to the development of the bioeconomy in EU Member States by March 2018.

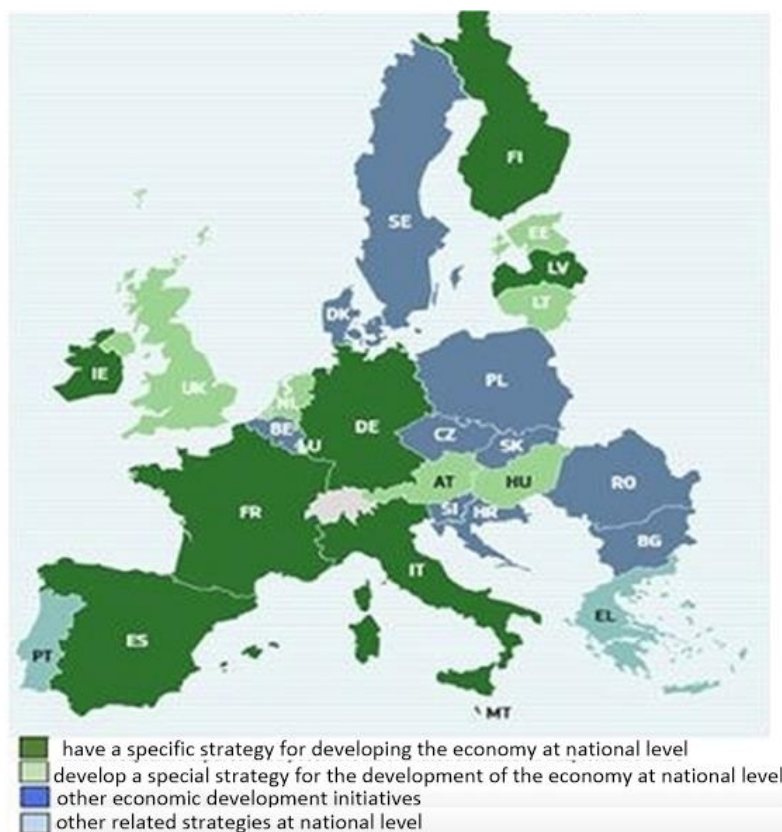


Figure 2. EU Member States' bioeconomy policy [9]

3. IMPORTANCE OF BIOECONOMICS FOR SUSTAINABLE DEVELOPMENT OF BULGARIA

The Bulgarian economy continues to be one of the most energy-intensive and one of the largest carbon-intensive economies in the EU. Despite the significant drop since 1990 (60% in carbon intensity and 39% in energy intensity), Bulgaria still emits 4.3 times more emissions than the EU average and consumes 3 times more energy per unit of GDP (European Commission, 2017 .). In addition, according to Eurostat data for 2018, Bulgaria is one of the last places in GDP per capita.

In the annual report of the Institute for Economic Research at BAS for Bulgarian Economic Development for 2018. the main structural weaknesses of the Bulgarian economy are indicated - low, unstable and unbalanced growth in the country; insufficient domestic and foreign investment in their priority focus on the non-tradable sector of the economy, contraction of corporate profits and disposable income for investment, etc., which are to a large extent characteristic of all countries with catching-up development in Central and Eastern Europe. Limited investment - local private investment, foreign direct investment and investment credit - cannot be fully offset by low-performing public investment, which largely



depends on the flow of European funds, and provide a sufficiently resilient cyclically-fluctuating internal economic environment.

All this implies the development of new strategies that could most logically be based on the introduction of policies for the development of a sustainable, circular bioeconomy. This will boost Bulgaria's economic development, drawing on the experience gained by other EU Member States.

As a member of the European Union, Bulgaria follows European policies, including in the field of bioeconomic development. This is enshrined in the Innovation Strategy for the Intelligent Specialization of the Republic of Bulgaria for the period 2014-2020, where one of the two main strategic goals is the efficient use of resources while reducing carbon emissions and preventing the loss of biodiversity, ensuring that present and future needs are optimally of the population. Improving Bulgaria's position in terms of competitiveness and moving our country up in the global and European rankings in the Strategy are set as priorities to introduce sustainable production and consumption models that are consistent with the capacity and capacity to restore ecosystems and do not cause environmental degradation and the introduction of innovative methods and ideas based on renewable rather than exhaustible natural resources, so that each region benefits from its natural capital. These priorities are directly related to the ideas contained in the concept of a circular economy.

The adopted Ministry of Agriculture, Food and Forestry website can find the adopted policies and programs in the main sectors of the bioeconomy - agriculture, forestry, agriculture, fisheries, organic production, etc., but Bulgaria has not yet developed a specific development strategy of the national economy. In this regard, at the end of October 2018, the Chairman of the Bulgarian Agricultural Academy (SAA) Prof. Vasil Nikolov announced that a strategy for bioeconomics was being prepared. No such discussion paper has yet been submitted. It is necessary to speed up the development of a national strategy that focuses public attention on the benefits that the development of the bioeconomy will have for the national economy.

In Bulgaria, there is still no common basis for available potential resources for bioeconomic development. Statistics are presented by economic sectors, which makes it difficult to assess the potential for the development of new technologies based on the development of the bioeconomy. A Joint Research Center with the Commission for Science and Knowledge has been set up at the European Commission [10]. It hires research scientists to provide independent scientific advice and support for EU policy. One study is to develop a common platform that provides information on the available resources for bioeconomic development both in quantity and at location, thus facilitating their economic evaluation and the possibility of new industries emerging. In the next programming period, funding is foreseen within 100 mil. EUR to build a platform where this information will be made available. This will require European countries, including Bulgaria, to be prepared to provide up-to-date information, which necessitates a change in the indicators by which the national statistical authorities provide the data.

Another area of support for the development and understanding of the need for the bioeconomy are various EU funded projects, such as those funded by Horizon 2020. Bulgaria has limited involvement in these projects. An example of a project in support of the bioeconomy is BioSTEP, led by the German Ecological Institute.

Bulgaria is an associate member of the BIOEAST initiative - the Central and Eastern European Knowledge-based Agriculture, Aquaculture and Forestry Initiative, which offers a shared strategic framework for research and innovation to work for sustainable bioeconomies in Central and Eastern Europe [8].

There are other initiatives that are rather sporadic and not supported by a comprehensive national policy. The most developed sector in Bulgaria based on the bioeconomy is bioenergy. This fact is due to a long-standing targeted national policy in support of increasing the use of renewable energy sources (RES). According to data from the National Statistical

Institute, the share of renewable energy in gross final energy consumption for 2017 it amounts to 18.7% and 7.2%, respectively, in transport fuels, which exceeds the targets set for the European targets.

The main problem here is that 58% of primary energy production from RES is from traditional solid biofuel - wood. It is necessary to widen the spectrum of use of different RES and to pay special attention to waste products, including municipal waste, keeping statistics on their quantity and location, which will facilitate the construction of facilities for their treatment.

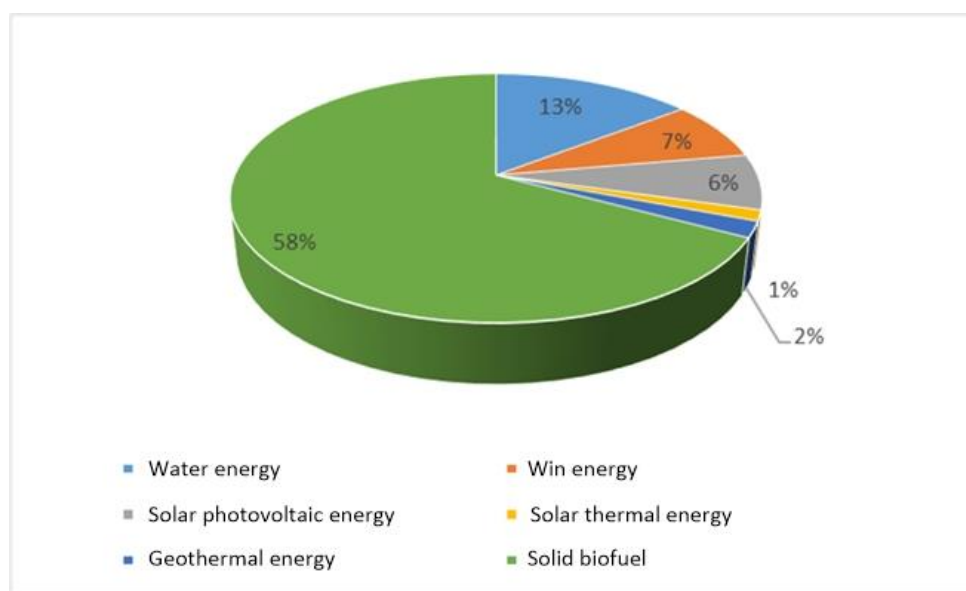


Figure 3. Share of RES types in Primary Energy Production, 2017 according to NSI data [5]

3. CONCLUSION

Analyzing the European policy towards the transition to a sustainable circular bioeconomy, it was found that the EU is pursuing a long-term, targeted policy to increase its importance globally, as evidenced by the increased annual turnover, added value and employment in the main sectors of the bioeconomy in EU countries.

The European Union invests a lot of financial resources to stimulate the bioeconomy not only as a direct investment, but also in the development of scientific innovation, such as the Regional Bioeconomic Strategies will be the highlights of Horizon 2020 in 2020, and in the 40 largest initiatives nearly € 2 billion will be invested in the bioeconomy sector.

The chance for stabilization and development of the Bulgarian economy is to take rapid measures to stimulate the bioeconomy on a national scale by adopting institutional policies, introducing the innovations achieved internationally and actively participating in European initiatives and funding opportunities for research. Although the field of bioenergy Bulgaria has met the set goals, it is necessary to work towards diversification of the used RES, paying special attention to the generated waste, including household waste.

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ON THE IRRIGATION WATER FLOWS AND SOIL EROSION PROCESSES

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Abstract: *The water flows for surface irrigation processes are determined by the amelioration and agronomic condition of the irrigated cultures and the physical-and-mechanical parameters of the soil. The state of erosion process occurs at the boundary between the soil's resistance forces and the flow's velocities and their hydraulic forces.*

This condition is most often expressed in terms of the time-averaged velocities which are not real in each points of cross section of the water flow. The real velocities which cause erosion are pulsation velocities into the water flow and they are irregularly variable, with varying repetition and magnitude. Based on analytical studies, there is established and offered a range of the optimal probability values of these pulsation velocities for which the soil has adequate safety against erosion for the applicable flow velocities.

Keywords: *soil erosion, surface irrigation, water flow velocity, pulsation velocities.*

1. УВОД

Въпросът за почвената ерозия при напояване на агро културите, особено при гравитачно напояване, е твърде актуален. При напояване на земеделските площи водните течения се реализират гравитачно по почвената повърхност под формата на напоителни бразди или лехи, скатово напояване и др., като по дължината на почвеното летло на браздите или др., хидравличния режим на течението обикновено е турбулентен.

Традиционно взаимодействието между почвата и водните течения, било в напоителни бразди, скатово напояване или др., се разглежда и експонира посредством времево осреднени скорости на течението в неговото напречно сечение. Този подход се базира на широко разпространените монографии и разработки (Гончаров В.Н. 1954, Мирцхулава Ц.Е. 1970 и др.), където хидродинамичният аспект на взаимодействието между почвената повърхност и водното течение се мотивира посредством средните скорости по вертикалата на сечението на течението.

При такива гравитачно формирани течения се предизвикват ерозионни процеси върху почвената повърхност. В основата на ерозионния процес е динамичното въздействие на течението върху почвата, определено на базата на средните по вертикалата скорости, респ. средните на течението. Но тези скорости при турбулентните течения, каквито са почти винаги теченията предизвикващи ерозиране, са приведени и осреднени от множество скорости по вертикалата на сечението и затова са един вид фиктивни, които буквално и реално не съществуват.

В същност обаче, реално проявяващите се скорости са пулсиращи, нерегулярно променливи, известни в специализираната литература под наименованията „пулсационни“ или „мигновени“. Тяжната величина и динамика на действието им и на произтичащите от тях хидродинамични сили са твърде различни от съответните при средните скорости.

2. ПОДХОДИ И МЕТОДИ

Изхождайки от същността на турбулентните течения, е установено, че скоростите в напречното сечение на течението са пулсиращи и твърде променливи във времеви аспект и това всъщност са реалните скорости на водното течение. Тези пулсиращи скорости, наречени пулсационни, се реализират и между почвените частици (агрегати) на почвената повърхност и оказват въздействие върху тях, което и формира ерозионния процес.

Ерозионните процеси на земната повърхност и в частност на почвената повърхност са обичайна даденост и са широко разпространени природни явления. Конкретно за обработваемите площи те се осъществяват когато силовото въздействие на водното течение върху почвената повърхност надвишава съпротивителните сили от сцепление и др. на обтичаните почвени частици. Видно е, че ерозионния процес настъпва когато хидродинамични сили на течението получат стойности по-големи от съпротивителните сили на обтичаните почвени частици или агрегати. Тези съпротивителните сили зависят от физико-механичните показатели на почвата, едрината и формата на частичките, сцеплението между тях и др., докато хидродинамичните сили са функция на пулсационните скорости на течението и тяхното нерегулярно изменение.

При ерозионните процеси, проявяващи се почти винаги вследствие на водни течения с турбулентен хидравличен режим, скоростите на течението, които са носители на ерозиращото влияние, са пулсиращи по големина, т.е. пулсационни и нерегулярно променливи във времеви аспект. Спецификата на тяхната променчивост, както и техните стойности се различават съществено от тези на осреднените по вертикалата на сечението скорости. Формираното водно течение за целите на иригационните процеси обтича почвените частици (агрегати) в дъното и откосите на поливните бразди, лехи или др. и посредством пулсационните скорости се създават активни дънни сили предизвикващи ерозиране. Различните пулсационните скорости в дадено сечение на течението, настъпващи в даден момент, имат определена големина и определена повтораемост – вероятност на настъпване, респ. вероятностен коефициент M , като са в зависимост от осреднената скорост V_{cp} в дадено напречно сечение и от τ - турбулентната интензивност на течението.

По този начин в изследванията и анализа се прилага реалната хидродинамична картина на ерозиращите течения чрез използване на тези показатели на иритационното течение.

Самият ерозионен процес се реализира не чрез средната скорост V_{cp} в напречното сечение на течението, а посредством придънните скорости [2,4]. За разглежданията, анализа и изследванията е необходимо установяване състоянието на ерозионния процес по дължина на леглото на течението и се изисква да се извърши съпоставяне и преобразуване на средната скорост V_{cp} до скоростите непосредствено обтичащи почвените агрегати по повърхността на леглото. Тези скорости се определят като придънни скорости и естествено имат същото пулсационно (пулсиращо) проявление и характер.

3. АНАЛИЗ, ИЗСЛЕДВАНИЯ И ОБСЪЖДАНЕ

Реализиращото се водно течение чрез неговите пулсационни скорости обтича повърхностните почвени частици и агрегати разположени по дъното и откосите на леглото на поливните бразди. Посредством същите тези пулсационни скорости се оказва хидродинамично силово въздействие върху частиците, което нарушава равновесието на съществуващите сили и в резултат се получава ерозиране, т.е. изнасяне на почвени частици от водното течение.

За анализиране на силите пряко оказващи въздействие е необходимо установяване на придънната скорост, за което може да се използва формулата на [Гончаров В. 54], която след преобразуване добива вида:

$$V_{cp} = v_g h^{0,167} \delta^{-0,167} \quad (1)$$

където δ е размера на еквивалентната грапавост на почвеното легло;

h – дълбочина на течението;

От разглежданията и анализа на хидродинамиката на течението, следва, че само чрез средната скорост не се дава възможност за определяне на момента на настъпване на ерозията без използване на пулсационните показатели на течението - турбулентната интензивност на течението τ и M – вероятностен коефициент на пулсационните скорости.

Показателят за турбулентната интензивност зависи от относителната еквивалентна грапавина на леглото, от Рейнолдсовото число и от местоположението на разглежданата точка от течението. За придънния слой на течението могат да се приемат ориентировъчни стойности на τ според грапавината -- при легла с малка грапавина $\tau = 0,12 \div 0,17$; при средна грапавина $\tau = 0,20 \div 0,30$; при голяма грапавина $\tau = 0,40$ [2].

Пулсационните скорости и тяхната връзка с осреднените скорости е развита в [3] и тяхното аналитично изражение има вида:

$$V_{пул} = V_{ср\ g} + \tau M V_{ср\ g} \quad (2)$$

където $V_{пул}$ е пулсационната скорост в дадена точка от течението. За случая $V_{пул}$ е придънната пулсационна скорост която обтича повърхностните частици на леглото;

$V_{ср\ g}$ – осреднената във времето придънна скорост в дадената точка. За случая $V_{ср\ g}$ е скоростта на дъното до повърхностните частици при ключова крива на течението при дадена негова дълбочина;

τ - турбулентната интензивност на течението. Установява се експериментално или по формули. При липса на данни за легло с почвени частици с едрина $1,0 \div 2,0$ mm може да се приеме $\tau = 0,13$;

M – вероятностен коефициент на настъпване на пулсационната скорост.

Таблица 1. Стойности на вероятностния коефициент M в зависимост от вероятност P .

P	M	P	M	P	M
0,30	0,384	0,70	1,040	0,990	2,58
0,50	0,675	0,90	1,650	0,995	3,30

При анализа и изследванията се използват различни показатели за наблюдаване на състоянието на поливните обработваеми площи при дадени съществуващи условия

относно ерозионните процеси, които са – наклон на терена и почвеното легло, агротехническо състояние на почвата, вида на насажденията, водопропускливост, физико-механичните показатели на почвата и др.. По отношение на водното течение се използват неговата осреднена скорост, турбулентната интензивност, вероятностния коефициент на пулсационните скорости, както и съпротивителната способност на почвата срещу процеса на ерозиране наречена пределна неизравяща скорост.

Пулсационните скорости по дадена вертикала на течението, притежаващи еднаква вероятност на настъпване, съставят фамилия от ключови криви с параметър $M = \text{const}$. Стойностите на M са положителни и отрицателни в интервала от $-\infty$ до $+\infty$, но тяхната приложимост в практиката е от $-2,58$ до $+2,58$ при вероятност P на настъпване $-P = 0,99$. По съществени абсолютни стойности на M са представени в табл.1. Тази част от фамилията с M от 0 до $+2,58$ представлява положителния сектор на пулсационните скорости, докато при M в частта от 0 до $-2,58$, съответно представлява отрицателния сектор, където пулсационните скорости са по-малки от средните, т.е. $V_{\text{пул}} < V_{\text{ср}}$. По този начин фамилията от вероятностни ключови криви с положителния и отрицателния сектор формира общото поле на реализиращите се пулсационните скорости при дадено повърхостно течение. Така съществуващата фамилия от пулсационни скоростни диаграми е действителната картина на турбулентните течения чрез които се създават действащите активните сили на ерозионните течения.

Самият процес на ерозиране при дадено реализиращо се иригационно течение се предопределя от съществуващата съпротивителна способност на почвата срещу процеса на ерозиране. Тази условност се дефинира от пределната неизравяща скорост на почвата отразяваща съпротивителните способности на почвата, като може да попада в положителния или отрицателния сектор на полето на пулсационните скорости. При ситуация на течение обтичащо почвените частици в леглото със скорост по-малка от пределната, означаващо със скорост имаща вероятностен коефициент M по-малък от този на пределната неизравяща $-M_{\text{пр}}$, то тя е в състояние на покой. При скорост на обтичане от страна на течението по-голяма от пределната неизравяща за даденият вид почва, т.е. със скорост с коефициент $M > M_{\text{пр}}$, то почвата започва да се ерозира и да се изнасят почвени частици.

Посредством този подход и метод на пулсационно експониране на скоростите в течението и на съпротивителните сили на почвата изразени чрез пределни неизравящи скорости се представя хидродинамичния аспект на ерозионния процес.

4. ИЗВОДИ

1. Предлага се метод за отчитане пулсационния характер на изменението на скоростите и тяхната вероятност на настъпване в зависимост от турбулентната интензивност на формираното течение в почвеното легло.
2. Разгледан е ерозионния процес и се предлага подход и анализ за ерозиращата способност на иригационното течение на базата на неговите хидродинамични показатели при отчитане на придънните скорости и съпротивителните сили на почвата срещу активните сили на течението.

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IRRIGATION SCHEDULE OF LONG-FRUIT CUCUMBERS AND HYDROAMELIORATIVE REQUIREMENTS FOR DRIP IRRIGATION IN PLASTIC GREENHOUSE

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Abstract: *The deficit of the irrigation water requires irrigation technologies with more efficient water use. For cucumbers, the most suitable is the drip irrigation technology. For establishing of the appropriate irrigation schedule of cucumbers under the soil and climate conditions in the village of Chelopechene, near Sofia city, the researches was conducted with drip irrigation technology, adopting varying irrigation schedules and hydraulic regimes - from fully meeting the daily crops water requirements cucumbers to reduced depths with 20% and 40%. It have been established irrigation schedule with adequate pressure flows in the water source, irrigation water productivity and yields of in plastic unheated greenhouses of the Sofia plant.*

Keywords: *Irrigation, yield, irrigation scheduling, drip irrigation, pressure flows, plastic unheated greenhouse, long-fruit cucumbers.*

ПОЛИВЕН РЕЖИМ НА ДЪЛГОПЛОДНИ КРАСТАВИЦИ И ХИДРОМЕЛИОРАТИВНИ ИЗИСКВАНИЯ ПРИ КАПКОВО НАПОЯВАНЕ ПРИ ОРАНЖЕРИЙНИ УСЛОВИЯ

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1. УВОД

Променените условия в земеделието в резултат от климатичните промени, налагат използването на подходящи системи и технологии за отглеждане и напояване на земеделските култури, съобразени с почвеноклиматичните, екологичните и новите икономически условия. При новите условия на развитие на земеделието водата се явява като ограничаващ фактор и става изключително важна от екологична и икономична гледна точка. Тя е и решаващ фактор за проява на максималните продуктивни възможности на земеделските култури с оптималното снабдяване на растенията с вода. Икономията на поливна вода може да бъде постигната чрез използване на ефективни методи, като оптимизиране на параметрите на приложения поливен режим, напояване на културите с намален размер на поливните норми и прилагане на водоспестяващи технологии на напояване

Една от най-перспективните области за прилагане на капковото напояване е оранжерийното зеленчукопроизводство. Този метод отговаря напълно на изискванията за устойчиво земеделие и екологично производство на плодове в т.ч. обезпечава високи добиви и качество на продукцията, намалява нежеланите странични ефекти. (Branson, R.L., 1981). Опитно е установено, че зеленчуковите култури реагират много

добре на капковото напояване, както по отношение на количеството и качеството на продукцията, така и по отношение продуктивността на поливната вода.

Краставицата е взискателна към влажността на почвата и въздуха. Това се дължи на относително слабо развитата ѝ коренова система и на устройството на листния ѝ апарат със слабо развита кутикула (Шабан, Н, и др, 2014). За нейното нормално развитие и плододаване е необходими почвената влажност да бъде над 80% от ППВ (Муртазов и др., 1975), като най-добри резултати по отношение на използването на водата от такива култури се получава при капково напояване, а завишението на добивите достига от 15% до 18% спрямо дъждуването и гравитачното напояване (Clark, 1979).

Във връзка с отглеждането на зеленчукови култури в Софийски район могат да се направят и следните по-важни изводи по отношение на природните му дадености:

-- Районът е подходящ за отглеждане на зеленчукови култури, тъй като температурните условия отговарят на изискванията им. Продължителността на периода с устойчиво задържане на средните денонощни температури на въздуха над 10°C е 180 – 200 дни. Температурната сума за този период е 3300 – 3500°C. Тази температурна сума е достатъчна за развитието на основните зеленчукови култури. (Хершкович и Стефанов, 1982).

-- За получаване на по-ранна продукция в този район е необходимо да се използват пластмасови оранжерии за предпазване от късни пролетни и ранни есенни мразове. (Михов и др., 1981 г.)

Изследванията върху поливните режими на зеленчукови култури в т.ч. и на дългоплодни краставици, отглеждани в култивационни съоръжения продължават да бъдат актуални, като се има предвид обективните промени, които настъпват в земеделието.

Целта на настоящата разработка е установяване на основните елементи на поливния режим на дългоплодни краставици, напоявани чрез капкуване и препоръки относно хидромелиоративни изисквания при системите при микронапояване.

2. МАТЕРИАЛИ И МЕТОДИ

Проучванията за установяване на поливния режим на дългоплодни краставици, сорт "Гергана", отглеждани в неотопляема пластмасова оранжерия тип „Полимерстрой“ при капково напояване са проведени в периода 2001 - 2004 г. в експерименталното поле на бившия ИММ, сега ИПАЗР "Н.Пушкарров" в Челопечене, Софийска област, България. Контролна норма за поливане 100% беше определена за реализиране на 85 % от пределната полска влагоемност (ППВ). Следните дялове на разход на вода са: 120%(вариант1); 100 % (вариант 2); 80 % (вариант 3); 60 % (вариант 4). Сеитбата е извършена директно в двуредова лента през първата десетдневка на м. април, а беритбите започнаха през втората десетдневка на м. май и приключиха в края на м. юли.

При капковото напояване не се подава размерът на цялата поливна норма, както при другите методи на поливане. Налага се редуциране за сметка на ненапояваната площ. За целта е използвана формулата на Ferckman, Grazoli [6], като е взета в предвид схемата на засаждане. След изчисляване на поливната норма за вариант 2, спрямо нейният размер се установяват и нормите на останалите варианти.

Динамиката на почвената влага се проследяваше чрез вземане на почвени проби, които са обработени по тегловно-термостатния метод при варианта със 100% реализиране на поливната норма. 100% поливна норма е нормата, изчислена на базата на водно – физичните свойства на почвата и нейният механичен състав, биологията на културата, ППВ на почвата и предполивната влажност.

Опитът е изведен по блоков метод в четири повторения върху излужена канелена горска почва, която се характеризира със следните водно – физични свойства: ППВ – 20,2 спрямо абсолютното тегло на почвата, обемна плътност при ППВ $1,54 \text{ g/cm}^3$ и влажност на завяхване 10,38%, спрямо теглото на абсолютно сухата почва.

Напояването е извършено с инсталация за капково напояване “Агродрип”. Тръбопроводите на този тип напоителни системи са полиетиленови, състоящи се от две тръби една в друга с формиран между тях дълъг винтов канал за движението на водата с външен диаметър 20 mm, отворите за подаване на вода са през 30 cm, водното количество на един отвор е 2,4 l/h при работно налягане 0,1MPa.

При използване на други разновидности от поливни тръбопроводи от полиетилен - ПЕ с едностранна структура и вградени капкообразуватели в тях, е необходимо да се спазват препоръките за хидромелиоративните изисквания с оглед формиращите се загуби на напор и промяната на режима на течение в тях (Гаджев Р., 2018). При такива тръбопроводи водното течение по дължина се редуцира поради захранване на тръбни отклонения и при транспортирането и разпределението на водата по дължината на напорните тръбопроводи. По дължината на кой да е тръбопровод от тръбната мрежа се разходва напор за преодоляване на съпротивленията от триене и местни съпротивления. Вследствие на редуцирането на водното количество по дължина се видоизменя и режима на течението и заради това се променя величината на разходваният напор поради промяна на съпротивителната област, което води до различни загуби на напор на единица дължина.

3. РЕЗУЛТАТИ И ОБСЪЖДАНЕ

Получените резултати от опитните години са еднопосочни, тъй като опита е изведен при контролирани условия, а опитните години са със сходни метеорологични условия. По отношение температурата на въздуха опитните години се характеризират като топли .

При осъществяване на напояване с гладки едностранни тръбопроводи от полиетилен (ПЕ) с вградени капкообразуватели е необходимо да се има в предвид, че при движението на водата в тръбопроводи се формират загуби на напор от триене и от местни съпротивления. Такива съпротивления могат да се реализират от входните водовземни тела за капкообразувателите или от самите вградени в стената на шлаухите капкообразуватели. Последния вид капкообразуватели са заводски монтирани в стената на шлаухите за микронапояване и стесняват светлото сечение на поливните тръбопроводите в относително неголяма степен, но все пак нарушават структурата на течението и предизвикват съпротивление.

Съпротивлението се формира от удебеляването на стената на тръбопровода от вътрешната страна поради имплантирането (вграждането) на капкообразувателя в самата стена на шлауха и е с големина в диапазона $0,5 \div 0,8 \text{ mm}$ и с дължина от 3 до 6 cm в зависимост от дължината и модела на вградения капкообразувател. Това удебеляване от вътрешната страна формира различни редуцирания на светлото сечение в зависимост от модела и от вътрешния диаметър на поливния тръбопровод, като в диапазона от 12 mm до 16 mm, които са най-използвани в практиката, площта на напречното сечение на това местно съпротивление е от 21 mm^2 до около 40 mm^2 , което редуцира светлото сечение в осреднени стойности от 11% до 18 %. Като величина на редуцирането вградените капкообразуватели предизвикват почти сходно намаляване на напречното сечение както тези от по-предишния модел с входно водовземно тяло в светлото сечение. Всъщност при вградените в стената капкообразуватели, съпротивлението се формира от обтичане със скорости реализиращи се близко до пристенния слой на течението, които са с по-ниски стойности и това води до по-малки загуби от местни съпротивления.

Загубите на напор при течение в гладки ПЕ тръбопроводи с постоянно по дължина напречно сечение се определят аналитично по закона на Вейсбах-Дарси при изпълнение на стандартните условия, че по дължината на тръбопровода всички местни съпротивления имат еднаква форма и размери. Това означава, че имат едно и също миделево сечение и при даден диаметър на тръбопровода стойността на коефициента на съпротивление ξ за всички съпротивления е с еднаква стойност, т.е. $\xi = \text{const}$, като общите (сумарни) напорни загуби се изразяват чрез формулата:

$$h_{\text{об}} = \left(\lambda_{\text{тр}} + \xi \frac{d}{L} \right) \frac{v^2}{2g} \frac{L}{d} \quad (1)$$

където $v = \frac{Q}{F}$ - средната скорост в напречното сечение на тръбопровода;

F - площ на светлото сечение на тръбопровода;

Q - водното количество провеждано от тръбопровода;

ξ – коефициент на местно съпротивление;

$\lambda_{\text{тр}}$ – коефициент на съпротивление от триене.

За общия коефициент на съпротивление $\lambda_{\text{об}}$ за тръбопроводи със светъл диаметър до 14,0 mm се предлага формулата:

$$\lambda_{\text{об}} = \frac{0,310}{\text{Re}^{0,237}} \quad (2)$$

Състоянието на течението в турбулентен хидравличен режим в гладката област на съпротивление се реализира при стойности на Рейнолдсовото число над $\lg \text{Re} = 3550$. Това представлява долната граница на гладката област по диаграмата на Moody, което се потвърждава и от изследванията на течения в гладки тръби. При реализиране на по-ниски стойности на Рейнолдсовото число, течението се намира в друга съпротивителна област, като преходно-критична или ламинарна, което е необходимо да се отчита при определянето на загубите на напор и оразмеряването.

Представяните резултати от реализираните поливки и напоителни норми показват, че за поддържане на почвената влажност в границите между 85 ÷ 100% от ППВ при дългоплодни краставици са реализирани с 21 броя поливки средно за периода на изследванята. За условията на Софийското поле те са реализирани за периода от началото на април до края на юли.

При вариант 2, където се подава изчислената поливна норма, се установи, че предполивната влажност е поддържана средно 85 ÷ 90% от ППВ.

Максималните поливни норми през отделните години в периода на най - голяма консумация на вода могат да се подадат през 3 ÷ 4 дни и да задоволят потребностите на растенията. При 1,5 атмосферри налягане те се реализират за 2 ÷ 3 часа.

Поливните норми по години варират от 11,6 до 22,1 mm при отделните варианти, а напоителните от 241,5 mm до 463,6 mm средно за периода на изследванията (табл.1). Основната част от водопотреблението на оранжерийните зеленчукови култури е евапотранспирацията, която не се различава съществено от напоителната норма, тъй като се формира почти изцяло то тях.

Таблица 1. Брой поливки, поливни и напоителни норми по варианти.**Table 1.** Number of watering and variants of watering and irrigation norms.

Вариант	Брой поливки				Поливна норма в mm				Средно2001-2004		
	2001	2002	2003г	2004	2001	2002	2003	2004	Брой поливи	Поливна норм,mm	Напоителна норма, mm
Поливна норма,%											
120	21	19	22	20	22,1	21,9	22,0	21,7	21	21,9	463.6
100	21	19	22	20	18,4	18,2	18,4	18,6	21	18,4	386.4
80	21	19	22	20	14,7	14,5	14,8	14,4	21	14,6	306.6
60	21	19	22	20	11,8	11,6	11,9	10,8	21	11,5	241.5

Реализираните поливни режими са оказали влияние върху формирането на добивите от дългоплодни краставици.

Най-високи добиви при почвено-метеорологичните условия за Софийското поле средно за периода на изследванията са получени при варианта, напояван със 120% реализиране на поливната норма. Добивът от него е 8391kg/dka, следван от варианта със 100% поливната норма – 8010 kg/dka. Най-ниски добиви се получиха при вариантът с 40% намаление на нормата – 6055 kg/dka. Завишението на поливната норма с 20% е довело до незначително увеличение на добивите с 5%, което в сравнение с разходите на подадената вода е икономически необосновано. В условията на воден дефицит и скъпа вода за напояване, набраната информация доказва, че не е оправдано завишението на поливните норми на изследваната култура, отглеждана в пластмасова оранжерия.

Намалението на напоителната норма с 20% е довело до намаляване на добивите с 8%, спрямо варианта, напояван със 100% реализиране на поливната норма. Този поливен режим може да се използва в случай на възникнал воден дефицит.

Таблица 2. Добив от дългоплодни краставици по години.**Table 2.** Yield of the long-skirted on variants and years.

Варианти Variants	2001	2002	2003	2004	2001 - 2004	
	Добив в kg/da Yeild kg/da	Добив в kg/da Yeild kg/da	Добив в kg/da Yeild kg/da	Добив в kg/da Yeild kg/da	Добив в kg/da Yeild kg/da	Отн. добив в % Relative yield %
120% M	8728	8189	8597	8051	8391	105
100% M	8320	7836	7938	7946	8010	St
80% M	7780	7327	7351	7184	7411	92
60% M	6520	5662	6204	5834	6055	75

Средно за периода на изследване 2001 ÷ 2004 г., от статистическата обработка за обезпечеността на добива, се получава: GD5% =1790 kg/dka;
GD1% =2510 kg/dka; GD0,1% =3548 kg/dka.

Опитите проведени при оранжерийн условия с дългоплодни краставици показват, че икономически изгодни добиви по отношение на поливната вода се получават при поддържане на почвена влажност в границите между 85÷90% от ППВ, отговарящо най-добре на биологичните нужди на културата и водно-физичните свойства на почвата. Завишението на поливната норма с 20% е довело до незначително увеличение на добивите от 2% до 5%, което в сравнение с разходите на подадената вода е икономически необосновано. В условията на воден дефицит и скъпа вода за напояване, набраната информация доказва, че не е оправдано завишението на поливните норми на изследваната култура, отглеждана в пластмасова оранжерия.

4. ИЗВОДИ

1. За поддържане на почвената влажност в диапазона 85 ÷ 90% от ППВ при отглеждане на дългоплодни краставици в пластмасови неотопляеми оранжерии са необходими 21 броя поливки със средна поливна норма 18,4 mm и напоителна норма 386,4 mm
2. Средно за периода на изследванията най – висок добив от дългоплодни краставици е получен при 120% поливна норма – 8391 kg/dka, а най – нисък при 40% намаление на поливната норма – 6055 kg/dka.
3. Завишението на поливната норма с 20% е довело до незначително увеличение на добивите от 2% до 5%, което не компенсира разходите за подадената вода и е икономически необосновано. В условията на воден дефицит и скъпа вода за напояване, набраната информация доказва, че не е оправдано завишението на поливните норми на изследваната култура, отглеждана в пластмасова оранжерия.
4. С оглед използването при напояване чрез капкуване на едностенни полиетиленови тръби са предложени подход и зависимост за загубите на напор при гладки тръбопроводи за микронапояване и границата на гладката съпротивителна област на турбулентния режим.
5. Получените резултати за добивите ни дават основание да препоръчаме напояването на дългоплодни краставици при оранжерийни условия да се извършва с поливна норма 18,4 mm или общо 386,4 mm (386,4 m³/dka) напоителна норма, при която се получава добив от 8010 kg/dka. В случаи на възникнал воден дефицит да се прилага поливен режим с 20 % намаление на поливната норма, при който се получава задоволителен добив от 7411kg/dka.

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ANALYSIS OF ENERGY EFFICIENCY IN PUBLIC BUILDINGS AFTER IMPLEMENTATION OF ENERGY SAVING MEASURES

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Abstract: *The report analyzes energy efficiency in public buildings. A mathematical model was developed describing the relationship between energy savings and heated space in buildings with energy saving measures implemented. The resulting model can be used to predict energy savings of buildings with an accuracy of 82%. The results facilitate the process of determining the energy savings of buildings in which energy-saving measures are to be implemented.*

Keywords: *Energy efficiency, public buildings, energy-saving measures*

1. INTRODUCTION

The main energy consumption in buildings is for heating and cooling. A large part of the building stock in our country is built according to old regulations, which implies unreasonably high costs of energy for heating and cooling in comparison with the current standards [1]. There is considerable potential for reducing energy consumption and generating CO₂ emissions in increasing energy efficiency [3]. In accordance with the European Commission directives on energy consumption [23,24], buildings in Bulgaria must reduce their energy consumption at times. In order to reduce energy consumption in the building sector, the precise implementation of energy-saving measures proposed after a thorough energy analysis is required [2,21,25].

The two annual Targets for Energy Efficiency in Buildings (CEEC) - 2007 and 2008, carried out by the Agency for Sustainable Energy Development (AUER) for the subject of activity were carrying out energy efficiency audits with funds from the state budget for buildings of state and municipal property subject to mandatory certification, in accordance with Art. 16, para. 2 of the Energy Efficiency Act currently in force [19,21]. These programs mainly examined schools - schools, universities, military academies, hospitals, kindergartens and nurseries, homes for disadvantaged people, cultural institutions - community centers, theaters, libraries, operas, barracks, prisons, administrative buildings, etc. Many of the CEECP buildings surveyed operate in conditions of severely low energy comfort. In this sense, bringing them in line with energy efficiency requirements also has a pronounced social effect, resulting in an improved living environment and healthy learning and working conditions.

Since 2007, Sliven and Yambol, Bulgarian have been implementing projects to implement energy-saving measures (ESM) in municipal schools, kindergartens and nurseries. The energy efficiency audits of municipal buildings were conducted mainly in 2007 and 2008 under the AERP CEPEC. The percentage of these buildings does not differ from the national average [24,26].

There are 85 municipal buildings on the territory of Sliven. In 37% of them energy efficiency measures have not been implemented. Table 1 shows the total number of buildings according to their purpose and the number of buildings to be completed by the ECM [23].

Table 1. Public buildings in the city of Sliven

Public buildings by purpose	Number	Number of buildings with unfilled ECMs
Education and science	32	7
Social services	34	19
Administrative service	4	2
Culture and art	7	1
Health care	3	1
Sport	5	2
Total	85	32

Table 2. Heating areas of public service buildings in the field of education, science and social services in Sliven, Bulgaria with unfilled ECM

Social services buildings				Buildings for education and science	
Name of the building	Heated area, m ²	Name of the building	Heated area, m ²	Name of the building	Heated area, m ²
Center for work with children	704	"V. H. Papazyan" kindergarden	1636	"Iskra" Community Center	300
Club sq. Bulgarka	110	ODZ "Elitsa"	4296	"Nadezhda" community center	116
Club in sq. Republic	101	"Zdravets" kindergarden	480	School of Art on P. Hitov str.	1878
"Bojur" kindergarden	1252	Auxiliary kindergarden	222	VI - "Miladinovi Brothers" Primary School	4305
"Temenuga" kindergarden	1281	Nursery №14	1307	Engineering school "Eng. N. Kanev"	1128
"Kalina" kindergarden	2671	Nursery №6	1100	SPGSG "Arch. G. Kozarov"	2155
"Mak" kindergarden	1281	Nursery №3	898	PGM "N. E. Zhukovsky"	1128
"Detstvo" kindergarden	1439	Nursery №9	1286	-	-
"Zvezditsa" kindergarden	1627	Nursery №15	1906	-	-
"Zornitsa" kindergarden	2597	-	-	-	-

As of September 2019, there are thirty-two public buildings in the city of Sliven in which ECMs are to be implemented (Table 1.) Owners of public service buildings are required to comply with the measures for achieving the minimum required energy consumption class prescribed by the first survey within three years from the date of acceptance of the results of the survey [21].

Thirty-two public service buildings in the field of education and science are located in the city of Sliven. Seven of these are to be implemented by the ECM. Out of thirty-four buildings in the field of social services, nineteen have not been implemented energy efficiency measures. Table 2 presents data on the heated areas of buildings in the area of education, science and social services to be implemented by the EJM [23].

The purpose of the report is to estimate energy savings (ECM) and CO₂ emissions after implementation of the EJM in public service buildings in the field of education, science and social services in Sliven.

2. MATERIAL AND METHODS

Energy consumption data from invoices for three consecutive years after the renovation of buildings has been used to evaluate the implementation of the recommended measures in energy audits [20].

The savings on heating energy per year (FES) are calculated by formula (1), and energy savings are only demonstrated by measuring the indicators in formula 1:

$$FES = F_{0\Pi}(SHD_c - SHD_n), \quad kWh/y \quad (1)$$

where: $F_{0\Pi}$ is heated area, m^2

SHD_c - the specific heat required for heating 1 m^2 of heated space, kWh/m^2y

SHD_n - the specific heat required for heating 1 m^2 of heated building area at measured annual energy consumption for heating after renovation, kWh/m^2y [20].

Following the implementation of the prescribed energy saving measures, the annual energy consumption for heating is determined. When calibrating the energy consumption model, this cost is calculated for the year with the highest specific cost. The annual consumption of the energy carrier, the dengue for the respective year and the dengue for the sixth climate zone are reported.

According to Article 14, paragraph 2 and Article 15 of Ordinance № RD 16-1058 / 10.12.2009 on the indicators of energy consumption and energy performance of buildings, the energy characteristics for annual energy consumption have the ecological equivalent of carbon dioxide emissions. (E_cP), which is determined by the formula 2:

$$E_cP = \left(\sum_{i=1}^m Q_i f_i \right) 10^{-6} \quad t/y, CO_2 \quad (2)$$

where E_cP is the amount of emissions (t/y, CO_2);

Q_i – the amount of the i-th type of energy resource/ energy in the annual energy consumption, kWh;

f_i – coefficient of ecological equivalent of the i-th type of energy resource / energy, gCO_2/kWh [5].

The value of the energy characteristic as primary energy is determined by increasing each component of the energy demand with its corresponding losses for production / production and transmission. For the determination of primary energy, an coefficient e_p is used to account for losses in production and / or production and transmission of energy resources and energy. The primary energy for the building (Q) in kWh is determined by the formula 3:

$$Q = \sum_{i=1}^m Q_{iH} e_{pi} \quad kWh \quad (3)$$

where Q is the amount of primary energy, kWh;

Q_{iH} – the amount of energy needed with the i-th energy carrier, kWh;

e_{pi} – coefficient accounting for losses for yield/ production and transmission of energy resource/ energy [5].

Data were processed in MS Excel (Microsoft Corp.). The Data Analysis Tool Pack was used.

3. RESULTS AND DISCUSSION

An energy efficiency analysis of thirteen public service buildings in the field of education, science and social services in Sliven and Yambol has been carried out, in which the ECMs proposed in the energy efficiency surveys have been implemented. For buildings in the city of Sliven heat energy costs were reported for three consecutive years 2004, 2005 and 2006, [6,7,9,10,11,14,15] before the energy efficiency audits and after the implementation of the energy saving measures (2011 , 2012 and 2013). For buildings in the city of Yambol, these

costs were reported for 2011, 2012, 2013 [8,12,13,16,17,18] before the inspection of the buildings and after the implementation of the ESM (2015, 2016 and 2017).

The amount of energy saved is equal to the difference between the energy before the introduction of the energy efficiency improvement measures and the energy used for heating after the implementation of these measures, while maintaining the temperature according to the regulatory requirements (Table 3).

Table 3. Energy savings, kWh/y and CO₂ emissions, t/y after ECM implementation

Name of the building	Heated area, m ²	Energy savings after ECM implementation, kWh/y	Saved CO ₂ emissions, t/y
IX Primary School "St. St. Cyril and Methodius" - Sliven	16200	646550	190
"Yordan Yovkov" Secondary School - Sliven	26376	554389	209
"Hristo Botev" Primary School - Sliven	15692	368222	81
Primary School "Dr. Ivan Seliminski" - Sliven	10776	195375	73
VII "Panayot Hitov" Primary School - Sliven	15775	371756	109
IV "Dimitar Petrov" Primary School - Sliven	6544	157704	59
"Konstantin Konstantinov" Secondary School - Sliven	36550	746075	281
Primary School "Petko R. Slaveikov" - Yambol	18512	708737	157
Foreign Language High School "V. Karagiozov" - Yambol	30781	1155038	256
Kindergarten "Slantse" - Yambol	5303	279964	62
Kindergarten "Bilyana" - Yambol	4372	246333	54
"Red hood" kindergarten - Yambol	5893	175300	38
"Prof. Noykov" school - Yambol	4749	91118	20

Figure 1 presents the results of regression dependence of energy savings, kWh/y for the thirteen buildings in the cities of Yambol and Sliven with completed ECM on the heated area, m². The horizontal axis shows the values of the independent variable, which in this case is the heated area of the buildings, m², and on the vertical dependent variable, the real energy savings kWh / y, after the implementation of energy saving measures. The graph shows that energy savings can be forecast with an accuracy of 82%. Proof of this is the obtained linear regression model, where the coefficients are much larger than 0,1.

The estimation of the expected energy savings in the twenty-six public service buildings in the field of education, science and social services in the city of Sliven, in which the ECM is to be implemented, was made on the basis of a regression analysis. The buildings have a total total area of 37204 m². 3608391,37 kWh/y of estimated energy savings were determined following an increase in the energy efficiency of these buildings (Table 4).

Figure 2 shows the results of the regression analysis of the savings of CO₂, t/y in buildings with completed ECM. On the horizontal axis are the heated areas of the buildings, m² and on the vertical the actual saved CO₂ emissions, t/y in the thirteen buildings in the cities of Yambol and Sliven, Bulgaria after the implementation of the ECM. The graph shows that the saved CO₂ emissions, t/y can be predicted to an accuracy of 93%. Proof of this is the obtained linear regression model, where the coefficients are much larger than 0,1. implementation of 861,45 t/y CO₂ estimated, the saved emissions for twenty-six buildings after the ECM (Table 4).

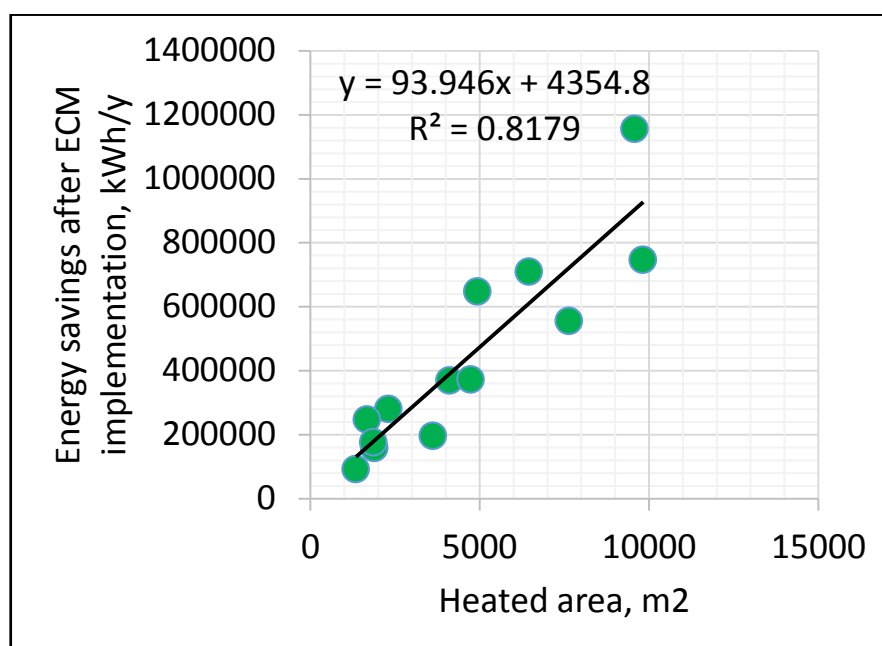


Figure 1. Regression dependence of energy savings, kWh/y on heated space, m² in buildings with ECM

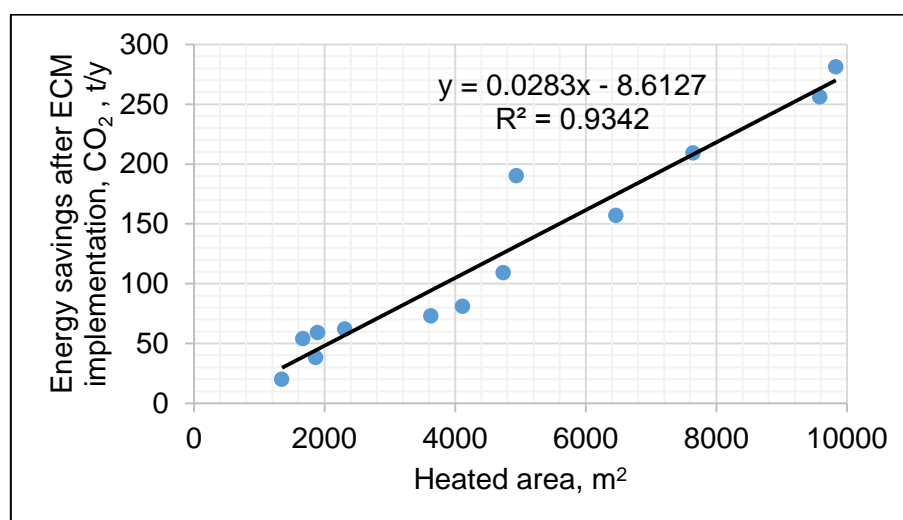


Figure 2. Regression dependence of saved CO₂ emissions, t / y on heated areas, m² in buildings with completed ECM

Table 4. Expected energy, kWh/y and CO₂, t/y savings after ECM implementation in buildings in Sliven, Bulgaria

Name of the building	Expected energy savings after ECM implementation, kWh/y	Expected saved CO ₂ emissions after ECM implementation, t/y
Center for work with children	70492,78	11,31
Club in "Balgarka"	14688,86	1,82

Club in "Republic"	13843,35	1,68
"Bozhur" kindergarden	121975,19	26,82
"Temenuga" kindergarden	124699,19	27,64
"Kalina" kindergarden	255284,57	66,98
"Mak" kindergarden	124699,63	27,64
"Detstvo" kindergarden	139543,09	32,11
"Zvezditsa" kindergarden	157204,94	37,43
"Zornitsa" kindergarden	248332,56	64,88
"V. P. Papazyan" kindergarden	158050,46	37,69
"Elitsa" children center	407946,82	112,96
"Zdravets" kindergarden	49448,88	4,97
Auxiliary kindergarden	25210,81	3,42
Nursery №14	127142,22	28,38
Nursery №6	107695,40	22,52
Nursery №3	88718,31	16,80
Nursery №9	125169,36	27,78
Nursery №15	183415,88	45,33
"Iskra" community center	32538,60	4,64
"Nadezhda" community center	15252,54	1,91
School of art "P. Hitov"	180785,39	44,53
VI - "Miladinovi Brothers" Primary School	408792,33	113,22
Engineering school "Eng. N. Kanev"	110325,89	23,31
SPGSG "Arch. G. Kozarov"	206808,43	52,37
PGM "N. E. Zhukovsky"	110325,89	23,31
Total	3608391,37	861,45

3. CONCLUSION

The amount of energy saved, kWh/y and CO₂ emissions, t/y after ECM implementation, was calculated, while maintaining the temperature according to the regulatory requirements in thirteen public service buildings in the field of education, science and social services in Sliven and Yambol, Bulgaria.

The regression dependence of the energy savings, kWh/y and the saved CO₂ emissions, t/y, was determined for the thirteen buildings on the heated area, m². 3608391,37 kWh/y of estimated energy savings have been determined following the increase in energy efficiency of twenty-six public service buildings in the field of education, science and social services in the city of Sliven.

An estimated 861,45 t/y CO₂ is estimated to be saved for twenty-six buildings after ECM implementation.

The resulting model can be used to forecast energy savings, kWh/y and CO₂, t/y emissions in public service buildings after ECM implementation.

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APPROACHES FOR SYSTEM DEVELOPMENT FOR ENERGY MANAGEMENT IN THE ENTERPRISE

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Abstract: В настоящия труд са разгледани състава и основните елементи на системите за управление, и в частност, на системата за енергиен мениджмънт в предприятието, базирана върху БДС EN ISO 50001. Най-общо нейната структура е приложима и при други стандарти относно системи за управление на други дейности. Анализирани са мотивацията и интересите на работодателя и са представени различни подходи при въвеждане на системата за енергиен мениджмънт.

Keywords: energy management system (EMS), approaches for development.

ПОДХОДИ ПРИ РАЗРАБОТВАНЕ НА СИСТЕМАТА ЗА ЕНЕРГИЕН МЕНИДЖМЪНТ В ПРЕДПРИЯТИЕТО

Иван Лазаров, Мирослав Биларев

1. ВЪВЕДЕНИЕ

1.1. Роля на ISO стандартите при въвеждане на Системата за енергиен мениджмънт в предприятието

В най-общ план, *стандартите по ISO* (International Organization for Standardization) са ориентирани към постигане на международен консенсус относно състоянието на технологиите или съответните видове дейности. Тяхното предназначение е да способстват за трансфера на най-новите технологии от развитите към развиващите се страни, както и да осигуряват защитата на техните потребители с цел подобряване на жизнения им статус.

Безспорен е приносът на ISO стандартите за хуманизиране на индустриалните отношения чрез развитието, производството и доставката на по-безопасни и съхраняващи околната среда продукти и услуги, стимулиращи международната търговия и способстващи за безпристрастността на икономическите участници [11].

В по-ограничен план, *стандартите ISO от системата за управление*, за разлика от всички останали ISO стандарти, отнасящи се за веществени обекти /продукти/, са концептуално ориентирани към системи за управление на определени показатели /например, серията от стандарти ISO 9001 относно управлението на качеството на продукта или на услугата.

Системата за управление на едно предприятие /организация, фирма/ определя такава форма на управление, гарантираща на потребителите постоянство на качеството /безопасността/, сигурността на предлагания продукт/услуга, независимо от

количеството и срока за изпълнение, както и пълното съответствие с приложимите нормативни изисквания. Тази система *стимулира непрекъснатото нарастване на удовлетворението на потребителите.*

Системата за управление е *основен фактор за развитието на всяко предприятие.* Наред със сериозното повишаване на конкурентноспособността, *внедряването и ефективното използване на системи за управление, базирани на ISO стандарти, води до:*

- ❖ въвеждане на единен начин на работа в една организация;
- ❖ намаляване на производствените разходи;
- ❖ увеличение на производителността при намалена себестойност;
- ❖ нарастване на печалбата;
- ❖ елиминирание на неефективните бизнес процеси.

1.2. Състав на системата за управление

Системата за управление /в по-широк смисъл/ се състои от:

- *структурата на организацията;*
- *ресурсите /материални, енергийни, финансови, човешки и др./;*
- *документацията,*

които се използват за постигане на целите, за да се осигури подобряване на продуктите и услугите и да се удовлетворят изискванията на потребителите.

Системите за управление /СУ/ могат да бъдат прилагани *в предприятия с всякакви размери и за всички аспекти на управлението*, като маркетинг, продажби и финансови дейности и всякакви други основни дейности за предприятието. При това е препоръчително е да се запази вече съществуващата структура на управление в предприятието, която да послужи като базис за разработване на система за управление. На практика обаче фирмите до голяма степен реализират много от изискванията на стандартите, но без те да бъдат описани и систематизирани.

Ето защо, системата за управление на дейността *подчертава важността на:*

- ❑ разбирането на потребностите на организацията и на необходимостта от установяване на политика и цели за управление на дейността;
- ❑ внедряването и прилагането на механизми за контрол и мерки за управление на цялостната способност на организацията да управлява дейността;
- ❑ наблюдение и проверката ефикасността на СУ;
- ❑ непрекъснатото подобряване, основано върху обективни измервания.

1.3. Основни елементи на системата за управление

Системата за управление, независимо от естеството на дейността, включва следните *основни структурни елементи [11]:*

- ❑ политика;
- ❑ персонал с определени отговорности;
- ❑ процеси за управление, свързани с:
 - ❖ политика;
 - ❖ планиране;
 - ❖ внедряване и действие;
 - ❖ оценяване на изпълнението;
 - ❖ преглед от ръководството;
 - ❖ подобряване;
- ❑ документация, осигуряваща достоверни доказателства за одит;

- всички процеси за управление на дейността, приложими към организацията.

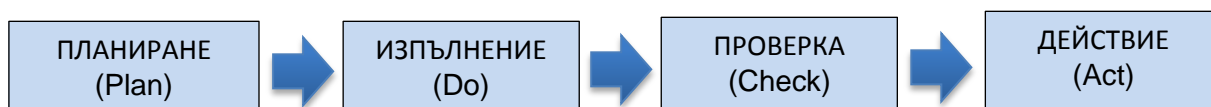
2. СТРУКТУРИРАНЕ НА СИСТЕМАТА ЗА ЕНЕРГИЕН МЕНИДЖМЪНТ

Структурата на ISO 50001 е базирана на общите елементи на стандартите за управление на ISO и лесно може да бъде интегриран с други системи за управление, такива като ISO 9001, ISO 14001, ISO 45001, ISO 22001 и др.

ISO 50001 се основава на рамката за непрекъснато подобряване *Планиране-Изпълнение-Проверка-Действие (Plan-Do-Check-Act - PDCA)* и включва управлението на енергията в ежедневната дейност на организацията.

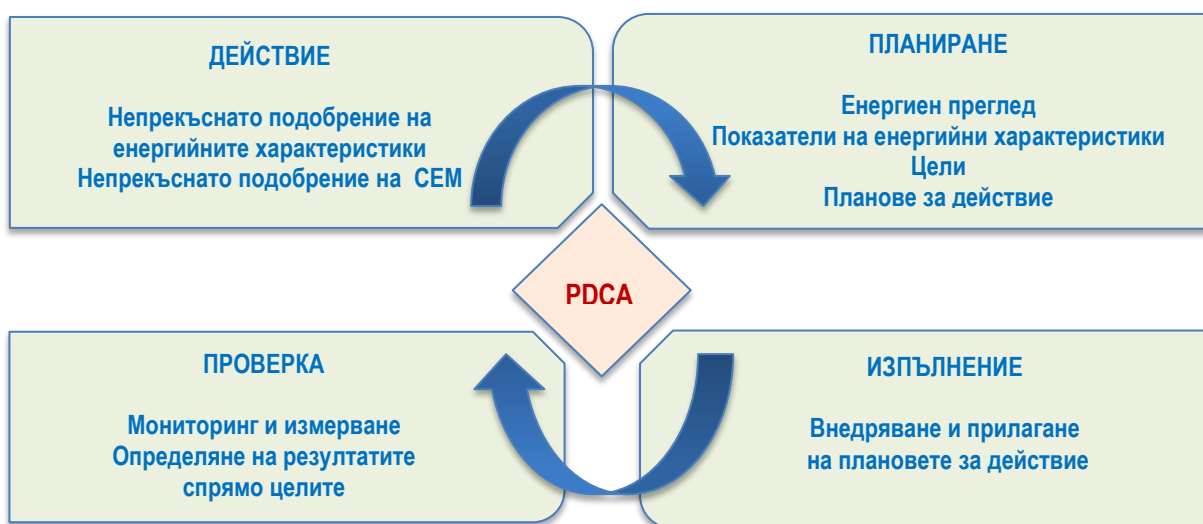
Разработването и внедряването на СЕМ може условно да се раздели на 4 основни етапа и един подготвителен, всеки от които има за цел изпълнението на отделните дейности, които следват стандарта БДС EN ISO 50001.

БДС EN ISO 50001 стандартът се основава на рамката /цикъла на Деминг/ за непрекъснато подобряване и включва управлението на дейността в ежедневната дейност на организацията (Фиг. 1).



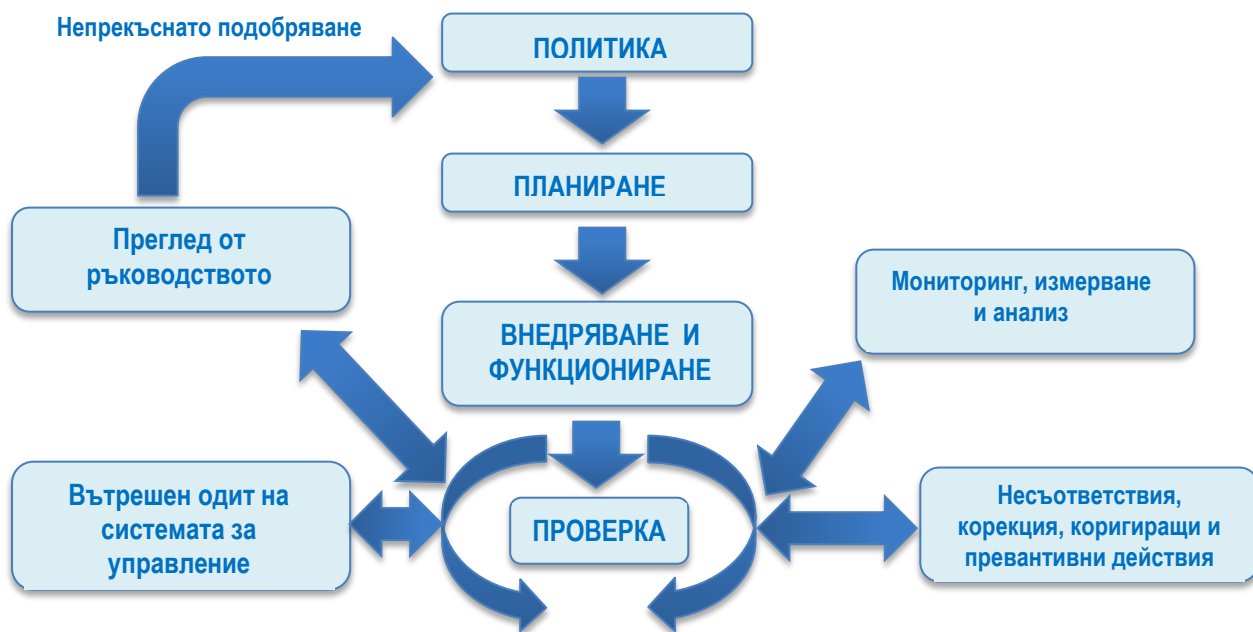
Фигура 1. Рамка /цикъла на Деминг/ за непрекъснато подобряване PDCA

При системата за енергиен мениджмънт /СЕМ/ се прилага системен подход на всички етапи на закупуване, преобразуване и използване на енергията в дадено предприятие. Тя е съставена от отделни елементи, служещи за определяне на енергийната политика с цели и процедури за постигане на поставените цели.



Фигура 2. Структура на системата за енергиен мениджмънт [1]

Цел на СЕМ: минимизиране на енергийните разходи и въздействие върху околната среда чрез перманентно и системно управление на енергията.



Фигура 3. Структурна схема на PDCA система [9]

Всеки етап от разработването и реализацията на системата за енергиен мениджмънт (според БДС EN ISO 50001, както и при другите стандарти за СУ) се изпълнява стъпаловидно в определена последователност [1] (Фиг. 4).

ПОДГОТОВКА	Стъпка А. Ангажимент на ръководството Стъпка Б. Създаване на организационна структура Стъпка В. Политика по дейността
ПЛАНИРАНЕ	Стъпка А. Определяне на законови и други изисквания Стъпка Б. Енергиен преглед, базови линии Стъпка В. Определяне на ПЕХ, общи и конкретни цели Стъпка Г. Разработване на план за действие
ИЗПЪЛНЕНИЕ	Стъпка А. Осигуряване на компетентност, осъзнатост и организиране на комуникацията Стъпка Б. Документално осигуряване на системата Стъпка В. Обхващане на оперативното управление Стъпка Г. Обхващане на проектирането и закупуването
ПРОВЕРКА	Стъпка А. Организиране на мониторинг и анализ Стъпка Б. Организиране на вътрешни одити Стъпка В. Превантивни и коригиращи действия
ДЕЙСТВИЕ	Стъпка А. Организиране на преглед от ръководството Стъпка Б. Решения и последващи действия

Фигура 4. Стъпалообразно внедряване на системата за енергиен мениджмънт [1]

Схемата на фиг. 4 е обезличена /с изключение на стъпки Б и В от етап Планиране, където са включени специфични дейности/, тоест е мултифункционална и приложима при други стандарти относно системи за управление на други дейности. Това способства за съвместно интегриране на всичките тези управленски системи към базовата система за управление на предприятието като цяло. По този начин се избягва излишната повтаряемост на отделни процедури, минимизират се значително сроковете за внедряване на СУ и се реализира икономия на човешки и финансови ресурси.

4. МОТИВАЦИЯ И ИНТЕРЕСИ НА РАБОТОДАТЕЛЯ ПРИ ВЪВЕЖДАНЕ НА СИСТЕМАТА ЗА ЕНЕРГИЕН МЕНИДЖМЪНТ

Работодателят е мотивиран да формира ново отношение към енергийната ефективност /ЕЕ/ в предприятието, прилагайки превантивен подход, с оглед на успешното:

- ❖ обновяване и динамично реструктуриране на продуктивния асортимент;
- ❖ постигане и утвърждаване на пазарна реализация в конкурентна среда;
- ❖ оптимизиране на фирмените ресурси (трудови, енергийни, материални, финансови);
- ❖ повишаване на качеството на продукцията и производителността на труда;
- ❖ подобряване на състоянието на пазара на труда и привлекателността на работните места – избягване на неосезаеми загуби (фирмен престиж и др.);
- ❖ постигане на максимална печалба, респ. минимизиране на загубите;
- ❖ реализиране на етично управление, т.е. подобряване на комуникациите, взаимоотношенията, удовлетвореността и постигането на консенсус между работодател и работещи относно енергийната ефективност и хармонизиране на интересите им;
- ❖ рационализиране на индустриалните отношения и ангажираност от страна на работещите.

Разходите на работодателя за осигуряване на ЕЕ в предприятието – включват:

- разходи за обучение и информация;
- разходи за консултанти и експерти;
- разходи за изследване, анализи, изготвяне на проекти и внедряване на подобрения;
- административни разходи (за подготовка на доклади, за организация, управление и координиране на дейностите и др.);
- загуба на време поради необходимост производствения персонал да сътрудничи при изготвяне, обсъждане и докладване на ЕЕ.

Оптимизирането на разходите за осигуряване на ЕЕ в предприятието е възможно чрез прилагане на известния принцип на „разумната достатъчност” – ALARA “As Low As Reasonable Achievable”, тоест на практика да се залага („толкова малък риск, колкото разумно може да се постигне”). Според ALARA, разходите на работодателя за осигуряване на ЕЕ се компенсират чрез значимостта и полезността от повишаване на нивото на ЕЕ в работната среда.

5. ПОДХОДИ ПРИ ВЪВЕЖДАНЕ НА СИСТЕМАТА ЗА ЕНЕРГИЕН МЕНИДЖМЪНТ

- ❖ **подход "последници - реакция"** – изисква предприемане на мерки в областта на ЕЕ, основани върху резултати (статистически данни) от изследване на ЕЕ; при него е необходим голям времеви и финансов ресурс за прилагането му;
- ❖ **превантивен подход** – изисква предварително реализиране на мерките за осигуряване на ЕЕ с оглед изпреварване появата на прекомерно енергопотребление и предотвратяване на неблагоприятните последици от това;
- ❖ **системен подход** – изисква поетапно интегриране (вграждане) на мерките за ЕЕ при реализиране на цикъла "*изследване-конструиране-производство-продажба*", и най-вече, в началния етап - при проектиране на продукцията (в конструкциите на оборудването, в организацията на технологичните системи и процеси, при оптимизиране на взаимодействието между елементите от системата „*процес- среда-човек*” и др.);
- ❖ **йерархичен подход** - изисква степенуване и реализиране на мерките за ЕЕ в зависимост от тяхната степен на ефективност, която постигат, т.е. в колкото по-висока степен една мярка намалява енергопотреблението, толкова тя е на по-високо и по-приоритетно йерархично ниво.
- ❖ **интегрален подход** - изисква интегриране на дейностите по ЕЕ с мерките за предотвратяване на промишлени аварии и тези за опазването на околната среда и повишаване на качеството на продукцията; функцията на интегриращия фактор тук се изпълнява от системата „*процес- среда-човек*”, а мерките за ЕЕ са ориентирани, както към елементите на тази система, така и към процесите по управление на качеството на продукцията и по опазване на околната среда; върху методическата основа на широко наложилите се в практиката стандарти за управление на качеството (серия ISO9000) и за управление на околната среда (серия ISO14000) се развива и т.нар. *тотално управление на ЕЕ*, т.е. управление на ЕЕ в технически аспект и защита от финансови рискове;
- ❖ **доминантен подход** - изисква от работодателя, при изпълнение на ръководните му функции на територията на предприятието, изцяло да доминират инициативата, отговорността и задълженията му относно подобренията в областта на ЕЕ (оценяване, обучение, контрол, информиране, документиране и др.), т.е. е недопустимо пренебрегването на мерките по ЕЕ, изхождайки от икономически подбуди;
- ❖ **мениджърски подход** – изисква разработване и прилагане на целенасочена фирмена политика за ЕЕ чрез съставянето на дългосрочна фирмена програма, реализираща стратегически цели относно мерките за ЕЕ; възникналата необходимост от изграждане на фирмена политика и система за управление, осигуряващи ЕЕ, е основният инструмент на работодателя и социалните партньори за прилагане на правната ни уредба относно ЕЕ;
- ❖ **информационен подход** - изисква формиране на т.н. *култура на енергоспестяване* от работещите като съвкупност от високоефективни мерки за ЕЕ, висока квалификация и изградено осъзнато поведение по спазване на изискванията за ЕЕ;
- ❖ **подход "разумна достатъчност"** (ALARA) – изисква реализиране на мерките за ЕЕ чрез оптимизация на разходите по осигуряването на ЕЕ (в зависимост от социалните и икономически фактори) и постигане на висока ефективност;
- ❖ **научен подход** – изисква осигуряване на необходимата научна основа при обслужване на дейността по ЕЕ, ориентирана към:
 - научно изследване и анализ на ЕЕ и закономерности, породени от условията на труд;

- разработване, внедряване и утвърждаване на СЕМ, ориентирана към превенция и оценка на ЕЕ;
- създаване на подходяща съвременна материално-техническа база, съобразена с последните постижения на научно-техническия прогрес;
- подготвяне на кадри, създаващи и работещи със съвременни средства, пособия и документация;
- ❖ **контролен подход** – изисква изграждане на високоефективна система за упражняване на интегриран контрол на ЕЕ на държавно, браншово и регионално ниво, чрез осъществяване на разнообразни форми на инспектиране и одитиране, съобразно с държавната политика по осигуряването на ЕЕ.

6. ЗАКЛЮЧЕНИЯ

С настоящия труд авторите считат, че:

- чрез прилагане на системния подход е възможно успешното интегриране на системата за енергиен мениджмънт към цялостната система за управление на предприятието.
- е препоръчително съвместяването на алгоритъма на системата за енергиен мениджмънт с алгоритмите на други системи за управление на други дейности, *базирани на ISO стандарти*, с цел успешното им внедряване и ефективно използване.
- успешното прилагане на различни подходи при внедряването на системата за енергиен мениджмънт способства за постигането на оптимални резултати и скъсяване на сроковете за внедряване на нововъведенията по енергийната ефективност в предприятието.

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DESIGNING OF ADAPTIVE MULTIFUNCTIONAL MEN'S UNDERWEAR

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Abstract: *The object of research is the process of designing of adaptive multifunctional clothing. The basis for improvement of designing of adaptive multifunctional clothing is the application of energy-information effects of materials on the functional state of the human body. On the basis of this, it is justified to form a package of materials for development of adaptive men's underwear for treatment and prevention of chronic prostatitis. A positive therapeutic and prophylactic effect on patients is ensured by silver plates located on adaptive multifunctional underwear sites according to the biologically active zones of the lower part of the men's body. Provision of multifunctional clothing with advanced functionality has a positive economic effect by reducing the consumer's money costs and reducing the time spent on medical procedures. The social effect of the work is manifested in improving the health status of men with chronic prostatitis, and, accordingly, improving the quality of their life. The effectiveness of the developed adaptive multifunctional underwear is confirmed by experimental wearing and clinical approbation.*

Keywords: *adaptive multifunctional underwear, energy-information impact, energy lability.*

1. INTRODUCTION

The desing of multifunctional clothing is the process of harmonizing the «man – clothing – environment» system on the basis of providing the product with additional functional capabilities aimed at improving the life quality of a modern person.

Multifunctional clothing is a product or a set of products, which has a wider application for the user due to a combination of basic and additional functions that expand its purpose [2].

Multifunctional clothing promotes human adaptation to changing environmental conditions (climatic, emotional, etc.), so it is adaptive and add of the body can restore their normal functioning.

1.1. Subheading

Today, the transition from a health care system focused on the treatment of diseases to a system based on the priority of a healthy lifestyle, the prevention of diseases and the preservation of human health is urgent. One of the promising areas of new health care system is the wave energy-medicine, the main provisions of which are based on the scientific concept of the importance and the information content of the internal electric fields in the vital processes of the body [4]. The mathematical model of wave processes in the «man-clothing» system is described in work [3], and in the works [2, 5] an effective energy-information component is determined in the development of clothing intended for improvement of the human body.

The lack of experimental data on the energy and information impact of textile and other materials on the functional state of the human body adversely affects the selection and substantiation of a rational package of materials for adaptive multifunctional clothing.

2. METHODS

In energy-information wave medicine, various methods and devices are used to diagnose and test the functional state of the human body. These include the hardware-software diagnostic complex (HSDC) «Intera-DiaCor», which is included in the register of medical equipment of Ukraine (No. 3277/2004 of 30.10.2009). And it is authorized for use in medical practice [1]. This HSDC allows to evaluate the functional state of organs and body as a whole at the cellular level, to monitor the health status and to observe the dynamics of the functional state of the body, organs and systems, to evaluate the effectiveness of health improvement and preventive and curative measures [1, 4].

Evaluation of the energy-information impact of knitted fabrics on the functional state of the human body is performed using hardware-software diagnostic complex (HSDC) «Intera-DiaCor». HSDC «Intera-DiaCor» consists of a device for electropuncture diagnostics (EPD) (Fig. 1) and software installed on a personal computer (PC).

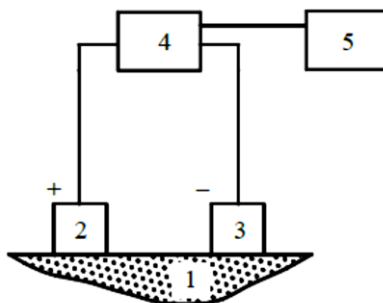


Figure 1. The scheme of the hardware-software diagnostic complex «Intera-DiaCor» (Ukraine): 1 – human skin; 2 – «active» electrode; 3 – «passive» electrode; 4 – device for electropuncture diagnostics; 5 – personal computer [6]

The method of the study is as follows (Fig. 1): on the skin areas (1) of the palms, feet and face of the person fix the «active» (2) and «passive» (3) electrodes. Through the electrodes from the device for the EPD (4), electrical impulses are applied to the skin areas (1), and they also register the frequency-wave characteristics of organs and organ systems. Information from the device for EPD is transmitted to the PC (5), where the data is processed using the software HSDC «Intera-DiaCor», which allows to get a diagnosis of the functional state of the human body. After that, a sample of investigated knitted fabric is introduced into the contour of the «passive» electrode and the frequency-wave characteristics of the organs and systems of the human body are repeatedly recorded with the influence of investigated sample.

After two complete cycles of diagnosis, the results of the diagnosis of the functional state of organs and systems of the human body are compared without affecting the knitted fabric and with it. At the same time, the histograms that reflect the three basic conditions of the organs and systems of the human body are compared on the PC monitor [6]:

- energy lability (upper histogram columns);
- energy instability (middle histogram columns);
- energy insufficiency (bottom histogram columns).

Energy lability is the norm and reflects the relatively stable energy processes of organs and systems. Energy instability indicates instability and the tension of the energy processes. According to energy insufficiency, it indicates the depression of the energy processes of organs and systems, which leads to the depletion of the functional state of the human body. In this case, the higher the column height, the better the energy and functional state of the organ.

The level of negative and positive energy-information impact of the knitted fabric on the human body, as well as its inertness, is evaluated by the numerical values of the coefficients k_N , k_P , and k_I , respectively [6]:

$$k_N = K_N / K_D, \quad (1)$$

$$k_P = K_P / K_D, \quad (2)$$

$$k_I = K_I / K_D, \quad (3)$$

$$k_N + k_P + k_I = 1, \quad (4)$$

where K_N – the number of organs (systems of organs) of the human body, in the functional state of which there were negative changes, caused by the influence of investigated knit fabric;

K_P – the number of organs of the human body, in the functional state of which there were positive changes caused by the influence of the knitted fabric;

K_I – the number of organs of the human body, in the functional state of which there was no change in the impact of investigated knitted fabric;

K_D – the number of diagnosed organs of the human body.

The mathematical notation of formulas (1)–(3) for calculating the levels of negative and positive energy-information impact of a knitted fabric on a human body, as well as its inertness, reflects a relative evaluation of the reaction of the human body to investigated materials.

3. EXPERIMENTAL

According to the principles of conceptual designing of adaptive multifunctional clothing, the authors develop therapeutic and preventive underwear – men’s underpants, the appearance of which is shown in Fig. 2.

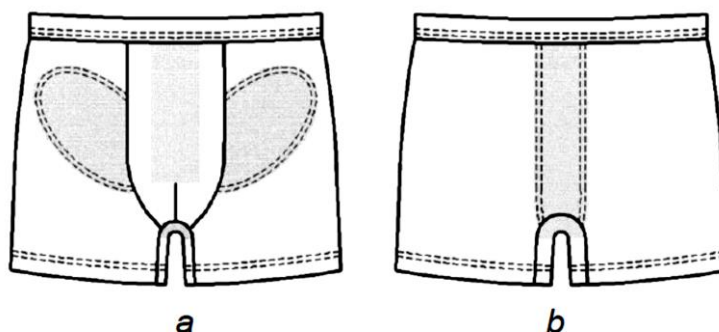


Figure 2. Appearance of men's therapeutic and preventive underpants:
a – front view; b – back view.

Note: gray color indicates the location of the overlays with silver plates

Expansion of the product functions is the treatment and prevention of urological diseases, in particular chronic prostatitis, which is justified by the urgency of treatment and prevention of prostatic diseases in men.

The therapeutic and prophylactic effect of men’s underpants is ensured by silver plates, containing medical information, and located on the clothing sites contacting the biologically active zones (BAZ) with a close fit of the product to the lower part of the human body (Fig. 3). Silver plates of round shape, diameter – 5 mm and thickness – 0.4 mm are located between the layers of the lining and the main material of the product in places that are projections of

the corresponding BAZ of the human body. Local impact of silver plates on certain BAZ of the body produces reactions of organs and organ systems that can restore their normal functioning [1, 4].

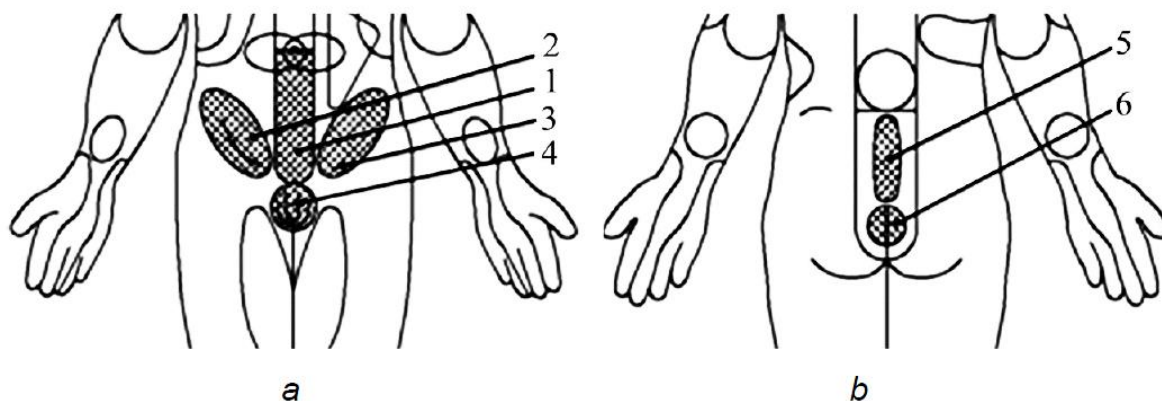


Figure 3. BAZ location for treatment and prevention of chronic prostatitis:
a – front view; b – back view

For the manufacture of men's underwear, knitted fabrics are selected (Table 1).

Table 1. Structural and physical-mechanical characteristics of knitted fabrics for making men's underwear

Designation of knitted fabric	Raw material composition,%	Thickness, mm GOST 120 23-2003	Surface density, g/m ² DSTU EN 12127:20 09	Hygroscopicity, % DSTU GOST 3816:2009	Humidity, % GOST 8845 -87
T1	Viscose – 97 Elastane – 3	0.45	146.0	23.0	5.47
T2	Cotton – 100	0.70	212.4	17.35	6.61
T3	Cotton – 100	0.64	185.0	20.0	6.79
T4	Viscose – 92 Elastane – 8	0.65	188.2	16.0	3.79
T5	Cotton – 97 Elastane – 3	0.31	116.0	20.35	3.99

4. RESULTS

To select an inert knit fabric, the level of its negative, positive and inert influence on the functional state of the human body is studied (Table 2). The study was carried out for ten persons, which functional state of the body at the time of the study did not have significant deviations from the norm. Such quantity is sufficient, as definition of the functional condition of the human body with the help of HSDC «Intera-DiaCor» differs high accuracy (relative guarantee error does not exceed 5 %).

Table 2. The results of calculation of energy-information impact level of the knitted fabrics on the human body

The level of energy-information impact of a knitted fabric sample on the functional state of the human body:	The level of energy-information impact of a knitted fabric sample on the functional state of the human body:		
	Negative (k_N)	Positive (k_P)	Inert (k_I)



	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
1	0.06	0	0	0.03	0.02	0.03	0.07	0.12	0.03	0.03	0.91	0.93	0.88	0.94	0.95
2	0	0	0.02	0	0	0	0.03	0.02	0.03	0	1.00	0.97	0.96	0.97	1.00
3	0	0.02	0.02	0	0	0.08	0.03	0.02	0.06	0.02	0.92	0.95	0.96	0.94	0.98
4	0.05	0	0	0.05	0	0.06	0.05	0.24	0.06	0.08	0.89	0.95	0.76	0.89	0.92
5	0.06	0.07	0.12	0.04	0.05	0.02	0.07	0.13	0.02	0	0.92	0.86	0.75	0.94	0.95
6	0.02	0	0.02	0.03	0.04	0.15	0.09	0.18	0.12	0.02	0.83	0.91	0.80	0.85	0.94
7	0.03	0	0	0.03	0.03	0	0.13	0.04	0	0.02	0.97	0.87	0.96	0.97	0.95
8	0	0.03	0.21	0	0.02	0.03	0.02	0.15	0.04	0.02	0.97	0.95	0.64	0.96	0.96
9	0.02	0	0.05	0.03	0.02	0.03	0.13	0.05	0.02	0.02	0.95	0.87	0.90	0.95	0.96
10	0	0.02	0.03	0	0	0.07	0.20	0.25	0.13	0.12	0.93	0.78	0.72	0.87	0.88

It is established that all knitted fabrics have an energy-information impact on the human body. Considering the purpose of knitted fabrics, it is important to choose fabrics with high inertness coefficients for the functional state of the body (Table 3).

Table 3. Analysis of the investigation results of inertness level of knitted fabrics for the functional state of the human body

Coefficient value k_i	Percentage distribution of the number of human subjects according to inertness level of knitted fabric samples, %				
	T1	T2	T3	T4	T5
0.95...1.00	40	40	30	40	70
0.90...0.94	40	20	10	30	20
0.85...0.89	10	30	10	30	10
0.80...0.84	10	–	10	–	–
0.75...0.79	–	10	20	–	–
0.70...0.74	–	–	10	–	–
less 0.7	–	–	10	–	–

Analysis of investigation results of inertness level of knitted fabrics made it possible to establish that a high inertness level ($k_i=0.95...1.00$) for the functional state of the body of 70 % of individuals has a pattern of knitted fabric T5. Since this fabric has the smallest thickness (0.31 mm) and a high inertness, it is selected as a lining material for manufacturing of the projected multifunctional clothing. Also high values of k_i have samples of knitted fabrics T4 ($k_i=0.87...0.97$) and T1 ($k_i=0.83...1.00$). This inertness level indicates that there is no excessive positive or negative energy-information effect of fabric on the state of organs and systems of the human body. That is why they are recommended as the main material for the manufacture of adaptive therapeutic and prophylactic clothing.

Analysis of research results made it possible to choose a knitted fabric T4 for the manufacture of therapeutic and prophylactic clothing. To ensure the therapeutic and prophylactic effect of the men's underwear, the distance between the centers of the silver plates is taken to be 30 mm, which makes it possible to achieve a uniform effect on the entire BAZ surface.

It is found that silver plates are intangible during adaptive multifunctional clothing operation, that is, do not cause discomfort for the consumer and do not deform during the operation of the product. This is confirmed by the results of experimental wearing of men's underwear, in which 10 people took part. Each of them used the clothing for an hour. By the beginning of the experimental wearing of the developed clothing and after its completion, the indicators of operational control are determined. Psychophysiological sensations of a person in adaptive multifunctional clothing are evaluated according to the following criteria:

- convenience in movements (seats, sit-ups, walking);
- self-estimation of the functional state of the body;
- comfort in the clothing;
- thermal sensations in the clothing.

According to the results of experimental wearing it is found that blood pressure, heart rate and self-estimation of the functional state of all persons do not deteriorate during the use of clothing. In addition, developed men's therapeutic and prophylactic underpants do not create uncomfortable sensations in motion. The persons who exploited it (100 %) note that the underwear is highly comfortable and pleasant in terms of warmth.

The effectiveness of the developed underwear is assessed by clinical approbation of medical and preventive underpants in Khmelnytsky (Ukraine) city polyclinic for ten patients, with chronic prostatitis with seasonal exacerbation in autumn. The duration of the disease lasted from five to seven years. The age of the patients ranged from twenty-one to forty-four years.

All patients underwent general clinical laboratory tests: general blood analysis with leukogram, general urine analysis, blood sugar analysis, prostate secretion analysis and ultrasound examination. In addition to the general clinical laboratory and apparatus methods, the patients underwent a study of the functional state of the body, in particular the genitourinary system, with the help of HSDC «Intera-DiaCor».

As a result of clinical examination, nine patients out of ten found a latent (subclinical) exacerbation of chronic prostatitis, which at the time of the examination was not accompanied by the manifest symptoms characteristic of this disease. One patient showed the onset of exacerbation of the disease, accompanied by clinical signs, in particular: pain, dysuric syndromes and erectile dysfunction.

All examined patients are recommended to wear the developed therapeutic and prophylactic underwear (underpants). This adaptive underwear is intended to be worn for one month for two hours a day during the period of the highest activity of the bladder channel (from 15 to 17 hours). A patient with clinical manifestations of chronic prostatitis is prescribed a course of treatment according to clinical protocols from urology, and it is recommended to wear the specified underwear according to the method described above.

In a month, all the patients underwent a control study: general clinical laboratory tests, laboratory study of the secretion of the prostate gland, examination with ultrasound and HSDC «Intera-DiaCor».

Fig. 4 shows the window of HSDC «Intera-DiaCor», which reflects the comparison of the diagnostics results of the functional state of the body without the influence of the developed multifunctional clothing and with it.

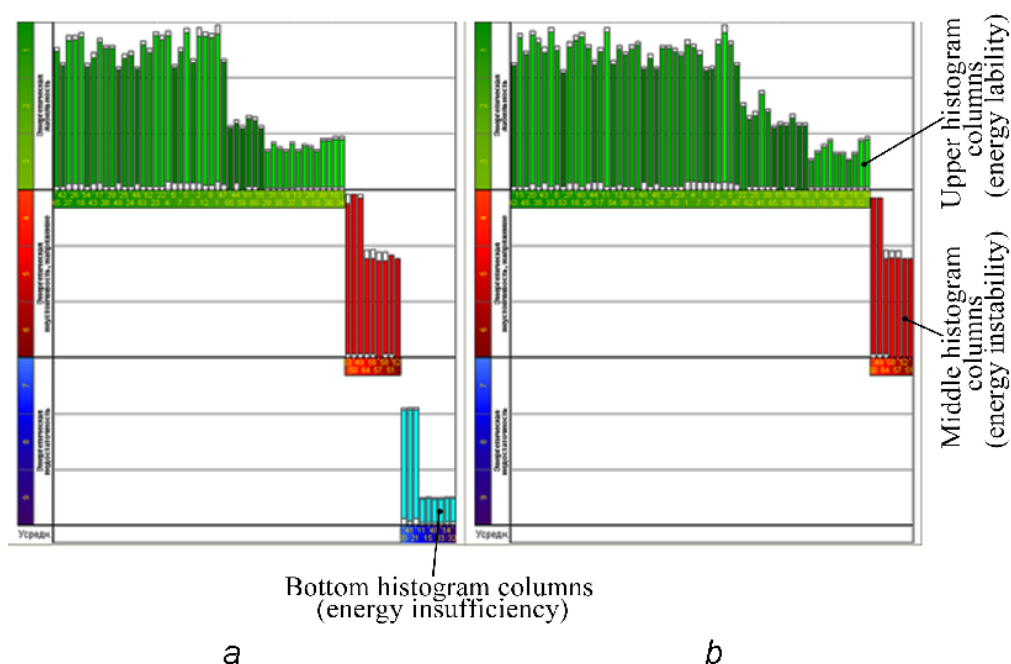


Figure 4. Windows of the software for «Intera-DiaCor» (Ukraine), reflecting the diagnostics results of the functional state of the patient:
 a – without the influence of the designed underwear;
 b – with the influence of the designed underwear

Comparing the number of organs in different energy states (Fig. 4), it is established that the men’s therapeutic and prophylactic underwear has an affect the functional state of the human body.

It should be noted that none of the nine patients with a subclinical course of chronic prostatitis had a seasonal exacerbation, which was regular in previous years.

In a patient who had clinical signs of exacerbation of chronic prostatitis, the period of exacerbation decreased from fourteen days to six, and the patient's improvement was felt on the third day of complex treatment.

Thus, it is established that the use of the developed therapeutic and prophylactic underpants makes it possible to improve the functional state of the men’s body with chronic prostatitis, that is, the formed package of materials is rational, and developed multifunctional clothing is effective and adaptive.

5. CONCLUSIONS

Among the strengths of this research, it is necessary to highlight the development and application of the principles of multifunctional clothing conceptual design, based on the use of energy-information technologies. This allows to choosing knitted fabrics, which have a high inertness level to the functional state of the human body. This is the basis for expanding the functionality of men's underwear. In addition to the basic functions, these clothing have additional functions for treatment and prevention of chronic prostatitis.

Knitted fabrics are selected and justified, which have a high inertness level ($k_i=0.87...0.97$ and $k_i=0.88...1.00$, respectively) for the functional state of the human body, and are recommended as the basic and lining materials for the manufacture of men’s therapeutic and preventive clothing.

The effectiveness and adaptability of the developed men’s therapeutic and prophylactic underwear is estimated through clinical approbation. The improvement of the functional state

of the men's organism with chronic prostatitis after the exploitation of the developed multifunctional clothing for one month is confirmed. According to the results of multifunctional clothing experimental wearing, it is determined that for 100 % of the respondents the indicators of operational control of all patients does not deteriorate. Evaluation of the psycho-physiological sensation of a person in the developed underwear shows that adaptive multifunctional clothing is comfortable and pleasant for a warm sensation for 100 % of patients.

A positive therapeutic and prophylactic effect on patients is ensured by silver plates located on adaptive multifunctional clothing sites according to the BAZ of the lower part of the men's body. The social effect of the work is manifested in improving the health status of men with chronic prostatitis, and, accordingly, improving the quality of their life. Provision of multifunctional clothing with advanced functionality has a positive economic effect by reducing the consumer's money costs and reducing the time spent on medical procedures.

So, the results of the work are aimed at satisfying the needs of consumers and market requirements. They also add of the opportunities for further research to provide different types of clothing of additional functionalities aimed at improving the life quality of a modern person.

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RESEARCH OF THE TECHNOLOGICAL PROCESS OF SCREEN PRINTING ON TEXTILE AND KNITTING MATERIALS

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Abstract: *The aim of the research is to identify the differences in the process of screen printing on textile materials. The equipment, which is used in the process of screen printing on light industry materials, as well as the technological process itself, require the formulation of a number of tasks of analytical and experimental studies.*

Established that the main differences in the process of screen printing on light industry materials are the stability of materials to high temperatures, their hygroscopicity, adhesion properties of paints and the surface of the material, significant linear deformation, temperature shrinkage, operational features of clothing and footwear. Analysed the operations of drawing images by screen printing on light industry materials, as well as done the grouping of equipment for the realization of this process. As a result of consideration and structuring of information on operations of technological process the tasks of further analytical and experimental researches are formulated.

The operations of the technological process of stencil printing on light industry materials derived as a result of theoretical and empirical studies are structured.

The stages and methods of screen printing operations on light industry materials are described.

The abstract should be written in English and not longer than 200 words. (Arial 10, Italic)

Keywords: *screen printing, material of light industry, printing plate, printing surface, photo mask, photo emulsion.*

1. INTRODUCTION

There are two ways to increase the competitiveness of products of light industry enterprises: to reduce the cost price or improve the quality of the products at a constant sale price. Cost reduction is not always feasible and possible, since it depends on the price of raw materials and materials, production costs. The movement to reduce the cost in this way leads to a decrease in the quality of products. Another direction is to improve the quality of products through the use of modern methods of processing, reorganization of production, as well as through the use of innovative processing methods and equipment for decoration of light industry products. The latter can include the application of details on clothing and footwear applications of decorative stones, embroidery of thematic patterns or logos, and the imposition of the image by direct printing or a screen printing method.

The printing of images on paper, plastics, plywood and other hard surfaces through a stencil way began to be widely used in printing and advertising services in the second half of the

20th century. At the beginning of the new millennium, this method of printing images began to be used in light industry for the decoration of clothing and footwear. However, the process of printing images on light industry materials has a number of unexplored issues [5]. First of all, this is due to the peculiarities of the physical and mechanical properties of textile materials and knitted fabrics, artificial and genuine leather, and other light industry materials. Unlike solid surfaces, textile materials have a high hygroscopicity and low temperature stability [12]. Due to the content of synthetic fibres and elastin yarns, a significant deformation of the fabric is possible during drying of the paint at temperatures above 120^o C [2]. The use of natural and synthetic leather requires the selection of paint with a low temperature drying mode in contrast to the paint for textile materials [7,11]. Lightweight fabric materials contain dyes [12], which can interact with the solvent as part of the paint of the image, thereby changing the colour of the imprint. In addition, each batch of fabric requires individual colour picking, technological printing modes and drying of the applied image. Therefore, finding the optimal modes of operation of the equipment, as well as improving the technological process of screen printing, taking into account the physical and mechanical properties of light industry materials, is an urgent task.

2. METHODS

Information on the technological process of the stencil printing method on light industry materials was obtained as a result of empirical studies carried out by the authors of the article, as well as on the basis of review and analysis of information sources.

3. RESULTS

The essence of the stencil printing method is to pushing a special tool (squeegee) the paint through open openings of a flexible mesh to the surface of the printing [3, 10]. Printing can take place on paper, metal, glass, cloth, polyethylene, plastic, leather and other sheet or roll materials or products from them.

The main differences in the process of screen printing on textile materials, natural and artificial leather, in contrast to printing on paper and other dense materials, are the peculiarities of light industry materials, namely their resistance to high temperatures, hygroscopicity, adhesion properties of the paint and the material surface, a significant linear deformation, temperature shrinkage, operational features of clothing and footwear.

For a screen printing method on materials of light industry, paints differing in their chemical composition, adhesion properties and temperature regimes are used. The most widely used paint: plastisol, water paint, solvent and "etching" [1, 6].

For example, the use of plastisol paint requires the influence of thermal radiation to dry it in the range 170 to 185 °C for three minutes [6]. However, this prolonged influence of high temperature leads to the destruction of artificial and natural skins, changes in the initial physical and mechanical properties of most textile materials to the loss of their specified operational properties. The processes of drying different in their chemical composition and properties of paints, their interaction with materials of light industry, as well as their further performance indicators remain unexplored.

In order to set goals for analytical and experimental studies, we will consider in more detail the stages of drawing of screen printing images for light industry materials and equipment used for this purpose.

Operations of this technological process can be divided into two groups.

The first group includes preparatory operations, namely: manufacturing of a printing form, applying a photo emulsion to the grid surface, making a photo mask and displaying it.

The second one is the main operations that directly affect the object of processing: drawing on the surface of the printing, intermediate and final drying of the paint layer.

Let's consider in detail each technological operation.

Manufacturing of a frame of a printing form. Frames are made of different types. For the used material distinguish between wood and metal, by the method of manufacturing - entire and collapsible, by the way of fixing the grid - with and without locks.

Wooden frames are made from solid wood species. In order to provide rigidity and specified geometry, increase the life of the frame, the wood is treated with special solutions that prevent swelling and corrosion. In the manufacture of metal frames, for the most part, aluminium is used which has a low density; therefore, the frame has a smaller mass compared to steel.

The main requirement for the quality of the frames is to ensure the admission of the parallelism and the plane of the working surface of the frame (the surface of the mesh fixation). Solid wood frames are made using a glue method, from aluminium - by welding.

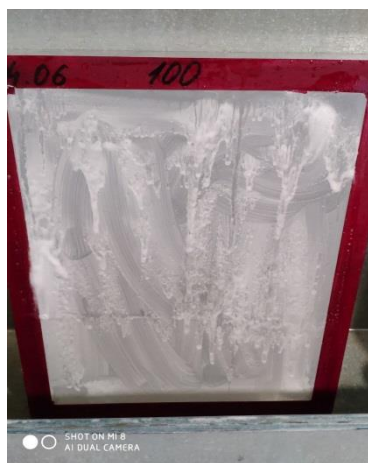
Tensioning and fixing the grid on the frame. For tensioning the grid on a frame, special equipment and devices are used that ensure that the grid is evenly stretched in all directions with the given effort. After stretching the net is fixed on the surface of the frame.

In the case of frames with retainers, the grid is stretched and locked mechanically. In the case of frames without fixings, the surface of the frame should be pre-prepared to improve adhesion.

The quality of the image depends on: Linear grid (the number of grid lines per 1 cm long), which is from 12 to 120 l/cm; fiber of the net; work piece material; the thickness of the applied paint layer; dispersion of paint components or special effects; accuracy and resolution of the minimum required size of the received imprint [5].

Prepare a grid surface before applying a photo emulsion. This technological stage involves several operations, during which the grid is processed with special chemicals.

The first operation is to increase the roughness of the surface - the grinding of the grid (Figure 1, a).



treatment with chemical solutions

a) preparation of a grid surface for applying a photo emulsion



purification



inflection from the side of the imprint

b) applying a photo emulsion

Figure 1. Applying a photo emulsion

It involves applying on a grid of reagents, excerpt, and purification to the surface. The reagent is applied by rubbing it to the surface of the grid with a subsequent endurance, in order to lift the micro wave of the threads. This can significantly increase the surface roughness and the contact area, which further improves the performance of the manufactured stencil, namely, the stability of the emulsion on the grid surface. The next step

is the mandatory degreasing of the surface to improve adhesion between the grid and emulsion.

The application of a photo emulsion is carried out from the working side, or from the contact surface of the mesh with the material (Figure 1, b). Depending on the type of paint and the desired printing effect, the emulsion is applied on both sides to one, two or more layers. The application of several layers from print side can increase the stability of the emulsion to mechanical wear under the action of squeegee. Laying on the side of the print allows you to get a thick layer of paint on the material in one working stroke of the cloth. Since photo emulsion is sensitive to UV radiation [8], it is necessary to apply neutral light or yellow and red light filters during application [9].

Drying the photo emulsion. Carried out in order to remove moisture from the emulsion until complete curing.

Production of photo stencil. This technological stage involves the transfer of a monochrome raster image into binary. In the case of processing a colour image, first divide the RGB, CMYK colour scheme or pontoon division of the existing colour gamut into the binary image [4]. Each binary image is printed with high resolution on a transparent polyethylene film (Figure 2, a), paper or other material that has high UV-bandwidth. In order to eliminate defects in printing, use a retouch, or so-called "blackening", using special sprays and dyes, or make a dual stencil.

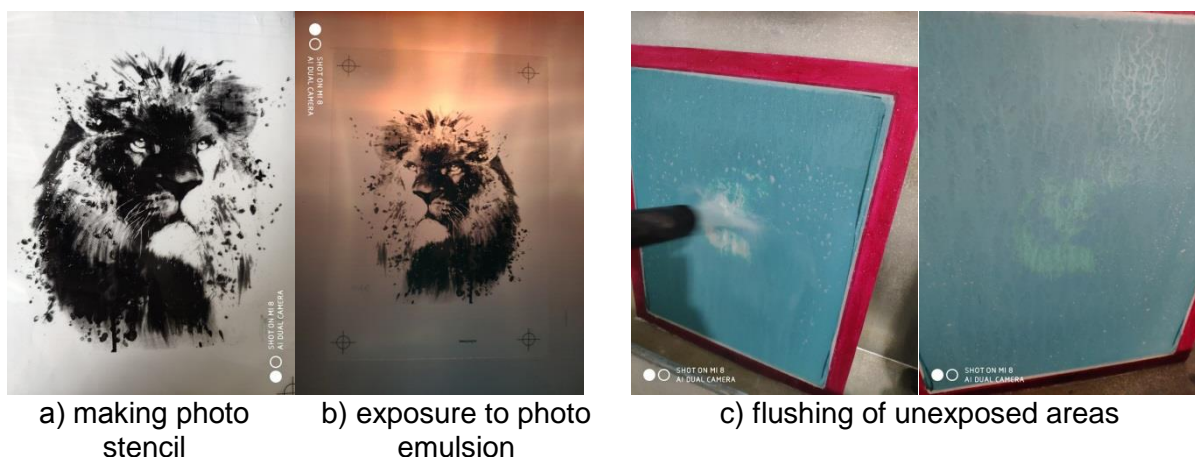


Figure 2. Production of printing forms

Exposure of a photo emulsion occurs under the influence of ultraviolet radiation [8]. A pre-made photo template is placed on a grid from the print side and fixed using an adhesive tape. A frame with a pattern is placed opposite the lamp on the glass, which has a high bandwidth of UV rays (Figure 2, b). So, ultraviolet flux penetrates flow through the glass and transparent film onto the grid surface. Unprotected areas are on display are exhibited, while the protected ones leave unexposed [9].

The rinsing of non-exposed areas of the grid is carried out in order to remove the emulsion from unexposed areas and clean the stencil grid. For water-soluble emulsions, grid is washed under high pressure, using special equipment or nozzles (Figure 2, c).

The drying of the grid is carried out in order to remove excess moisture from the grid surface. Upon completion of the surgery, a visual inspection of the surface of the exposed areas of the photo emulsion and, if necessary, perform a retouch.

Retouching the grid. After detecting defects on the exposed areas of the grid that appear as a result of uneven application of the photo emulsion, or as a result of imperceptible dark pixels in the photo-output, it is necessary to retouch the grid surface. This operation is a point (zonal) application of a photo emulsion or a special mixture, sensitive to UV rays, in places

where defects occur.

In the event of significant defects, re-drying the deposited photo emulsion with subsequent exposure is carried out.

Re-exposure to fixing the received stencil. This operation is performed in the case of retouching of sites of considerable size or after multilayer application of a photo emulsion, for the guaranteed exposure of the inner (first) layers of the emulsion.

At the end of the preparation of the stencil, they move themselves to the procedure of applying the paint to the surface of the print.

Fixing a frame in a device or machine for printing. On a rigid basis mark the location of the print surface. Water-soluble glue mixtures, polyvinyl acetate-based mixtures and special sprays are used to fix the surface of the printing on the plane. After placement of the work piece, the frame is locked in the holder and a test is carried out on the transfer of paint on the work piece (Figure 3, a). If necessary, the frame is shifted relative to the work piece or vice versa, depending on the design features of the equipment and the location of the drawing on the printed form.

Alignment frame relative to the reference image in case of full-colour printing. When printing a pattern in several colours, or in full-colour printing, or printing with the use of additional effects, apply the combination of all stencils relative to the reference imprint. As a reference, you can apply a white print, which is the basis for printing on dark blanks, or black. As a benchmark, in our opinion, it is better to use the photo template itself, which is fixed on a hard surface - countertops, taking into account the location of the work piece.

Printing by forcing paint through the mesh holes. The procedure of applying the image includes the following steps: lowering the stencil on the plane of the print, paint fill empty cells of the pattern, transferring the paint, returning the frame to its original position (Figure 3, b).

The fill of paint with empty cells is realized by uniformly distributing the paint with a squeegee cloth in the printing area. After that, a squeegee cloth press down to the grid with the effort, which provides the choice of technological gap between the grid and the work piece, and the transfer of the layer of paint to the surface of the work piece, is carried out by the rapid movement of the squeegee along the stencil.

The drying of the applied paint layer on the print surface (preliminary or intermediate) is carried out to prevent the bonding of the work piece during moving to the next position, or to dry the first layer of paint during full-colour printing, in order to prevent the mixing of the newly applied colour with the following.

As a result of empirical experience, it has been established that there are two technologies for performing full-colour printing: "wet on wet" or "dry". "Wet on wet" printing allows you to get a larger amount of shades of a colour image as a result of mixing the base colours with RGB or CMYK [4]. However, the disadvantage of such printing is the effect of "dirt" that appears as a result of the transfer of each pre-applied colour to the grid of the next printing form. This requires a continuous cleaning of the printing form. During a dry print, a much cleaner image is obtained however; the colour range of shades suffers from poor mixing of the base colours.

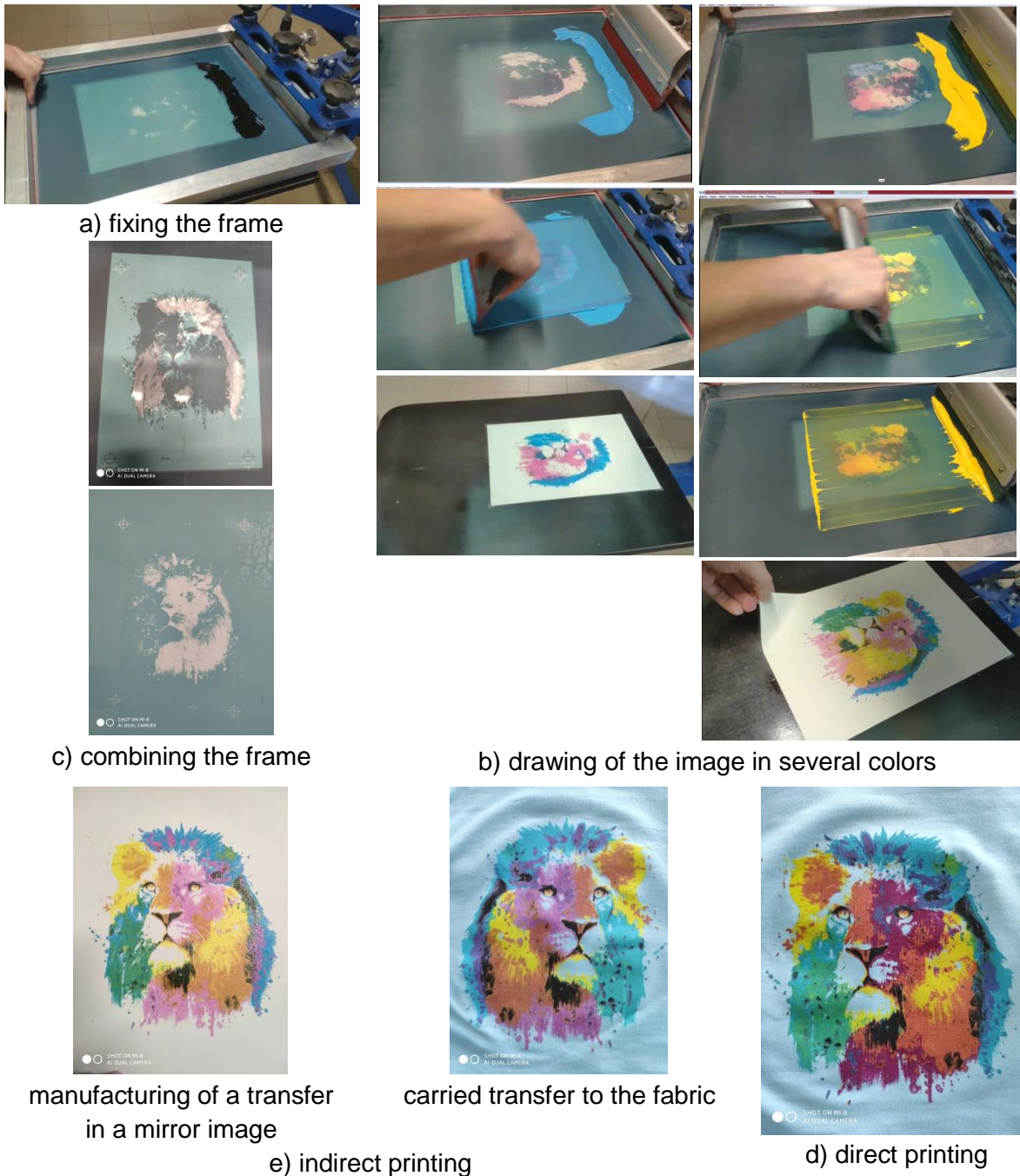


Figure 3. Drawing a drawing on the print surface

Drawing the next color of the image occurs when full-color printing. The procedure of applying a layer of paint or additional effects is similar to the operation of printing a print, or the first color of full-color imprint.

Final drying or polymerization of the paint layer on the surface of the printing. This operation is carried out for the purpose of fixing, polymerizing the applied pattern. The main purpose of this operation is to fix the paint layer on the work piece in order to increase the resistance to abrasion and wear and tear.

For each of the described stages of the screen printing method, special tools, appliances and

equipment are used.

4. CONCLUSIONS

As a result of consideration and structuring of information on the operations of the technological process of the screen printing method on the materials of light industry, obtained as a result of theoretical and empirical studies, the problem of further analytical and experimental research is formulated:

- to review and analyze the equipment for the screen printing method on light industry materials;
- as a result of the analysis, develop a classification of equipment for screen printing on light industry materials;
- to develop engineering methods for calculating the technological regimes of the process of applying and drying the paint, as well as the technical parameters of the technological equipment;
- to develop recommendations for the design of equipment for screen printing on light industry materials.

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MODULAR GARMENT AS A WAY TO ASSEMBLE THE READY-MADE CLOTHING

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Abstract: *The awareness of sustainability is increasing in diverse industries, including fashion industry. The second-hand clothing trade might be considered as a way to make apparel more sustainable. However, the second-hand market adds to the environment contamination using toxic elements to disinfect the clothing. Enhancing the lifespan of product by making it transformable is another approach to sustainability.*

Transformable modular clothing is one of the alternatives to reduce consumption. Thus, this paper aims to develop a modular garment construction as a way of forming the ready-made clothing by the consumer himself.

While fashion depends on continuous updates, the proposed way of assembling the ready-made clothing as a modular item allows the garment to last emotionally long enough to be addressed practically by consumers. An example of modular clothing is designed based on the typological range of women clothing. The range consists of different garment types, which might be transformed into each other. The principle of universality was applied as a basic principle of modular garment design. The universal basic garment designs were found for several different combinations of garment types. The technical information needed to design the modular garment is represented in a form of database of transformation elements.

Keywords: *modular garment, utilization, transformable clothing, typological range.*

1. INTRODUCTION

The awareness of sustainability is increasing in diverse industries, including fashion industry. In order to reduce the harmfulness to the world, fashion industry is seeking appropriate ways to be more sustainable.

Approximately two-thirds of clothing materials are sent to landfills, making it the fastest growing component of waste in the household waste stream. Within the last five years, textiles disposed of in landfill sites have raised from 7% to 30%.

With environmental issues being more prominent and fashion pollution noted, people learn how to be environmental friendly and second-hand/pre-owned stores have become very fashionable and respectable in Europe and the US. That is why nowadays, the second-hand clothing trade, globally, has grown considerably. Internet connectivity added strongly to the online trade of second-hand garments. However, for some countries it is important to ban or restrict such a trade in order to protect the local textile and garment industry. Besides that, the second-hand market adds to the environment contamination using some toxic elements to disinfect the clothing.

Sustainable fashion concerns more than addressing fashion textiles or products. It comprises addressing the whole system of fashion. This means dealing with interdependent social, cultural, ecological and financial systems. It also means considering fashion from the perspective of many stakeholders – users and producers, all living species, contemporary and future dwellers on earth. Sustainable fashion therefore belongs to, and is the responsibility of citizens, public sector and private sector.

1.1. Trends towards sustainability

In modern times, with a prominent trend towards sustainability and being 'green', sustainable clothing has expanded towards reducing the amount of clothing discarded to landfills, and decreasing the environmental impact of agro-chemicals in producing conventional fiber crops.

In order to reduce the amount of clothing discarded to landfills zero-waste design is used. Zero-waste design is a concept that, although has been prevalent for many years, is increasingly being integrated into production. Zero-waste design can be used through multiple industries but is very applicable in developing patterns for garments. The concept of zero-waste pattern making is designing the pattern for a garment so that when the textile is cut, there is no extra fabric going to waste. This means the pattern pieces for a garment fit together like puzzle pieces in order to use the entire amount of fabric provided, creating no waste in this step of production.

Enhancing the lifespan of products have been yet another approach to sustainability, yet still only in its infancy. Upmarket brands have long supported the lifespan of their products through product-service systems, such as re-waxing of classic outdoor jackets, or repairs of expensive hand-bags, yet more accessible brands do still not offer even spare buttons in their garments. One such approach concerns emotionally durable design, yet with fashion's dependency on continuous updates, and consumer's desire to follow trends, few garments last emotionally long enough to be addressed practically by consumers.

Nowadays, emotionally durable design of clothing might be considered as a part of a slow fashion concept that is a counterpart of the fast fashion concept.

Fast fashion is a contemporary term used by fashion retailers to express that designs move from catwalk quickly to capture current fashion trends. Fast fashion clothing collections are based on the most recent fashion trends presented at Fashion Week in both the spring and the autumn of every year.

Slow fashion is a fashion concept that reflects a perspective, which respects human living conditions, biological, cultural diversity and scarce global resources and creates unique, personalized products. Slow fashion consists of durable products, traditional production techniques or design concepts that are season-less. New ideas and product innovations are constantly redefining slow fashion, so using a static, single definition would ignore the evolving nature of the concept.

Transformable clothing is one of the appropriate alternatives to reduce consumption and reinforce consumers to engage in sustainable lifestyle. Authors consider such approach as a representative of slow fashion concept.

1.2. Transformable clothing

There is much different information about the appearance of the transformable clothing in literature [1-4], fashion shows, online shops, fashion magazines, online fashion reviews, patents databases, etc. Many researchers investigate the principles of transformation in the clothing design [5].

They mostly agree with the statement of sustainability of transformable clothing.

1.3. Modular garment design

Many consumers are contented with the fast fashion styles, abundant choices, and affordable price. However, other consumers and environmental advocates began to question about fast fashion system, including the problems of overconsumption and disposable clothing. As a result, many fashion practitioners and scholars have been developing different strategies and methods to minimise the fabric waste, and prolong the product lifespan through innovative design [6].

The modular clothing is an alternative resource for consumers to ultimately save in regards to money and time.

Modular clothing items or wardrobes are becoming increasingly popular as consumers look to make long-term fashion purchases over pieces that are considered to be “on-trend.” These pieces offer consumers the flexibility to change up their style without the costs associated with constantly purchasing new items.

This paper aims to develop a modular garment construction as a new way of forming the ready-made clothing by the consumer himself. Such a garment construction would benefit in reducing the amount of landfill space occupied by discarded clothes.

2. METHODS

The principle of universality is considered as a basic principle of heuristic clothes design. It was discovered that the set of universal parameters might and must be obtained for every one of the objects of unification. The main ones of them are the details of a front, a back, and a sleeve. The parameters of them depend on the characteristics of the chosen fashion fabric. The lists of fabric characteristics, which are needed to be investigated in order to select a fashion fabric for garments of the given transformation chain, were formed in previous works. If S is a set of basic designs of garment types, which belong to women clothing, then S_i the sets those consist of basic designs of specific garment type, which is represented by basic designs of any possible silhouettes. Usually one consider silhouettes as follows: fitted, semifitted, straight, and trapeze.

The silhouette is formed by using the combination of amount of eases at the main constructive levels $S_{ij}=(P_{gij}, P_{tij}, P_{cij})$.

Amount of eases usually are presented as a range such as follows [a, b].

However, each designer suggests using the specific range based on his own experience and often the ranges are different. That is why, in order to get the valid basic design it is advisable to operate with mean value of eases rather than specific value suggested by specific designer.

Thus, the features, which form the sets of basic designs S_g , S_t , and S_c , are the mean values of amount of eases at the bust line, waistline, and the hipline respectively. Then parameters of the universal basic design of the garment set must be calculated as follows:

$$\bigcap_{g \in G} S_g = \{ P_g / \forall g \in G, a_g < P_g < b_g, P_g \in S_g \} \quad (1)$$

$$\bigcap_{t \in T} S_t = \{ P_t / \forall t \in T, a_t < P_t < b_t, P_t \in S_t \} \quad (2)$$

$$\bigcap_{c \in C} S_c = \{ Pc / \forall c \in C, a_c < Pc < b_c, Pc \in S_c \} \quad (3)$$

where P_g, P_t, P_c – amount of eases at the bust line, waistline, hipline respectively, cm;
 a_g, a_t, a_c – minimal value of the amount of eases at the bust line, waistline, hipline respectively, cm;

b_g, b_t, b_c – maximum value of the amount of eases at the bust line, waistline, hipline respectively, cm.

As all three parameters are obligatory to form a specific silhouette design, thus, the universal basic design exist only if:

$$\exists S = (\bigcap_{g \in G} S_g \neq \emptyset; \bigcap_{t \in T} S_t \neq \emptyset; \bigcap_{c \in C} S_c \neq \emptyset) \quad (4)$$

Then:

$$\bigcap_{g \in G} S_g = S_{g11} \cap S_{g12} \cap \dots \cap S_{gij} = (S_{g11} \cap \dots \cap S_{gij}) \cap (S_{g12} \cap \dots \cap S_{g(i-1)(j-1)}) \quad (5)$$

3. EXPERIMENTAL

The development of the modular garment is based on the heuristic methods of the typical design of the typological ranges of clothing in the design situations that are rapidly changing [7].

The range consists of different garment types, which might be transformed into each other.

Typological analysis of the set of garment structure elements is a basis of the knowledge base that is needed to make a well-grounded decision to select a garment prototype [8].

The structure of any garment comprised of the following elements: a bodice, a sleeve, a collar (sometimes a cape). Thus, the garment type should be described as a combination of the mentioned elements while some of them are constant and others are variable. Transformation is performed through the recombination of the elements. Furthermore, any possible garment type is constructed of the very same elements. Therefore, in order to construct a garment out of the set of its parts, it is necessary to develop the elements of garment that would be universal and could be included in different garments without any improvements or adjustments.

Geometrical parameters of the garment parts depend on the two parameters such as body measurement and amount of eases. The body measurement for the current study must be assumed constant. That is why, it is advisable to focus on the amount of eases in order to develop universal design of garment elements.

3.1. Universality principle

As a result of investigation of amounts of eases at the main constructive levels it was discovered that there is no any universal basic garment design, which can be used for the transformation chain that is consist of more than three garment types. However, the parameters of universal basic garment designs were calculated for several different combinations of garment types (formulas 1-5, table 1).

Table 1. Parameters of the universal pattern blocks of shoulder women clothing

Garments types	Number of garments types	Code	Amount of eases, cm		
			Pg	Pt	Pc
Coat, suit jacket	2	FC-SfSJ	6.2-6.9	4.7-6.2	4.2-4.5
Coat, raincoat	2	FC-FR	6.2-6.6	4.7-6.2	4.2-5.4
Coat, suit jacket	2	SfC-SSJ	7.2-8.0	6.6-7.8	5.4-6.0
Coat, suit jacket	2	SC-TSJ	8.4-9.7	8.7-10.2	7.9-9.4
Coat, raincoat	2	SC-SfR	8.4-9.8	8.7-10.2	7.9-9.4
Coat, suit jacket	2	TC-TSJ	9.2-9.7	>10.7	>11.0
Coat, raincoat	2	TC-SR	9.8-11.0	11.3-14.9	11.0-13.1
Suit jacket, raincoat	2	SfSJ-FR	5.8-6.6	4.7-6.4	3.4-4.5
Suit jacket, raincoat	2	SSJ-SfR	7.2-8.6	7.6-7.8	6.4-7.4
Suit jacket, jacket	2	TSJ-FJ	8.2-9.7	12.0-18.0	7.8-10.0
Suit jacket, raincoat	2	TSJ-SfR	8.2-9.7	7.6	7.8-9.8
Jacket, raincoat	2	FJ-SR	8.0-12.0	12.0-14.9	9.8-10.0
Jacket, raincoat	2	SfJ-TR	12.9-16.0	18.0-18.5	13.1-14.0
Jacket	1	FJ-SfJ	12.0	18.0	10.0
Jacket	1	SfJ-SJ	16.0	24.0	14.0
Jacket	1	SJ-TJ	20.0	30.0	18.0
Raincoat	1	FR-SfR	6.6	7.6	6.4
Raincoat	1	SfR-SR	9.8	11.3	9.8
Raincoat	1	SR-TR	12.9	14.9	13.1
Raincoat, coat, suit jacket	3	FR-FC-SfSJ	6.2-6.6	4.7-6.2	4.2-4.5
Coat, suit jacket, raincoat	3	SC-TSJ-SfR	8.4-9.7	8.7-10.2	7.9-9.4
Suit jacket, jacket, raincoat	3	TSJ-FJ-SR	8.2-9.7	12.0-14.9	9.8-10.0

In the table 1: FC – fitted coat; SfC – semifitted coat; SC – straight coat; TC – trapeze coat; FSJ – fitted suit jacket; SfSJ – semifitted suit jacket; FJ – fitted jacket; SfJ – semifitted jacket; SJ – straight jacket; TJ – trapeze jacket; FR – fitted raincoat; SfR – semifitted raincoat; SSJ – straight suit jacket; TSJ – trapeze suit jacket; SR – straight raincoat; TR – trapeze raincoat.

The matrix of combinations of eases, which are recommended for the different sleeves, was formed by using the same method. The recommendations, which are needed in order to construct the universal basic garment design that is taking into account the fabric properties, were developed [8]. The universal designs of the collars were developed by using the same principle of universality [9].

3.2. Transformability analysis

As it was mentioned before the modular garment or so called garment set is a kind of the transformable clothing. Therefore, the sewing sequences, which are needed to sew the parts of garment set, are presumably the same ones as for the transformation parts of transformable clothing. As a result of the analysis of design and methods of construction of transformable sections, it was determined that the change of garment length frequently causes the change of garment type. Due to the transformation, the internal seam lines of the original garment become to be the hemlines of the transformed garments.

The basis of informational and analytical grounding of transformation process is a structural characteristic of transformable segments that are the most essential parts of the

transformable garment design. Presence of the transformable segments is the main feature that differentiates transformable garments from the other ones [10].

In order to investigate the process of transformation the analysis of ready-to-wear transformable clothing was performed. Over 600 transformable garments styles were selected out of online shops catalogues and fashion blogs. The sample size was decreased to 50 garment styles due to the most significant differences between them. The list of differences includes characteristics of garment type, material, silhouette, style seams, collar, pockets, etc.

The analysis allowed forming the structure of typical basic transformation parts. It determines the content of general sewing sequences, which are used to sew the transformation parts [11]. Rational levels of the segmentation lines of transformable clothes were determined based on the information research of the segmentation. Interrelationships between levels of segmentation of different parts of garments were established.

3.3. Expert system recommendations

The information of design parameters of bodice, sleeve, and collar was implemented in the database of transformation elements together with the information of general sewing sequences, which are used to sew the transformation parts.

The database of transformation elements that has an open structure and might be filled in during the exploiting as well as the prototype of the expert system (ES) of rapid change in clothing design were used in order to design the modular garment [8]. The prototype of the expert system consists of the following subsystems "Transformation chain", "Basic design", "Fabric selection", and "Functional part". Consequently, the design parameters of the garment were proposed by the ES.

4. RESULTS

As a result of research an example of modular clothing is designed based on the typological range of women clothing (fig. 1). The garment set consists of the following parts: a bodice, a skirt, an upper part of sleeve, a cuff-sleeve, a collar, a waistband, and the decorative part of the skirt. Each part is manufactured separately from the other ones. Thus, every garment part is a separate item to be sold and bought. The parts are not sewn together. The consumer himself using zippers, which are located at the hemlines of the items, must assemble them into one garment. There are several different variations of each part of the garment set. It allows combining them into various garment types and styles (fig. 2). In the figure 2 one can see several clothing items, which were constructed out of the developed garment set, such as long coat, coat, vest, jacket, and spencer. All of them belong to the typological range of women clothing.



a b

Figure 1. Garment Set: a) the basic structure; b) variations of the basic garment parts



Figure 2. Examples of the garments constructed by consumers

A consumer can create his own style by combining elements and their parameters such as colour or fashion fabric.

While geometrical parameters of the bodice parts are limited to the list, which is shown in the table 1, the style lines, colours and decoration of each part of the garment set may have unlimited number of variations and depend only on the designer's imagination and current fashion trends.

5. CONSLUSIONS

As a result of the current study the example of modular garment is designed based on the typological range of women clothing, which consists of several different garment types such as coat, jacket, suit jacket, and vest. Besides, several of sub-types of garments represent each of garment type. Therefore, one modular garment or so called garment set allows constructing any given style. The modular garment construction is a new way of assembling the ready-made clothing by the consumer himself.

The principle of universality was applied as a basic principle of modular garment design. The parameters of universal basic garment designs were calculated for several different combinations of garment types. The technical information needed to design the modular garment was obtained from database of transformation elements.

While fashion depends on continuous updates, the proposed way of assembling the ready-made clothing as a modular item allows the garment to last emotionally long enough to be addressed practically by consumers. Such a garment has enhanced lifespan and consequently benefit in reducing the amount of landfill space occupied by discarded clothes. The option to buy a part of the modular clothing is an alternative resource for consumers to save in regards to money. Another option, which is to transform the clothing when it is necessary, is an alternative resource for consumers to save in regards to money and time.

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ASSESSMENT OF THE CLOTHING COMFORT

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Abstract: *The main objective of the study is to develop a method to assess the clothing comfort with taking into account physical parameters such as temperature and humidity.*

In order to gather information about the physical parameters of human body in the certain garment a universal device was developed. The device consists of following elements: a controller, a data logger, a power source, and seven sensors.

The parameters under consideration were as follows: temperature and humidity of the space between the fabric of garment and the human body. The garment under study is a summer dress. The sensors were placed at the positions that are selected due to the location of the human body perspiration areas. Temperature and humidity were recorded to the data logger. The experimental assessment was conducted in three different states: static (sitting position), moderate physical activity (strolling) and high physical activity (running). The parameters were measured near the human skin and compared to the similar environmental parameters.

As a result of the research authors aim to develop the indices to select the garment, which would be advisable to wear in some environmental conditions by certain person, who is described by his psychological preferences and certain body type.

Keywords: *comfort, temperature, humidity, sensor.*

1. INTRODUCTION

In the last few decades, the concept of comfort became crucial for marketing products and services. The concept of comfort became crucial for clothing items, especially to women clothing.

From food to fashion advertisement, constantly, people are exposed to commercial stimuli that link products to the idea of comfort. Despite the familiarity and the frequent occurrence of words related to comfort in daily life, it is difficult to describe the exact meaning of comfort. Comfort has not a consensual definition, however, great part of the researchers agree that comfort is a multidimensional and subjective experience [1–8]. The comfort of clothing is often considered as being a complex phenomenon that comprises at least three dimensions: the physical, the physiological and the psychological.

Although it is difficult to describe comfort positively, discomfort can be easily described in such terms as prickle, itch, hot and cold. The discomfort arises from too hot, too cold, and odorous or stale atmosphere. Comfort conditions are those that do not cause unpleasant sensation of temperature, drafts (unwanted local cooling), humidity or other aspects of the environment.

Thermal comfort greatly affects the human health. It is defined by the state when thermoregulation of human body is not overloaded.

Design of the rational comfort clothing, which might be applied in different environmental and manufacturing conditions, is the scientific issue that might be solved by complex applying data from the physiology, physics, material science, and clothing design.

2. METHODS

The main objective of the study is to develop a method to assess the clothing comfort with taking into account physical parameters as well as psychological response of the consumers. In order to achieve the objective of the study it is necessary to analyse the conditions of comfort, and, consequently, to choose the parameters, which must be considered to get the valid assessment of the clothing comfort. Furthermore, the parameters are to be measured. That is why a simple device to measure the chosen parameters must be developed.

2.1. Conditions of comfort

There are three basic conditions for the optimal thermal comfort.

The first condition necessary for thermal comfort for a person under long exposure to a given environment is the existence of a heat balance, a condition, which is naturally far from sufficient.

The parameters, which meet requirements of the first condition, are as follows: clothing with 0.5-1.0 Clo, light work, human body weight is 40 to 110 kg, air temperature 14-27 °C, air humidity 30-70%, speed of air movement 0-0.6 m/s.

The second condition determines the temperature limits of the heated and cooled surfaces that are placed near the human body.

The third condition of the comfort temperature setting is as follows: the consumer according to his subjective feelings should be able to regulate the parameters of the climate under the clothing individually.

Thus, the parameters, which must be measured in order to assess clothing comfort objectively, are as follows: the temperature and the humidity of the space between the fabric of garment and the human body.

2.2. Development of the universal device to assess the parameters of clothing comfort

In order to gather information about the physical parameters of human body in the certain garment the universal device was developed (fig. 1). The design of the device is based on the modular assembling. It is developed by the authors and described in [9]. The structure of the device consists of the few main elements: a controller, a data logger, a power source, and seven sensors.

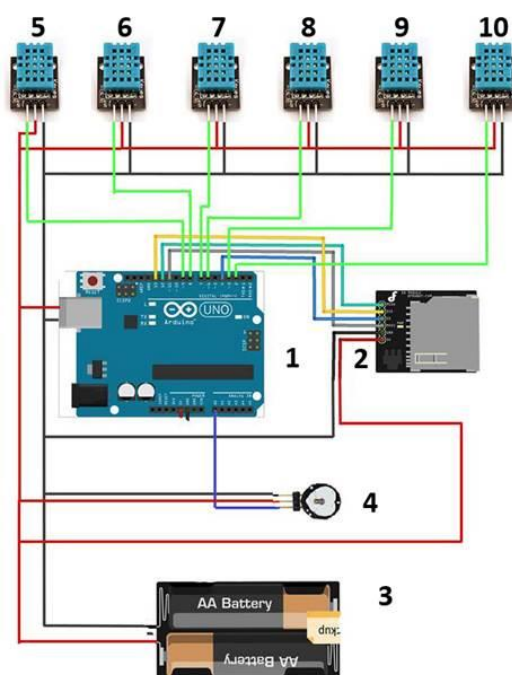


Figure 1. The device to measure the parameters of clothing comfort: 1 – the controller; 2 – the data logger; 3 – the power source; 4 – the heartbeat sensor; 5-10 – the sensors of temperature and humidity measuring

The device was composed based on the open-source microcontroller board Arduino UNO that is based on the Microchip ATmega328P microcontroller.

The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable.

The sensor DHT22 is used to measure temperature and humidity of the environment. The sensor is simple in use. It has high accuracy and low power consumption.

This sensor is very popular because it is very cheap but still providing great performance. The main specifications of the sensor: its temperature measuring range is from -40 to +125 degrees Celsius with ± 0.5 degrees accuracy. In addition, the DHT22 sensor has humidity-measuring range from zero to 100% with 2-5% accuracy.

The sensor consists of a humidity sensing component, a NTC temperature sensor (or thermistor) and an IC on the backside of the sensor.

For measuring humidity, it use the humidity-sensing component, which has two electrodes with moisture holding substrate between them. So as the humidity changes, the conductivity of the substrate changes or the resistance between these electrodes changes. This change in resistance is measured and processed by the IC, which makes it ready to be read by a microcontroller.

3. EXPERIMENTAL

As it was mentioned before, the considered parameters were as follows: the temperature and the humidity of the space between the fabric of garment and the human body. Thus, the device was attached to the clothing of the person. The sensors were placed at the positions

that are selected due to the location of the human body perspiration areas (figure 2): a front, a back, an armpit, and a leg.

Temperature and humidity were recorded to the data logger. The experimental assessment was conducted in three different states such as static (sitting position), moderate physical activity (strolling) and high physical activity (running). We obtained the average from the 3 measured data as the result at each state. One of the sensors was attached on the clothing rather than under the clothing in order to measure the environmental conditions. The parameters, which were measured near the human skin, were compared to the similar parameters of the environment. The heartbeat sensor was placed on the finger.

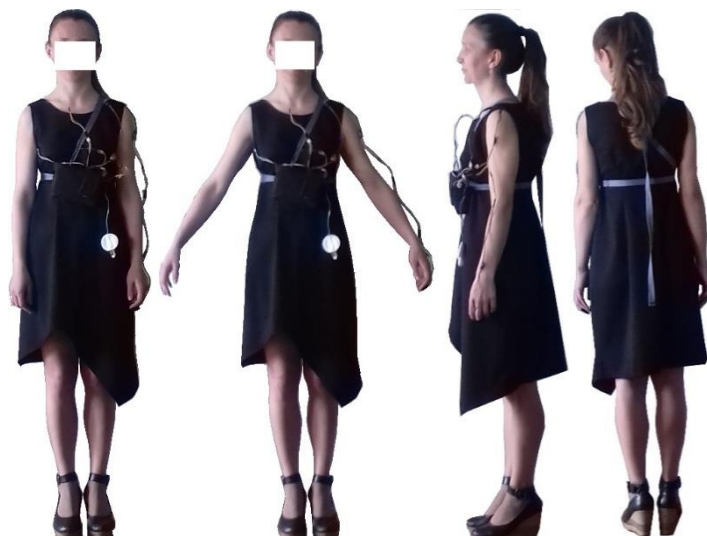


Figure 2. The tested garment with the device attached

The garment under study is a summer dress. The dress was previously designed according to consumer's body type as well as harmonization design rules. The tester is a female with skinny body type. She is 38 years old. The body weight is about 50 kg.

3.1. Experimental conditions

The experimental conditions were as follows: humidity – 80-90%, temperature 22 °C.

The states of physical activity of the tester: static (sitting position) ($M/F_{DU} = 70 \text{ W/m}^2$), moderate physical activity (strolling with speed 3 km/hour) ($M/F_{DU} = 130 \text{ W/m}^2$), and high physical activity (running) ($M/F_{DU} = 200 \text{ W/m}^2$).

Tester's weight is about 50 kg. Between the measurements tester rested for five minutes. Every time-phase was about 10 minutes.

Indicators, which were used for measurements, are as follows:

Parameter PMV (PMV – Predicted Mean Vote). The PMV index predicts the mean response of a larger group of people according the ASHRAE thermal sense scale: +3 (hot), +2 (warm), +1 (slightly warm), 0 (neutral), -1 (slightly cool), -2 (cool), -3 (cold).

Parameter M/F_{DU} , where M is metabolic heat, which is radiated by human body during its life activity and physical work; F_{DU} is the so-called Dubois surface of the body, which considers the most important individual 'metric' characteristics and can be defined based on the following correlation:

$$F_{DU} = 0.203 G 0.425 L 0.725 [m^2] \quad (1)$$



where: G is the weight of the individual (kg), L is the height of the individual (m).

The results of the measurements are shown in the figure 3-6.

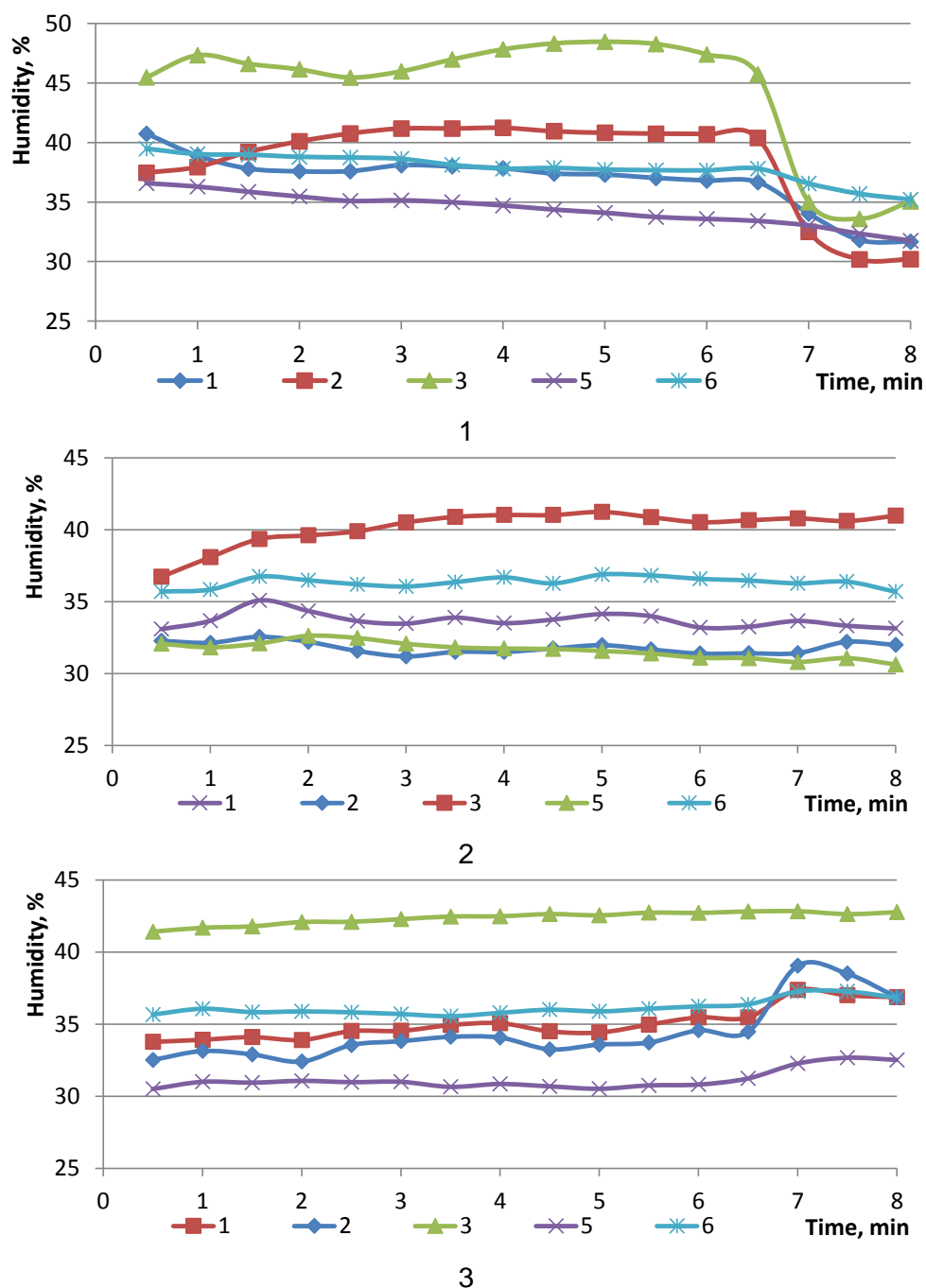


Figure 3. Humidity graphs

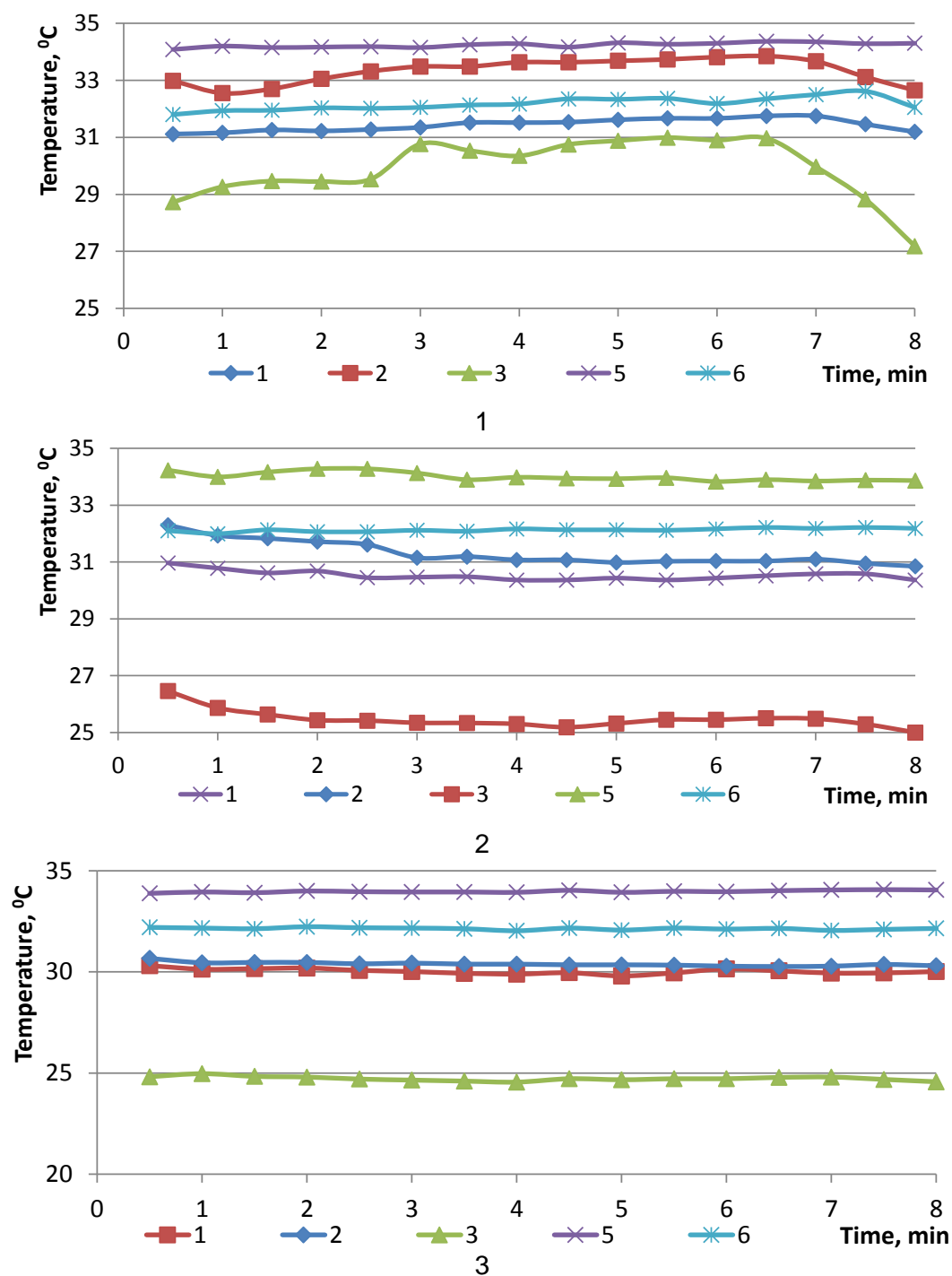


Figure 4. Temperature graphs

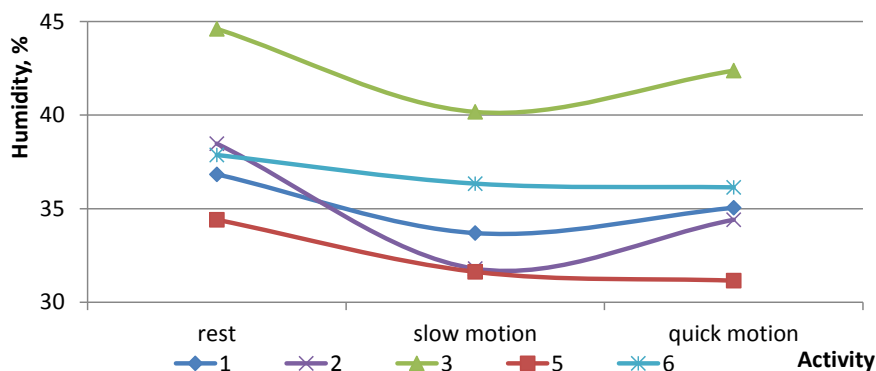


Figure 5. Humidity time-phase change graphs

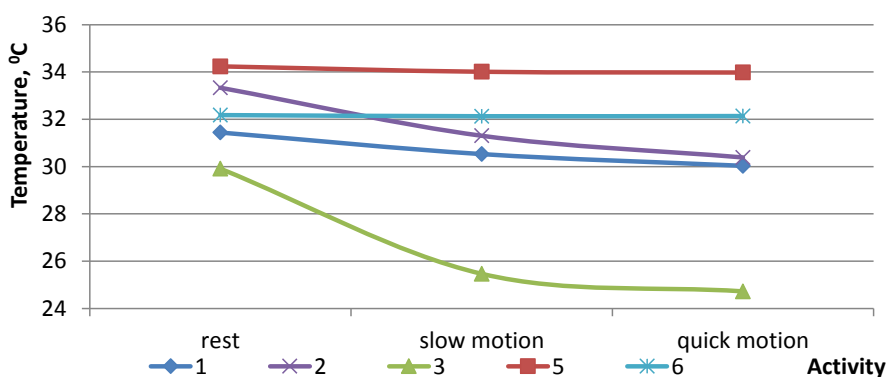


Figure 6. Temperature time-phase change graphs

4. RESULTS

The graphs show the changes of humidity and temperature over a period of half an hour. The graphs show that the humidity as well as the temperature is the highest at the first phase when the tester was sitting. While the tester was strolling the rates of humidity and temperature slightly decreased due to the air movement and cooling the human body down. The third experimental phase (quick motion) demonstrated increasing of both parameters due to the high physical activity.

The highest numbers of humidity were observed at the sensor 3 (located outside of the clothing) and sensor 6 (located under the front of the dress). The sensor 5 that was located at the armpit measured the highest numbers of temperature.

Therefore, it would be appropriate to adjust the design of the dress in order to balance the heat distribution over the human body. The parts that must be improved are the front and armscye. The most advisable adjustment is to low the neckline and the armscye.

At the same time as it was observed that humidity under the garment is much lesser than in the room it testify that the fashion fabric of the dress is selected well.

5. CONCLUSIONS

The main objective of the study, which is developing the method to assess the clothing comfort with taking into account physical parameters, was successfully achieved by developing the universal device. It allowed measuring the parameters such as humidity and temperature near the human skin and comparing them to the similar environmental parameters.

As a next stage of the conducted research, authors aim to develop the indices of clothing selection those might be used to develop a production model of the expert system to select the garment, which would be advisable to wear in some environmental conditions by certain person, who is described by his psychological preferences and certain body type.

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IMPROVEMENT OF THE DESIGN PROCESS OF CLOTHING FOR PREGNANT WOMEN

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Abstract: *The article is devoted to the improvement of the design process of clothing for pregnant women on the basis of the concept of a systems approach.*

The role of clothing in this period acquires a special functional significance. The most important functions of clothing for pregnant women are to provide comfortable conditions for physiological and spiritual life.

Significant influence on constructive-composite solution of clothing models is carried out by biosocial features.

Functionality of clothing is realized on the basis of the choice of properties of materials, package design, constructive-composite and coloristic solution of models.

The recommended color palette for pregnant women's clothes is formed taking into account the color type of appearance and personality type.

The influence of changes in the size and shape of the body of women in the course of pregnancy progression on constructive-compositional solutions in clothing is investigated by constructing and analysing sweep of the body surface of women in different periods of pregnancy.

The use of transformation methods in the design of clothing for pregnant women can significantly expand the range, enhance its versatility and functionality, extend the service life, reduce the cost of purchase.

Keywords: *pregnant woman, systems approach, constructive-composite solution, clothing model, quality indexes, color palette, transformation methods.*

1. INTRODUCTION

In the course of economic reforms that are oriented to the free market and competition, the success of garment enterprises depends on their ability to produce competitive products that will ensure the efficiency of production.

For producing of competitive products a necessary decision a number of tasks of the design process of clothing for pregnant women on the basis of the concept of a systems approach. It covers all the factors that determine properties of the clothing models that meet the requirements of consumer and production.

The role of clothing in this period acquires a special functional significance [1]. The most important functions of clothing for pregnant women are to provide comfortable conditions for physiological and spiritual life.

It should be noted that in pregnant women there are significant changes in psycho-emotional, psychophysiological, anthropometric nature, changing biosocial characteristics that have an influence on decision making when choosing clothes [2]. However null information about

character of their influence on requirements to the clothing complicates the design of competitive garments for expectant mother.

The body of a woman during pregnancy works in extreme conditions, which affects the requirements of women to clothing. Functionality of clothing is performed on the basis of the choice of properties of materials, layers of fabrics, constructive-composite and coloristic solution of models. It has not been established which of the properties of materials and why it is necessary to give preference when designing clothes for pregnant women [3]. In addition, there is no information on the properties of materials that women prefer themselves.

Therefore, it is necessary to study the most significant from the practical point of view, the properties and features of clothing that provide the comprehensive comfort of women during pregnancy.

By the way, it is very important to design garments that have the ability for transformation [1, 5, 6]. The transformation of clothing is the ability of the garment to change its shape and silhouette due to the mobile structure. Such garments are necessary for pregnant women.

2. METHODS

The article deals with the use of transformation techniques and methods for the development of a rational pregnant woman's wardrobe. The object of the research paper is a multifunctional clothing for pregnant women. The aim of the work is to develop and test principles of designing multifunctional clothing for pregnant women on the basis of transformation methods. The paper used general scientific theoretical and empirical research methods, principles and methods of transformation, as well as well-known methods and techniques of designing clothing and other items of clothing. It has been established that the basic principle of designing multi-functional clothing for pregnant women is the principle of functional transformation. Analyzed the basic techniques of transformation, providing the opportunity to design multi-functional clothing for pregnant women.

According to existing classifications [1, 5, 6], the main principles of clothing transformation are: "stretching – compression", "separating – joining", "regulation – fixation", "folding – deployment", "replacing", "orientation", "relocation", "reversing".

It should be taken into account that a certain type of transformation provides the realization of specific functions of the transformable clothes.

Structural solutions of the elements of transformation and the types of their structural connections in the wardrobe were systematized for effective use in the design of models of the clothes (Table 1).

Table 1. Classification of types and principles of transformation of clothing

Transformation type	Function	Constructive decision
Stretching – compression	The principle of self-regulation	Inserts made from elastic materials in seams of a garment; elastic braid in straps and belts
Separating – joining	Separating or joining of the parts of garment	Removable parts
Regulation – fixation	Alteration of the volume or shape of the garment	Alteration of the length of the pants; alteration of garment tightness
Folding – deployment	Alteration of the construction of the parts of garment	Folding of the hem of the pants and sleeves
Replacing	Replacing some parts of garment with others	Removable complete sets of additional elements
Orientation	Adaptation to age, climatic	Removable parts

	conditions etc.	
Relocation	Relocation and combination of the parts of garment	Relocation of removable parts of different colors and materials from one place to another
Reversing	Increase of the appearance of the garment at the expense of the front and back side	Reversible garments

The use of transformation methods in the design of clothing for pregnant women can significantly expand the range of clothing, enhance its versatility and functionality as well as extend the service life and reduce the cost of purchase.

3. EXPERIMENTAL

There are lots of factors, which influence on the formation of consumer demand occurs. Significant influence on constructive-composite solution of clothing models is carried out by biosocial features. There are character, age, place of residence, social status, education, as well as the size and shape of the human body.

The best method of a research for definition of the most important factors is a questionnaire method. Questions for definition biosocial characteristics of respondents are given in the questionnaire.

According to [8], biosocial characteristics include education, social status, marital status, the presence in the family of children, place of residence, psychological type of personality, age, color type of appearance.

It is assumed that the perception of clothing is also affected by the term of pregnancy.

All these characteristics are taken into account when developing the questionnaire.

According to the results of the survey, statistical tables and diagrams have been developed, which show that the sample of respondents is dominated by women with higher education (38%), employees of commercial institutions (40%), married without children (32%), having the first pregnancy (48,7%), mixed color type of appearance (51%), live in the city (95,8%), sanguine (24%), age from 20 to 28 years (39,2%). In the group of respondents, who assessed attributes of clothing, women who were in the second trimester of pregnancy (40,3%) prevailed.

To establish the weightiest qualities of clothing, average scores were calculated for each group and subgroup of questions, as well as for each feature within the group. To establish significant indexes a 5-point scale was used [9].

As a result, it was found that for pregnant women the most important are physiological (4.51 points) and psychological (4.1 point) comfort, as well as convenience in statics and dynamics (4.83 points), wearing and removing (4.52 points) of the garment. The preference is given to the universal clothes of industrial production (4.6 points). Actual are the clothes of daily appointment (4.8 points), average volume (3.5 points), elegant style solution (4.64 points). The interviewed women prefer soft pastel colors of materials (4.7 points).

For revealing the influence of biosocial personality traits on clothing requirements, a dispersion analysis was conducted. It was found that the most active requirements for the properties of clothes for pregnant women are influenced by the term of pregnancy, education, social status and type of body.

Thus, the social and individual psychological comfort of the employees of state and commercial institutions is most highly appreciated.

The convenience of clothing in statics and dynamics, when wearing and removing and performing basic movements, pay special attention to housewives and workers.

Comforts and protection from the environment pay great attention to women in the first trimester of pregnancy.

The role of clothing in this period acquires a special functional significance [9]. There is an opinion that the traditions and customs of society influence the choice of models of clothing. Some women tend to hide their condition, others emphasize it.

The nomenclature of quality indexes of dresses for pregnant women has been established taking into account their functions and normative documentation. The substantiation of the choice of quality indicators for modern women's garments for pregnant women and the determination of their weight was carried out by expert method. This list includes five classes of group indicators of the subsystem of the consumer level of quality [9].

The most important indexes are ergonomic (4.82 points) and performance (4.27 points) indexes of clothing quality. Ergonomic indexes, which influence on the creation of aesthetic perception of the woman's figure, are very important.

The body of a woman during pregnancy works in extreme conditions, which affects the requirements of women to clothing. Functionality of clothing is performed on the basis of the choice of properties of materials, layers of fabrics, constructive-composite and coloristic solution of models. It has not been established which of the properties of materials and why it is necessary to give preference when designing clothes for pregnant women. In addition, there is no information on the properties of materials that women prefer themselves. This list includes the properties of materials of 10 points, which are confirmed by [10].

According to the results of the survey, it was determined that garments for pregnant women should be made of materials with high hygroscopicity (4.8 points), a smooth surface (4.67 points), materials with a high elasticity (4.51 points) and busting strength (4.82 points).

The clothes for pregnant women should be made of materials that will not irritate the skin, impair blood circulation, tire with its weight, etc. An important index is that the layers of clothing will quickly absorb moisture, since in such conditions a comfortable climate will be maintained.

Today, along with natural fabrics, it is possible to recommend modern synthetic materials for designing clothes for pregnant women. These materials in some cases surpass natural ones in terms of hygienic indexes. Preference was given by the respondents to materials that contain mix of fibers (natural and synthetic) (56.4 %). These materials have good dimensional stability, retain their shape well and have sufficient hygienic properties. The rest of the respondents (43.6 %) think that clothes for pregnant women should be made from natural materials.

For the manufacture of high-quality clothing it is necessary to have correct information about the shape and size of the consumer's body.

That is why, in the manufacture of clothing for pregnant women, defects often occur, one of the reasons for the appearance of which is the discrepancy between the anthropometric characteristics of the figure, which change as a result of the progression of pregnancy and clothing size.

As you know, the size and shape of the body of pregnant women vary continuously.

Analysis of the outlines of the figures of women at different periods of pregnancy showed that during pregnancy progression, not only the protrusion of the abdomen changes, but also the level of the most prominent abdomen point relative to the waistline. Therefore, when constructing a design for clothes for pregnant women, the dimensional sign "The length from the waistline to the protruding point of abdomen", which proposed in the work [11, 12] was taken into account.

In order to carry out the research a specific drawing instruction that is called EMKO CMEA was chosen to design the pants [13]. The expediency of choosing this instruction is confirmed by studies [14].

The design is based on a zero silhouette, which takes into account physiological amount of eases and carries information about the matrix construction (with zero amount of eases) [15]. Drafts of the matrix designs of the pants for women corresponding to 17, 33, 39 weeks of gestation were constructed. These periods of pregnancy are the most informative on the change in the size of dimensional signs. Drafts were constructed without taking into account the amount of eases, which excludes their influence on the dimensions and shape of the parts and brings the drawing as close as possible to the body surface. In order to establish the differences between the main constructive segments in the drafts of women's pants, the layering of the constructed drafts with respect to the middle line of the front and waistline was made (Fig. 1).

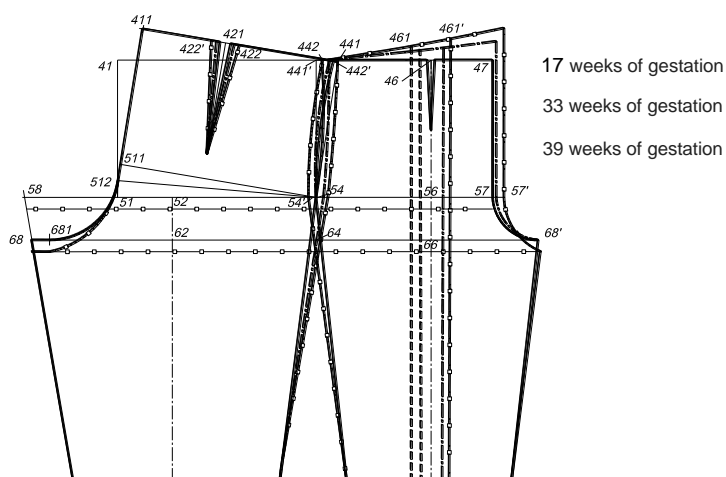


Figure 1. Complex drawing of matrix drafts of pants for pregnant women

The results of the analysis of drafts taking into account the change in the body structure of women at different periods of pregnancy, according to the above parameters are shown in table. 2.

Table 2. Comparative analysis of the values of the main measurements of the segments of drafts of women's pants

Segments of drafts	The values of the main measurements of the segments, sm				
	17 weeks of gestation	33 weeks of gestation	Δ, %	39 weeks of gestation	Δ, %
/422-422'/	2.8	3.3		4.0	
/441-442/	2.7	1.7		0.4	
/41-51/	17.4	17.4		17.9	
/441-64/	23.2	23.2		23.7	

/51-54/	28.6	30.6		31.8	
/461-461'/	1.0	-2.0		-2.7	
/441-442'/	2.7	2.1		1.2	
/57-54'/	25.4	25.9		33.4	
/441'-47/	25.4	25.9		27.1	
/47-57/	17.4	20		21.8	

According to the table, there are certain differences in the values of constructive segments, especially the forming elements.

There was also a decrease in the level of the waistline and a significant expansion along the lines of the waist, the protruding point of the abdomen and hips on the front, which are associated with changes in the size and shape of the abdomen.

It should be noted that pregnancy leads to an increase the back waist dart intake, which is caused by the appearance of a straightened posture of a figure that disappears in the postpartum period. This leads to a decrease the front waist dart intake more than 3 times (33 weeks) and more than 3.7 times (39 weeks of gestation).

With the progression of pregnancy, there is a decrease the side waist dart intake on the front (by 28.6% with a gestational age of 33 weeks and by 55.6% with a period of 39 weeks) and back (by 37% with a gestational age of 33 weeks and by 85.2% with a period of 39 weeks).

These changes lead to a decrease in the bending of the parts along the side on the waistline and a decrease in the size of the protrusion of the buttocks. A rising of the level of the waistline is observed due to the progression of pregnancy: (by 14.9% with a gestational age of 33 weeks and by 25.3% with a period of 39 weeks).

In addition, significant changes in the design parameters of clothing for pregnant women require the use of methods that allow the transformation of clothing parts during its operation.

4. RESULTS

Thus in the manufacture of clothes for pregnant women, it is advisable to use knitted fabrics that have a number of valuable properties: they are soft, elastic, do not hinder movement even with tight fitting of the figure, have high wrinkle resistance, air permeability, are characterized by high hygroscopicity and good thermal resistance.



When designing clothes for pregnant women, it is advisable to introduce amount of eases that will take into account the dynamics of changes in measurements, namely the increase in the hips, taking into account the protrusion of the abdomen, waist level girth, and hips level girth.

In order to assess the possibility of practical use of the developed recommendations offered artistic-decorative and structural-technological solutions of the three multifunctional products that can change appearance and function and provide an opportunity to meet the needs of pregnant women. The recommended color palette for pregnant women's clothes is formed taking into account the color type of appearance and personality type [16-17], table 3-6.

Table 3. Personal coloring for the consumer

Consumer type	Hair color	Skin color	Eye color
Cool – “Summer”	Ash brown	Creamy	Blue
Warm – “Spring”	Golden brown	Rosy	Green

Table 4. Recommended clothes colors for consumers' types (monochrome harmony)

			Chromatic, %					
Type			CMYK	red	green	blue	yellow	violet
Consumer type	Cool	“Summer”	C	00...36	35...84	20...100	12...20	25...100
			M	40...100	00...18	02...88	03...08	15...90
			Y	00...70	19...60	00...31	29...62	00
			K	00...40	00...3	00...17	00	00...55
	Warm	“Spring”	C	00	27...86	31...84	02...11	20...80
			M	45...100	00...24	01...28	09...20	25...100
			Y	25...80	61...100	02...32	55...88	00
			K	00	00...12	00...02	00	00...45

Table 5. Recommended fashionable colors for pregnant women's clothes

Color model	Recommended fashionable colors for the consumers' types, %					
	Cool – “Summer”			Warm – “Spring”		
	Pale blue	Light-blue	Hyacinth	Zircon	Yellow	Lilac
C	25	44	100	07	11	29
M	10	20	60	07	18	48
Y	10	08	00	06	68	00
K	00	00	14	00	00	00

Results of the study could be shown in the tables that include recommendations for using of the combinations of preferred color palettes (table 6) and types of transformation for pants for pregnant women.

Table 6. Basic color for pregnant women's clothes

Image	Classic	Sports	Casual
Colors	pale blue, light-blue, hyacinth	zircon, yellow, lilac	zircon, yellow, lilac, pink, brown, crimson

Sketch			
Impression	female, romantic, practical	practical, functional, comfortable	comfortable, creative, energetic

Analysis of the drafts showed that in pants for pregnant women it is advisable to use such types of transformation: “stretching – compression”, “separating – joining”, “regulation – fixation”. Examples of these types of transformation in pants for pregnant women are shown in the figure 2.

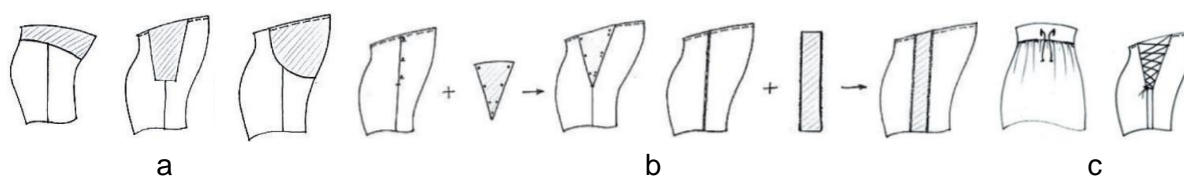


Figure 2. Transformation types: a) stretching – compression; b) separating – joining; c) regulation – fixation

5. CONCLUSIONS

Thus, the above results of research on the improvement of methods of designing clothes for pregnant women are promising, as they help to solve a number of topical issues: expansion of product assortment; increase in the number of items of clothing in the wardrobe of a pregnant woman; extension of service life of the product; increasing the versatility, functionality and aesthetic qualities of clothing.

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THE SCREEN-WAY OF FORMING WEDDING GRAPHICS IN THE UKRAINIAN TRADITION

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Abstract: *The "screen" way of determining the stylistics of the Ukrainian wedding dress on the basis of the rhythmic structure of an ethnic costume is offered. The modern ensembles of the bride and groom in the Ukrainian style are actually analyzed. The photos plates of ideas for wedding ensembles for the "screen"- survey are developed. The capsules of the traditional Ukrainian ethnic dress in the compositional transformation of the bride's wedding dress have been explored. A short notation of the geometry of a form of a wedding dress in the Ukrainian style has been developed. The triangle of the compositional dominant of the main part of the embroidery and the identity of the authenticity of the image is determined.*

Keywords: *Ukrainian traditions, rhythmic string, ensemble capsule, "screen"-survey, transformation, compositional dominant, style.*

1. INTRODUCTION

The Ukrainian ethnic group is characterized by a deep historical memory in ritual traditions. The current state of our society is characterized by an increase in the ethnic consciousness of the population, an increase in its interest in national history and culture, and the awareness of the need to preserve the traditions of the people as a gene pool of its spirituality [24]. The inexhaustibility of the sources of traditional clothes, the appeal to the traditions of folk life and wedding ceremonies determine the relevance of the combination of ethnicity with modernity in the method of designing the wedding ensemble in general by determining the optimal version of the stylistics of the Ukrainian wedding dress on the basis of the structural recording of the links of elements of the art form and ethnic capsules.

In the semiotic aspect, the Ukrainian wedding is a code of national mentality. It was associated not only with the marriage of the young people, but also the combination of two families. It was a large-scale and responsible event in which many people took part in the role of elders, matchmakers, best men, bridesmaids, lights, friends, boyars, musicians, cooks, invited relatives and neighbors [26].

Everything, from clothes and accessories to folk shows, should contain elements of the Ukrainian national style. The bright clothes of guests in embroidered clothes, the beautiful design of the hall in folk style, Ukrainian national food and the bride, who is not in the usual dress, but in a luxurious dress with ethnic elements or with embroidery are essential elements of a wedding ceremony. The image of the bride and groom is a testimony to the spirituality of the wedding in the Ukrainian style.

An integral feature of the Ukrainian traditional wedding capsule is the complexity. The main components of the outfit complexes were the linen, waist elements of wear, breast elements

and outerwear. The wedding complex was an important social indicator, emphasizing the property and family status of a person, his age, nationality, and regional features.

2. METHODS

The expressiveness and functionality of the Ukrainian wedding costume were achieved through the use of various materials, the simplicity and workability of structures and shapes, the richness of types, techniques and compositions of accessories and decorations, the unity of constructive, technological and artistic techniques [18].

The character of the form is expressed by lines. As geometric analogues of silhouette forms of clothing, more complex geometric shapes can appear which are connected in their contour by straight lines and curved lines.

On the example of a wedding dress typical for the Podillya region of Ukraine [11] (Figure 1, a), a short recording of the rhythmic composition of the composition is made, which is executed by the vertical (Figure 1, b) and horizontal lines (Figure 1, c).

In both cases, the shape has a calm character: its silhouette is accented with straight soft lines. When combining vertices and horizontal lines (Figure 1, d), there is an impression of the ratio of parts and the whole, which gives the perception of harmony.

The character of the traditional form is clearly traced - it is an oval (Figure 1, e). The accents in the depicted costume emphasize the main parts of the shaping masses.

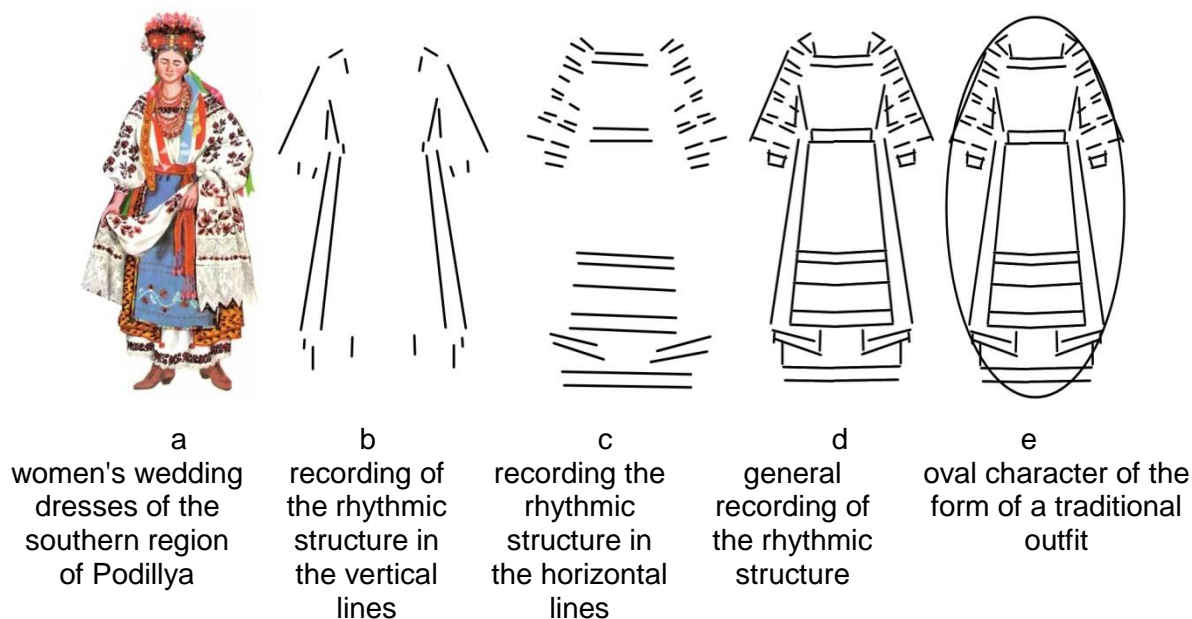


Figure 1. Analysis of the rhythmic order of the ethnic wedding costume of Podillya

The sketch of a scheme of pure form of a folk costume without decor, where the lines of cut (lines of design) are the limits of proportional formations and rhythmic patterns, is the starting point for creating a modern form of a wedding dress. In this costume there is a gradual nuance change of the external form of one object to the full exhaustion of the adopted scheme, until the moment of a fundamental change in form [7].

3. EXPERIMENTAL

A capsule is an optimal group which includes from five to eight items of clothing that are commonly used and interconnected with each other in style and color [13]. According to the results of the poll in the social network "Vkontakte", the traditional wedding gown capsule of the bridegroom's main outfit includes a suit, a shirt and a shoe. The traditional wedding capsule of the bride's main dress includes a dress, a headgear, a bouquet and shoes.

One of the main components of an ideal bridegroom's wedding image is a man's shirt. Its choice depends on the tie and costume model. Depending on the cut, the shirt may be classic, fit and free [9].

The classical shirt belongs to the office style of clothing. It is chosen most often, because it is suitable practically for all men, regardless of the figure and body build.

The fitted shirt features an adjacent trim and therefore suits men with a sporty and slim body. Free shirts combine convenience and rigor. With a free cut it is allowed that the shirt can be 1-2 sizes larger than the parameters of the figure of its owner.

The collar is a very important part of the shirt. The types of collars and their combination with the ensemble are presented in Figure 2.

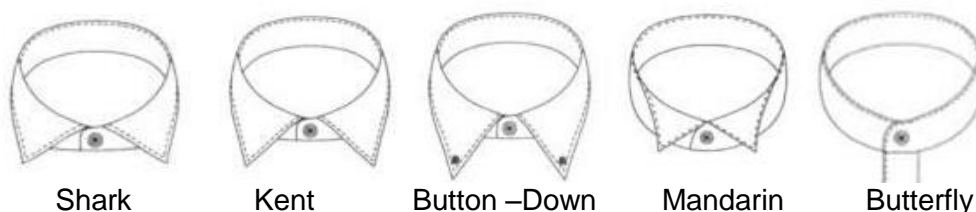


Figure 2. Types of cut-outs of men's shirts

Cuffs are an integral part of a man's shirt. They come in two types: cuff links (French cuffs) and buttons (regular cuffs). For the wedding ceremony in the Ukrainian style, the following ensembles of the bridegroom are the most common: a traditional embroidered shirt with trousers (Figure 3, a); a modern embroidered shirt with short sleeves, a Ukrainian belt and classic trousers (Figure 3, b), an embroidered shirt and a classic suit (jacket, trousers) (Figure 3, c); a vest and a tie in the color of the selected themes (Figure 3, g) and a suit (jacket, pants, vest, shirt, tie) (Figure 3, d). To determine the most popular ensemble, a "screen" was conducted, that is a survey of 132 respondents. The ensemble (Figure 3, b) which received the most votes consists of a modern embroidered short-sleeved shirt, Ukrainian belt and classic trousers (37,1%).



Figure 3. Topical ensembles of the bridegroom in the Ukrainian style

To determine the type and location of the embroidery on the shirt [5], a screen was made " - a survey, in which 118 respondents participated. The 5th option (Figure 4, e) got the largest number of votes (36, 4%), so it is the most typical.



Figure 4. Current decorations of a man's shirt

Additions to the men's wedding ensemble include a tie, a headgear and a boutonniere. Tie is an important aspect of the bridegroom's wedding dressing. The following criteria must be taken into account when choosing a tie: pattern, color, length and width, type of fabric, as well as the quality of the fabric. Characteristics of neckties for decoration are presented in Figure 5.



Figure 5. Characteristics of neckties by decoration

The length of a tie usually varies within 130-150 cm, and the width is 6-9 cm. The length of a neck tie must cover the belt buckle. The width is selected according to the bridegroom's body and the width of the lapel jacket. The wider shoulders and lapels are, the wider should be the tie. There are also narrowed neckties, which usually suit well only tall and lean males [19]. The style of a bridegroom determines the style of a headgear. To determine the most typical bridegroom's main suit for the Ukrainian wedding, a "screen" survey was conducted, in which 107 people participated. 43,9% chose the option without a headgear (Figure 6, b, 26,2% chose a Cossack hat from an artificial astrakhan (Figure 6, a).



Figure 6. Current hats for a groom

To determine the most characteristic boutonniere of the bride [8] for the Ukrainian wedding, a "screen" survey was conducted, in which 164 people took part. Most of the votes (38,4%) were given to a boutonniere with a composition of white roses and a red ribbon (Figure 7, b).

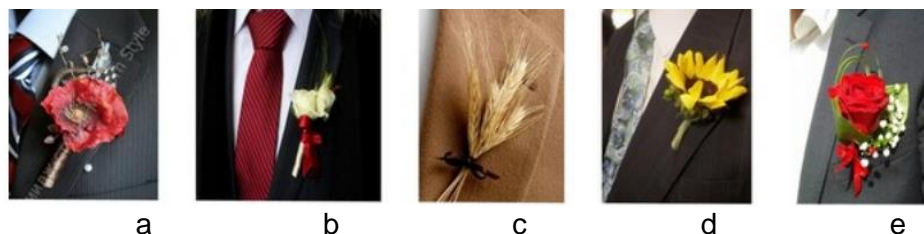


Figure 7. The actual boutonnières of a groom

The traditional wedding capsule of the bride's main dress includes a dress, a headgear, a bouquet and shoes. For the wedding ceremony in the Ukrainian style, the following ensembles of the bride's clothing are the most common: a short white dress with ethnic embroidery (Figure 8, a); a long white dress with embroidery beads (Figure 8, b); a traditional embroidered shirt and a skirt [15] (Figure 8, c), a designer dress with an ethnic embroidery (Figure 8, g) and a traditional dress with artificial flowers (Figure 8, g). To determine the most popular basic product, a "screen" survey was conducted, in which 140 respondents took part. The largest number of votes (38.6%) was given to a designer dress with ethnic embroidery (Figure 8, g).



Figure 8. Top bride ensembles in the Ukrainian style

Bride's Bouquet is not less important attribute of a wedding than a wedding dress. The bouquet is usually assembled exclusively from natural flowers [25]. To determine the most typical bouquet of the bride at the wedding ceremonies in the Ukrainian style, a "screen" survey was conducted, in which 140 respondents took part. The most votes 34,3% were given to a bouquet of red and white roses in the form of a drop (Figure 9, a).



Figure 9. Top wedding bouquets in the Ukrainian style

Today, some brides do not pay less attention to shoes than to wedding dresses. Most often they use the following models of shoes: ballet shoes, bootlings, boots, sandals, shoes [3]. To determine the most typical bride's shoes for the Ukrainian wedding, a "screen" survey was conducted, in which 149 respondents participated. 43,6% of the respondents chose red shoes with black embroidery (Figure 10, a).



Figure 10. Trendy shoes for the bride in the Ukrainian style

The classic headgear of the bride is a veil, which symbolizes the transition of a girl from parents' care to her husband's power. Today, the traditions of the past years have gone to the background, and the brides are free to choose not only the length and color of the veil, but also its presence in general in the wedding dress. Of course, a veil adds a gay image of femininity and gives the entire ensemble a special color.

Also, brides are often found in hats. If the bride wants to become a real princess, she chooses a diadem. A wedding diadem, being part of a hairstyle, dramatically attracts the attention of others.

The headgear of the traditional Ukrainian bride is a wreath [25]. Wreaths can be of the most varied colors, they can also consist of artificial or natural flowers.

To determine the most typical bride's headgear for the Ukrainian wedding, a "screen" was conducted - a survey of 144 people. 43.8% of respondents chose a combination of white veil and a traditional Ukrainian wreath made of artificial flowers (Figure 11, a).



Figure 11. Current bride's headgear

To determine the most typical decorations of the bride [1] for the Ukrainian wedding, a "screen" survey was conducted, in which 127 people took part. 39,4% respondents chose a necklace made of small black beads and red roses (Figure 12, c). 32,3% of the respondents chose handmade cuff decoration of wool in the form of grizzly berries and its leaves (Figure 12, b).



Figure 12. Actual decorations used by a bride

4. RESULTS

Recommendations [4, 10, 12, 16, 22, 23] have been given to form the optimum wedding capsule in the Ukrainian traditions. The capsule of the traditional ethnic Ukrainian wedding dress was as follows: the bride’s capsule included a bridal shirt, a sleeveless jacket (captop), plakhta, an apron (stock), an upper suit, a skirt, a belt; the bridegroom’s capsule consisted of a wedding shirt, pants, a belt, a sleeveless jacket, a Ukrainian overcoat, a vest, a wedding rushnik (wedding towel), a headscarf.

The optimal capsule of the contemporary bridegroom’s wedding dress includes an embroidered short-sleeved shirt, a Ukrainian belt and classic trousers or a classic suit, a shirt and shoes in the color of the chosen theme (Figure 13, a).



Figure 13. Optimal capsule of a wedding outfit for a bridegroom

The optimum imagery of the additions to the bridegroom's dress is made up of an embroidered Ukrainian-style tie, an artificial astrakhan Cossack hat (or without a headgear), and a boutonniere with a composition of white roses and a red ribbon (Figure 14).



Figure 14. Optimal imagery of additions to the bridegroom's outfit

The wedding clothing items capsule for a bride has the following characteristics: a white designer dress with ethnic embroidery, red shoes with black embroidery and a bouquet of red and white roses in the form of a drop (Figure 15).



Figure 15. Optimal capsule of a bride's wedding wear

The optimal imagery of the additions to the bride's dress includes a veil and a traditional crochet of flowers, a red clutch decorated with flowers, a necklace made of black beads and red roses (Figure 16).



Figure 16. Optimal imagery of additions to the bride's dress

Compositional transformation of a bride's wedding dress is developed taking into account the principles of emotional engineering [2, 6, 14, 17]. The oval character of the wedding dress is written only by the smooth curve forming the oval. Also, oval lines depict the smaller elements of the whole silhouette - sleeves, skirts - along with the main line, express the unity of the character of the outfit. It is dynamic and at the same time calm and monumental in all three researched ensembles (Figure 17).



Figure 17. Compositional transformation of a bride's wedding wear

The oval form is convenient for the manifestation of unity, because its lines are calm, voluminous and do not constrain human movements. Unity of character as a compositional means, in addition to the organizing role, plays an important role in achieving the emotional expressiveness of the presented wedding ensembles (Figure 17).

The character of the oval form of the investigated wedding ensembles is simplified, as shown in Figure 18. There is a unity in the nature of the shape of the presented models due to the simplified notation.

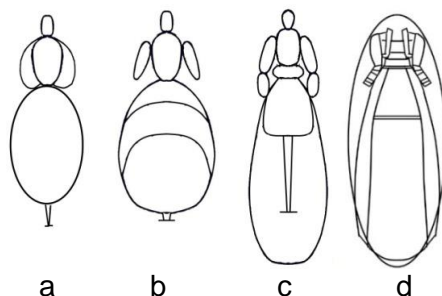


Figure 18. Brief notation of the shape of the bride's wedding dress

For the Ukrainian traditional wedding ensemble (Figure 18, a), the short notation is represented by 4 ovals, namely: a brassiere, sleeves and a skirt.

The short entry of the dominant dress in the survey consists of 8 ovals (18, b): the bodice, sleeves, the 1st, 2nd and 3rd layers of the skirt. The entry was developed with use of the specific software "OOO Draw" (add-on "GEKKR") [21].

The notation of a designer wedding dress in the Ukrainian style (18, c) consists of 8 ovals: a belt, a bodice, an upper and lower part of sleeves, a skirt and a loop. A brief notation of the rhythmic structure of the ensemble is presented in Figure 18. The curvature of the oval is transferred to the shoulder line, the shape of the sleeves, the loop and the constructive lines.

As it can be seen from Figure 19, the Ukrainian traditional wedding ensemble (19, a) and the designer wedding dress in the Ukrainian style (19, b) are characterized by the focus on the shoulder line and headgear. There is a certain "triangular dominant" [20], which is based on the main part of the embroidery and the brightness of the image. The vertex of the triangle has the symbolism of the female element - fertility. In these ensembles, the crown of flowers on the head serves as the triangle vertex.

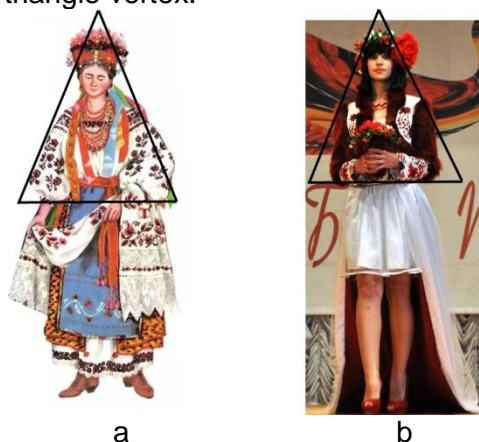


Figure 19. Compositional dominant

5. CONCLUSIONS

The compositional dominant of the wedding Ukrainian bride's dressing capsule is based on a combination of ovals of the bodice form, sleeves and skirts with a triangular dominant of the compositional accent on the shoulder belt and a headgear with the base of the triangle on the line of embroidery limitation. The formula for notation the character of the oval form of wedding bride's dress is based on the proportional division of the ethnic wedding dress.

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COLORISTIC DESIGN OF CLOTHING ON THE BASIS OF COLOR PERCEPTION

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Abstract: *This work contains knowledge about a color theory that plays an important role in the process of planning the visual variety of clothing. The special attention is paid to the creation of the authors' clothing models on the base of the color perception.*

The fractal structural model of perception of color is worked out. It allows taking into account character of functioning of component parts of this process.

The consumers' reactions to the color of a garment are taken into account. The consumers' color preferences from the standpoint of not only the personality of the individual, but also the socio-psychological appearance are determined.

Using the results of the current research, a designer can choose the color solution for single or serial production, as well as specify a certain color range, which can also be applied for outfits. In the last stage, a transition to the distribution of selected colors among the details of a garment is made. It takes into account the dimensions of the specific elements to obtain a harmonious combination of proportions of details.

Keywords: *color theory, harmonious color palette, design, consumer, clothing, perception.*

1. INTRODUCTION

The problems of planning clothing color are determined by the specific of perception of color by consumers. Therefore, they should be solved in a complex manner taking into account all levels of formation and perception of color.

Color related psychological studies are a phenomenon of the twentieth and twenty-first centuries. The problem of optimal color palette selection has been studied by many researchers. An overview can be found in works [1-7]. All of authors considered color palettes in relationships with person individuality and described different aspects of using these relationships in regular person life.

In works [8, 9, 11] were described basic principles of the design clothing with account of color as one of the main elements of garment composition. Particular case of using the color palette in design of garments was shown in [7, 11-13].

Color preference tests have been devised in [10] in order to gain useful information on how people will react to certain colors in given situations, and as a means of personality analysis. In the paper, the developments of the described in [15-17] approach as a basic for the coloristic design of clothing are being continued.

Much attention is paid to the questions of the design of complex products with due regard to coloristic solutions which allow planning the variety of the produced products.

The use of mathematical apparatus and partial automation of the creative process can give the specialist opportunities to meet various demands (economical, resource conditions, the theory of coloristic, fashion trends, etc.) in the optimum way. Therefore, the development of the research in this direction is actual and greatly requested.

2. METHODS

In the field of color science, a significant amount of information is collected, but there is no integrity of the synergistic approach to the aspects of color perception: 1) the study of the structure of specific color values (semantics and semiotics of color) for the formation of the planned perceptual color image; 2) the question of the role of perception of color in the system "costume" for the consumer.

Objective factors of perception of color in a suit include the color characteristics of color, the proportion of colored areas, the peculiarities of color combinations, light-colored environment. Subjective factors of perception of color include the subject and the subjective (socio-cultural) environment. The subject of perception is a person, his psychophysiological features, which are determined by sex-age characteristics, health, social status, etc.

Subjective environment - socio-cultural environment, determined by the level of development of society, its culture, tradition, ideals, etc.

Particularly important for the solution of the problems of the social and consumer complex is the creation of comfortable conditions for human perception of color in clothing.

Thus, color design is not associated with a separate color science, but covers virtually all levels of color learning. This is the specificity of color design. Therefore, the problems of color design of the project should be solved comprehensively, taking into account all levels of formation and perception of color that is shown on the Figure 1.

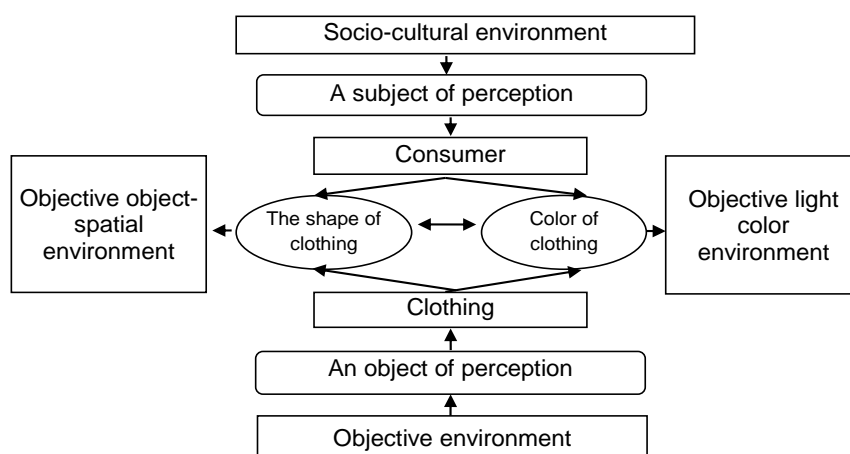


Figure 1. The structural model of color perception

The main purpose of this research is to develop practical recommendations for coloristic design of clothing on the basis of color perception.

3. EXPERIMENTAL

3.1. Color design of a "costume" system based on fractal structural perceptual models of color

Thus, the color as a means of composition in the design of a costume, necessitates its consideration in the system "culture - society - production". It is known [8] that the society determines in advance and regulates the development of both culture and production. Then the problem of color is investigated in three aspects of the components of the system, the structure of which is shown in Figure 2.

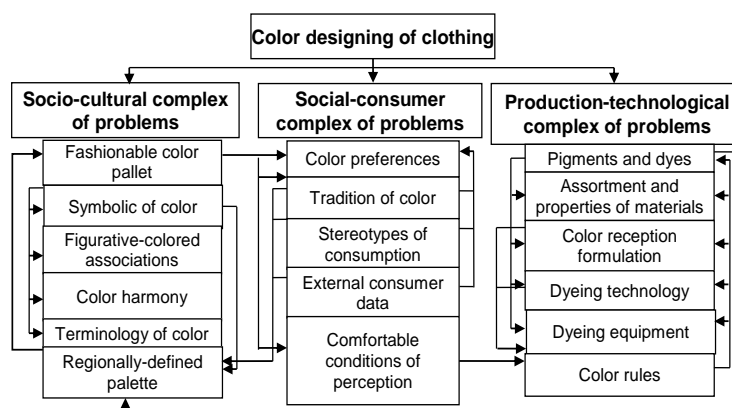


Figure 2. Three complex problems in the system of color designing of clothing

All factors of color perception are in interconnection and interaction. The developed fractal structural model of perception of color allows us to take into account the nature of the functioning of the components of this process (Fig. 3).

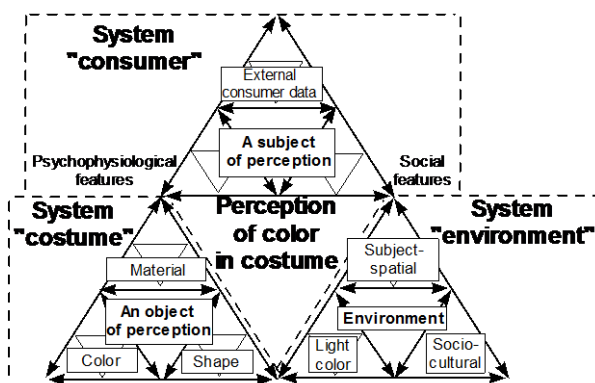


Figure 3. Fractal structural model of perception of color in costume

Allocated perception factors should be taken into account when designing a strategy for color designing of conceptual variants of perceptual images of an individual consumer. Consideration of the fractal structural pattern of perception of color in costume determines the need for the following research:

- modeling of the consumer's reaction to the projected color of the product;
- terms of matching color and shape at all stages of designing;
- interconnection of the color of the object with its surrounding environment;
- definition of color preferences of the consumer from the standpoint not only of individuality, but also of socio-psychological appearance;
- construction of mathematical models for the task of finding coloring solutions of clothing models on the basis of perception.

3.2. On finding coloristic solutions

The construction of mathematical models for the problem of finding color solutions is based on the recommendations of the theory of costume design, taking into account the selection of harmonious color grades, which give the impression of color entirety and the relationship between colors of details. To research the problem of finding the optimum coloristic solution

from the point of view of several criteria, we use the twelve-part color wheel [17], the fragment of which is presented in Figure 4.



Figure 4. Fragment of the scheme of harmonious color combinations according to Wilhelm Ostwald

The color wheel is an important foundation for any aesthetic theory of color, since it gives the system of color arrangement and allows us to understand clearly the schemes of harmonious combinations.

We now turn to the construction of mathematical models for the problem of selecting the dominant color (by varying the weights), searching for optimal color combinations according to the [14]. We construct a new mathematical model. We introduce the following notations:

J – the set of color numbers, $J = \{1, \dots, n\}$;

v_j – the color with number $j \in J$;

x_j – a boolean variable that takes the value of true if v_j is a part of the palette and false otherwise;

s_j – the weight of the color according to $v_j, j \in J$;

p_1, p_2 – the lower and upper bounds for the total number of colors included in the product;

I – the set of logical formula numbers used in the model $I \in \{1, \dots, m\}$;

C_i – the logical formula corresponding to the i -th constraint, which is the disjunction of variables and/or their negations;

The task is to find the values of the logical variables that limit the total number of colors included in the product, and formulas $C_i, i \in I$, are satisfied, and the weight of the colors included in the gamut will be maximum.

Similar to the previous model we denote by y_1, \dots, y_n boolean variables, that y_j corresponds to literal x_j , and $(1 - y_j)$ corresponds to literal $\overline{x_j}, j = \{1, \dots, n\}$.

The problem of integer linear programming for the case under consideration is as follows:

$$f = \sum_{j \in J} s_j y_j \rightarrow \max, \tag{1}$$

$$\sum_{j \in C_i^-} y_j - \sum_{j \in C_i^+} y_j \leq 1 - |C_i|, \quad i \in I, \tag{2}$$

$$p_1 \leq \sum_{j \in J} y_j \leq p_2, \tag{3}$$

$$0 \leq y_j \leq 1, y_j \in \mathbb{Z}, j \in J, \tag{4}$$

$$0 \leq z_i \leq 1, z_i \in \mathbb{Z}, i \in I, \tag{5}$$

All the conditions of a harmonious combination of colors (2) considered in the problem are constraints of a hard type. Condition (3) determines the possible number of colors in the found gamma. As the result of solving these problems, the user will receive a set of color scales that satisfy the set conditions.

4. RESULTS

As input data for the current research it is advisable to use the recommendations that were described in [4, 7-10, 13, 15-17]. The examples of such recommendations for the creation of the authors' clothing of models on the base of the color perception are presented in the tables 1-5 and in Figures 5-7.

Example 1: The monochrome composition of the costume ensemble involves the presence of one color tone sector of the color wheel of different degrees of light and saturation. Using the use of the "shadow line" in the costume reach color harmony and achieve a balance of holistic costume uniforms. Impression: calmness, refinement, a sense of space, Figure 5, table 1.

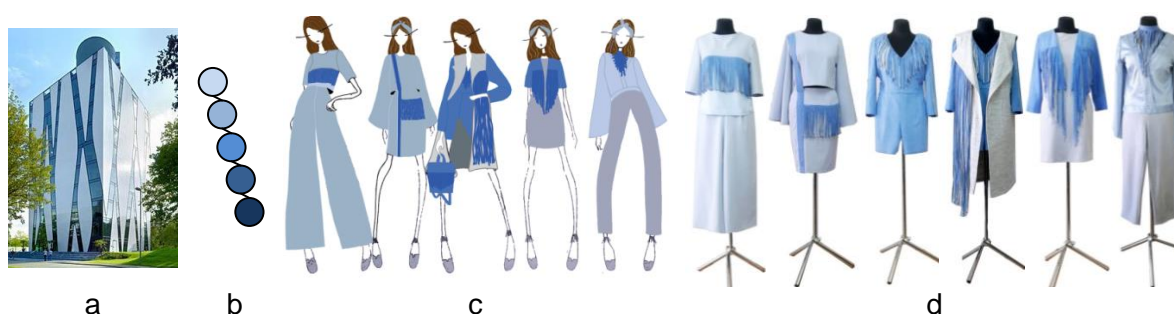


Figure 5. The source of creativity (a), color scheme (b), sketches (c) and photo of the author's collection of ensembles by the motto "Free Space" (d)

Table 1. Blue in clothing

Group of hues	Color	Association	Alternative name	Tint percentage in color %				Impression
				C	M	Y	K	
Blue color								
Light hues	Pale blue	delicate, cold, calm	Aquamarine Heavenly blue	25	10	10	00	Bright tones nice and peaceful. In delicate blue shades combine calm and elegant elegance.
	Light-blue	cold, romantic, fresh	Calcareous Lagoon	44	20	08	00	
Bright hues	Indigo	precious, stately, posh	Iris Azure	81	40	03	00	Bright shades of blue are active, energetic, luxurious, bold and cheerful.
	Neon	cold, sports, youth	Ultramarine Electrician	100	50	00	00	
	Hyacinth	active, cheerful, sporty	Cobalt Kerosene	100	60	00	14	

Example 2: The polar harmony uses two opposite colors in the color wheel. These colors enhance each other, creating a visual vibration effect. The scheme is noticeable, dynamic and creates a lively dramatic effect, tables 2, 3, Figure 6.

Table 2. Types of color contrasts

Types of color contrast	Characteristic	Impression
Contrast of complementary colors	This is a combination of colors that are opposite each other in the color wheel. This type of contrast is most impressive, since each combination of colors contains a strong contrast of light and dark, as well as cold and warm	Expression, vibration, feeling of space, complete balance and harmony

Table 3. Yellow and blue color in clothing

Group of hues	Color	Association	Alternative name	Tint percentage in color %				Impression
				C	M	Y	K	
Yellow color								
Bright hues	Yellow primrose	blinding, cheerful, slightly	Yolk Lemon	00	00	81	00	Bright hues are impressive and energetic. They charge with cheer and optimism.
Blue color								
Dark hues	Lead blue	strong, serious, decisive	Patriotic	100	70	00	28	Restrained, balanced and conservative. They demonstrate authority, dignity, power.



Figure 6. Color scheme (a) and photo of the author's collection of ensembles by the motto "Shield of the Nation" (b)

Example 3: The typological group of color harmonies is the polychrome harmony of achromatic colors with chromatic: a rich red color with white and black, tables 4, 5, Figure 7.

Table 4. Types of color contrasts

Types of color contrast	Characteristic	Impression
Contrast of areas of color spots	Colors can be combined with each other in different proportions in clothing. The force of influence is determined by two factors: the brightness and size of the stains of the color area	From the dramatic-formal to the softly delicate

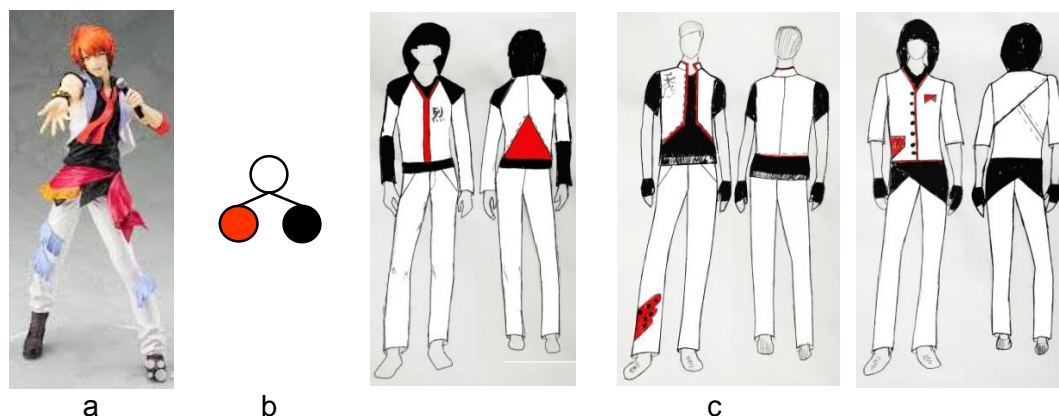


Figure 7. The source of creativity (a), color scheme (b), sketches of the author's collection of ensembles by the motto "Sports - the eternal classics" (c)

Table 5. Red, white and black color in clothing

Group of hues	Color	Association	Alternative name	Tint percentage in color %				Impression
				C	M	Y	K	
Red color								
Bright hues	Red	active, live, benevolent	Cherry Strawberry	00	82	70	00	Bright hues are active and passionate. They express emotions, energy and power.
White color								
White hues	White	serious, strong, decisive	The color of white roses Lily color Marble	00	00	00	25	Light and carefree. They radiate purity, harmony and flawlessness. They combine minimalism, calm and aristocracy.
Black color								
Black hues	Black	authoritative, conservative, serious	Wet asphalt Black iron	00	00	00	75	Variable and varied. May be sinister, magical, luxurious, and youthful.

Thus, it is confirmed that the choice of a harmonious color palette, which creates the impression of color integrity and the relationship between the colors of details of the model of clothing, is important. The results of experiments confirmed the prospects of applying the developed approach to obtain a number of different solutions based on the perception of color.

5. CONCLUSIONS

Thus, color harmony is a function of the interaction between colors and the factors that influence positive aesthetic response to color: individual differences such as age, gender, personality and affective state; cultural experiences, the prevailing context which includes setting and ambient lighting; intervening perceptual effects and the effects of time in terms of prevailing social trends.

The information we have obtained can be used as a basis for expert system. Such system is intended for make a decision about selection of colors and fabric for the garment. Input data in system must be the list of colors properties, garment type, and consumer type. The rules of selection the colors are formed in the tables 1-5. Thus these tables form the basis of the simple knowledge-base system.

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INNOVATIONS EQUIPMENT FOR DETERMINING CAPILLARITY OF FIBROUS MATERIALS FOR CLOTHES

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Abstract: *Modern textile materials entering the world market do not always correspond to those physical, mechanical and hygienic characteristics, which are indicated in the corresponding accompanying documentation. This creates considerable difficulties in the manufacture of sewing products of various purposes and, most importantly, affects their final quality and service life. In this regard, there is a need for a comprehensive check of modern textile materials to meet the necessary level of their operational properties. For example, one of the most important indicators of hygiene of textile materials is their ability to interact with liquids, such as water or its chemical compounds.*

Analysis of literary sources showed that the least technically secured is the technique of studying the capillarity of materials, that is, their ability to raise the liquid with fibers at a certain height. This is due to the fact that the specified physical and chemical process is difficult to study, because it is associated with many indicators of materials: the type of their interweaving, thickness, raw material content, the size of fibers, the type of decoration, etc.

This article provides a comprehensive analysis of existing techniques and techniques for the study of capillarity over the past 30 years. In particular, existing and projected special devices are considered, the basis of which is the principle of interaction of the experimental material and the column of liquid. In addition, contemporary developments of the Ukrainian scientists in this area are proposed for consideration, the achievements of which have been confirmed by their patentability and official acts of tests.

Keywords: *properties of materials, capillary, fibrous materials, research.*

1. INTRODUCTION

Such important technological operations of decoration, as painting, impregnating with aplets and others are based on the capillary processes, that is, on the processes of moisture transfer into the capillary-porous bodies. Capillarity determines the hygiene of materials and products, made of them. Unfortunately, in the technical literature devoted to the issues of hygiene of textile materials and products, the study of capillarity is not given sufficient attention. In our opinion, this situation is due to the complexity of the process of capillarity and the lack of unanimity in relation to its essence, since the indicated index of textile materials depends on a whole set of properties of the latter (type of interweaving, thickness of the threads of the base and under the fabric, raw material content, surface decoration with dyes or aplets, etc.).

The importance of the study of capillary processes is due to the fact that other indicators of physical properties of materials do not always allow to determine to the full the level of

hygiene of any other textile materials. In addition, inside the space under clothing, as well as in the materials of clothing, capillary processes occur continuously, which significantly affect the hygiene, and, thus, the level of garment's comfort. The study of capillary properties of textile materials allows you to create materials with the necessary properties that meet the requirements of hygiene and technology, and this ultimately plays an important role in managing the quality of manufactured products.

Taking into account the importance of the indicated hygiene index, it is quite natural to have a modern methodology and equipment for its determination. At the same time it should be noted that in the world technical literature, it is extremely rare to find out the materials of this direction. Mainly, there are results of studies of capillarity of bulk materials but not of non-fibrous ones. That is, it is a completely different subject of research, which is related to the work with different types of soils or powder substances. In this article we will discuss the capillary nature of fibrous textile materials which are used for the manufacture of clothing, footwear and some technical items [1, 2, 3, 4, 5].

2. METHODS

Capillarity is an indicator of textile materials, which determines their height of lifting a standardized liquid for a certain time under the influence of capillary forces when one end of an elementary sample of the material is in a hinged position and immersed at a certain depth in this fluid (Fig. 1).

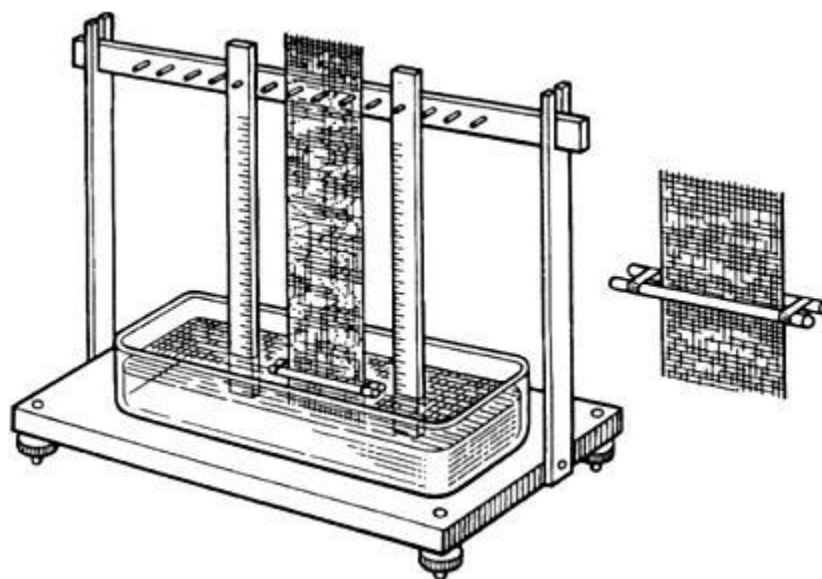


Figure 1. Standard installation for capillarity determination of textile materials according to GOST 3816-81 (ISO 811-81)

The technique for the determination of capillary textiles, which is regulated in the countries of the former Soviet Union by GOST 3816-81 [6] is based on the principle of the interaction of a sample of fibrous material with water.

The disadvantages of the current standard methodology include the fact that studies are carried out only on bleached (pure white) fabrics and with respect to the chemically colored (eosin) water only, and the process of capillary rise of the liquid is visually controlled. Therefore, the technique and the device, recommended by GOST 3816-81, do not allow to automate the process of studying the capillarity of textile materials. In addition, this standard does not regulate the conditions for testing woven, nonwoven, woven, fabric-knitted, knitted materials in relation to fluids that may vary in chemical nature (alcohols, ether, acids, etc.).

Thus, there was a need for the creation of more modern equipment for determining capillarity of textiles.

Over the past 20-30 years, devices have been developed to determine the capillarity of textile materials - capillaries, the most famous of which are the capillary meter by Volkova, Kamenskyi, Orkin, Porkhaev, Deryagin, Kavkazov and others [7, 8].

The weight capillary meter, developed by the staff of the Central Research Institute of Light Industry (CRILI), became one of the first attempts by scientists to expand the concept of the capillarity of fibrous materials by determining the amount of water raised in the sample of the material during the test. The indicated device, which is made in the form of a glass cylinder with a scale and mounted on the scales, allows you to determine not only the height of lifting h of the liquid per time t , but also the mass M of absorbable liquid. As the fluid is absorbed by the sample, its mass in the cylinder decreases, which is recorded by the scales and is determined at certain intervals and the amount of the absorbed liquid is determined by calculation. The height h is determined by the vertical scale. The disadvantages of this device are related to the visual definition of the investigated indicators and the lack of an automated way of recording them. In addition, the gravimetric method for determining the mass of collected water does not guarantee the avoidance of fluid losses during the preparation of samples, which contributes to the occurrence of significant errors in the results.

The next step to improve the equipment for the study of capillary textiles became a device developed at the Department of Technology and Design of Sewing Products of Khmelnytskyi National University (Ukraine) [9].

This capillary meter contains electrically conductive contacts, a liquid vessel, a registration device, a device for fixing a sample of a textile material, which is made in the form of two split electrodes, one of which is made in the form of an electrically conductive plate, and the other - in the form of point electro contacts throughout its length with a step of 5 mm apart from each other (Fig. 2).

In addition, the process of capillary lift through the control unit, which includes the recorder, is constantly monitored and displayed in the form of a curve of the line on the millimeter paper, or the graph accordingly, which also leads to an increase in the accuracy of measurements. The method of work on a significant capillary meter is that, between the rails 6 and 7 with a set of electrodes, a sample 8 of a textile material (on base or weft) in the size of 300×50 mm is placed horizontally in such a way that its lower edge protrudes at 0.5-0, 8 mm from the bottom edge of the electrodes. Then, the material sample is lowered to the contact of its lower section with the surface of the liquid contained in the vessel 12.

Then, the control unit 9, which is electrically connected to the electrodes and the recording device, is turned on and forces them to operate. From this moment, the liquid begins to climb on the sample 8 upwards and when it reaches the level of the first electrocontact of the electrode 7, an electric current arises between it and the electrode 6. The received signal enters the control unit 9, which issues the command to turn on the timer 10, while the recorder 11 graphically captures the passage of the capillarity process. Upon reaching a certain height of raising the fluid at a given time, the control unit 9 stops the work of the recorder, and the timer 10 fixes the time of the passage of the capillarity process.

The advantage of this device is that it allows simultaneously holding the experimental test in an upright position and controlling continuously the lifting of the conductive fluid throughout the duration of the research, which increases the accuracy of the results and allows you to reflect the objective picture of capillarity in the test materials. In addition, the device allows you to work not only with individual samples, but also with whole packages of a wide range of textile and other fiber materials, for example, with filter paper, vlieseline, etc.

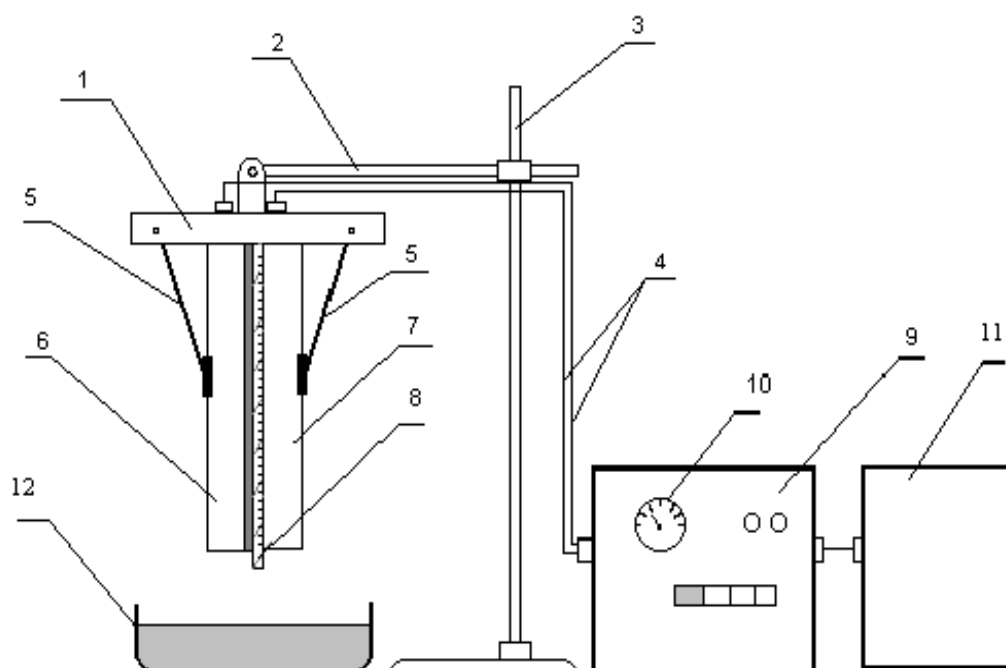


Figure 2. A device developed by the staff of Khmelnytskyi National University (KhNU) to determine the capillary properties of fiber materials:

1-guide rail; 2 - mobile strap; 3- tripod; 4- electric conduction; 5- latch; 6-7 electrodes; 8- sample of textile material; 9- control unit; 10 - timer; 11- recorder; 12- vessel with liquid.

The disadvantage of the considered capillary meter is that it only works with conductive liquids; otherwise, for example, when using distilled water, the electrical part of this equipment will not work. In addition, a considerable distance (5 mm) between point electrodes makes it impossible to carry out continuous control over the process of capillary rise of the liquid and limits the amount of experimental data, which causes an increase in the magnitude of the error of their values.

Consequently, the existence of this development did not allow to automate the process of capillary identification of textile materials, since existing equipment has certain disadvantages, which significantly affects the measurement accuracy and limits its use.

3. EXPERIMENTAL

In our opinion, the way out of such a situation is to create a fundamentally new equipment, which will not be influenced by such subjective conditions for conducting research as the raw material content of the ingredients of the researched materials and the chemical composition of the fluids used for research, the geometric parameters of the samples, the presence of their color and other decoration, etc. In addition, such equipment should work in a semi-automatic or automatic mode to continuously monitor the experimental parameters, which will provide an objective picture of capillary processes in fibrous systems.

The action of the new VKV-TM device (Fig. 3), developed by Khmelnytskyi National University (KhNU), is based on the ability of infrared (IR) radiation to change its optical

properties when it passes through dry and wet textiles, thus avoiding the disadvantages inherent in the existing equipment [10].

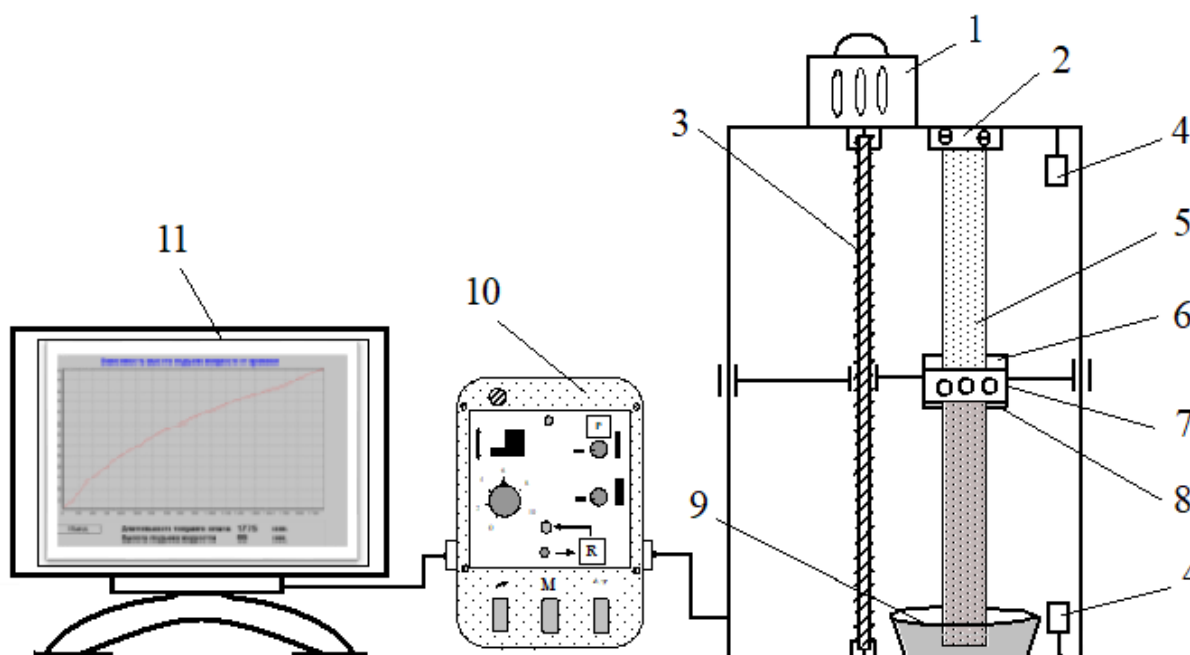


Figure 3. Scheme of the capillary meter VKV-TM for the determination of the capillarity of the fibrous materials:

1 - electric motor; 2- clamping latch; 3- lead screw; 4- electromagnetic locking system; 5- sample of textile material; 6-mobile carriage; 7- LEDs of infrared radiation; 8- photodiodes; 9- vessel with liquid; 10- control unit; 11 – computer

The method of work on the capillary meter of VKV-TM relies on the fact that the sample of textile material is placed vertically in the device. At the same time, the upper side of the sample is fixed in the clip-clamp 2 of the device, and its lower end is lowered into a vessel with a liquid of 8, in relation to which the research is conducted. In the case when the liquid, rising on the sample, reaches the line through which the radiation flux crosses this sample, the level of infrared radiation coming into the photo-diodes will increase. In this case, the control mechanism operates and the carriage starts to move upwards, bringing the source and receiver of the IR radiation beyond the moisture of the sample. The movement of the carriage is performed by the electric drive 1 and the propeller 3, and the value of the displacement of the carriage relative to the liquid is deducted by an internal meter with an accuracy of ± 0.5 mm. Control of the carriage movement mechanism is carried out by the electromagnetic locking system 4, which in the upper or lower extreme positions stops the operation of the device.

From the very beginning of the experiment, due to the connection of the capillary meter to a personal computer and software developed, they receive in graphic form (Fig. 4) information on the course of the capillary rise of the liquid with a real-time countdown, which allows reproducing an objective picture of the dynamics of processes that occur.

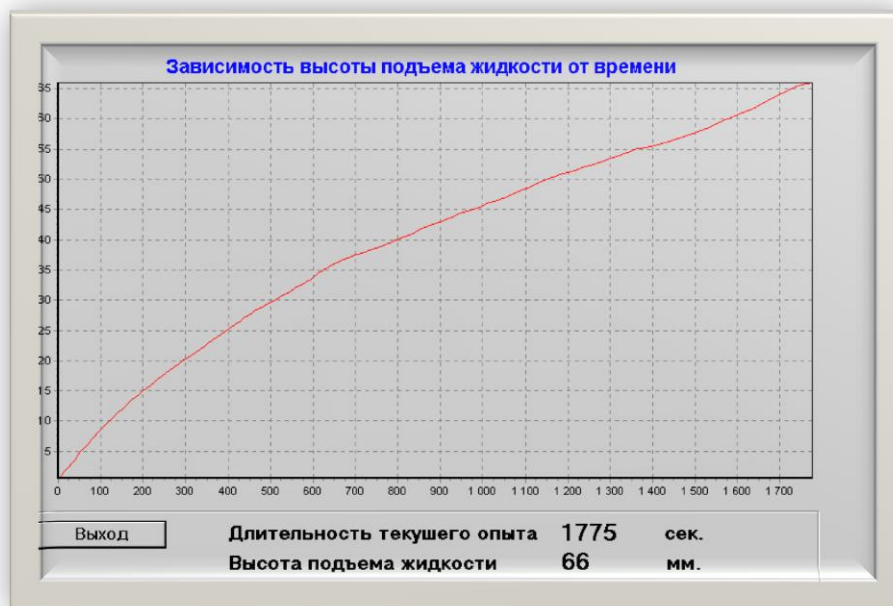


Figure 4. The on-screen form of the program for the determination of capillarity of textiles on the device VKV -TM: an automatic graphical representation of the kinetics of the capillary process in real time.

The advantage of the device is that it allows you to explore fabrics (or packages of them) up to 7 mm thick, regardless of their raw material content, structure, type of binding, color and type of placement, as well as to attract various fluids of organic and inorganic origin. In addition, the use of the device VKV-TM in conjunction with the computer allows you to process the received data in real time with the reflection of the dynamics of the process of flow of capillary rise of the liquid.

So, it became possible to obtain data at any stage of the test, which is especially important in conducting research work with practically no human involvement.

4. RESULTS

However, as it turned out later, the only disadvantage of the VKV-TM device was its sensitivity to the change in the thickness of the test material, which required the setting of the device before each subsequent study. The employees of Khmelnytskyi National University eliminated the aforementioned technical inconvenience due to the use of a modern sensitive optical camera, which had been added to the design of this device. The effectiveness of this implementation is confirmed by the patent for the invention of Ukraine [11].

5. CONCLUSIONS

Consequently, by performing the analysis of the material written above, it can be noted that today there are already interesting innovative technical developments of equipment for the qualitative determination of the capillary content of fibrous textile materials that annually enter the world market. The above described equipment allows increasing the accuracy of measurement by automating the test process, which makes it impossible to influence the results of the so-called "human factor".

The use of a computer together with the developed VKV-TM device allows you to obtain information not only about the size of the final height of the lifting fluid, but also to obtain data at any stage of the test, which is especially important while conducting research. When working with aggressive or volatile liquids it is possible to seal the device, which will expand the limits of its use.

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CAPSULAL APPROACH TO SIGNIFICANCE OF ETHNIC EMBROIDERY IN FORMATION OF MODERN WARDROBE

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Abstract: *The problem of capsular method in forming of modern clothes on the basis of ukrainian basic embroidery was investigated. Theoretically proved composition of geometrical ornaments in combinations of tunes of the ornament. The schemes of transformations in modifications of variants of reports of ukrainian national embroidery were created. The investigation of isomorphic filling using the technique "cross" in ornaments in the style "modern" according to zones of usage was carried out. The capsules of representative clothes according to folk ornaments were developed. The algorithms of scaling the ornaments are created with the help of schemes of setting the ornament. As examples such pieces of clothes were used: dress, woman costume, family embroidered blouse.*

Keywords: *ethnic embroidered blouse, isomorph, zone of detail, combination, product, capsule.*

1. INTRODUCTION

The representative component of ethnicity in the Ukrainian national costume is markedly determined by the embroidery ornament [1, 2, 3], which is a means of identifying regional differences in canonical representations about the ethnic image of Ukrainians.

The shape of the product is motivated by the form of the human body, since the anthropological function determines the method of using the garment as a shell. The spatial aspect of the division of clothes at the anthropological level sets the structural belts of the division of the figure, which, at the structural level of form-forming, set the proportional relation of the elements of division into parts. Scaling at the compositional level is conditioned by the functional purpose, stylistic features of the decorating of clothes and is a means of increasing the emotional expressiveness of the elements [4].

Despite the commonality of the principles of decorating, the structure of ornaments, technology of embroidery, coloring, ornamental motifs vary at the compositional level in the search for signification as an integral part of the spiritual life of the people.

2. METHODS

2.1. Theoretical foundations of the ethnic component of embroidery ornaments

The compositional component of the embroidery ornament in Ukrainian folk clothing is based on the symmetrical equilibrium in the lines of the golden section, which coincide with the main lines of the clothing grid. Harmonious filling by the embroidery ornament is based on the report composition, which is realized by a combination of modules-motives in a certain order in the design of the ornament.

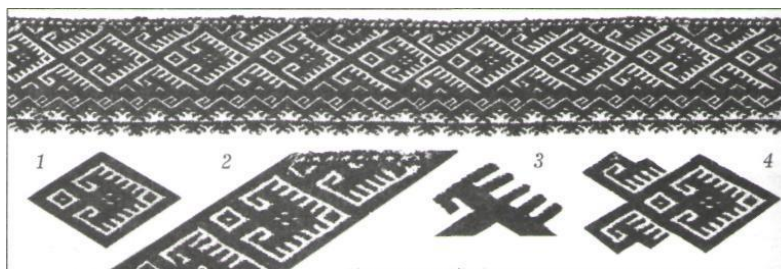


Figure 1. Compositional parts of the ornament:
1 – motive; 2 – report; 3 – element; 4 – module

A solid combination has the form of a chain or a grid, where the background is involved in the ornamental structure. In the dismembered pattern combination, the rhythmic repetition of the module is fixed through the bigger or smaller interval of the unclammed tissue field or the background monochrome sewing. The background emphasizes on the self-sufficiency of the module.

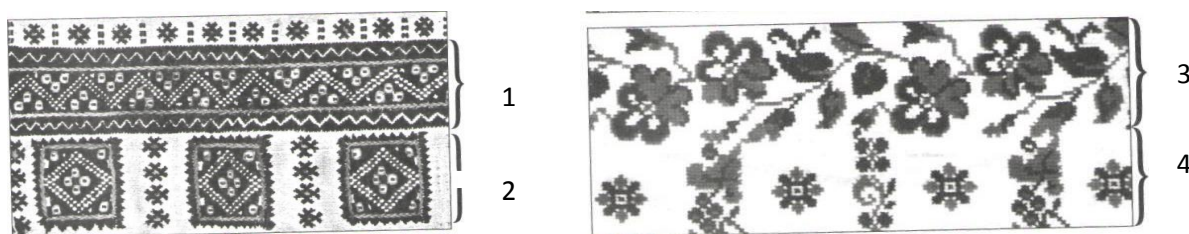


Figure 2. The character of the composition and a combination of motifs of ornamentation:
1, 3 – solid; 2, 4 - dismembered

Embroidery composition is usually based on the same motive, but in different reports, using methods like combinatorics, transformation, kineticism. Combinatorics are carried out by the following means: permutation, grouping, overturning, organization.



Figure 3. Types of ribbon symmetry for the development of ornaments

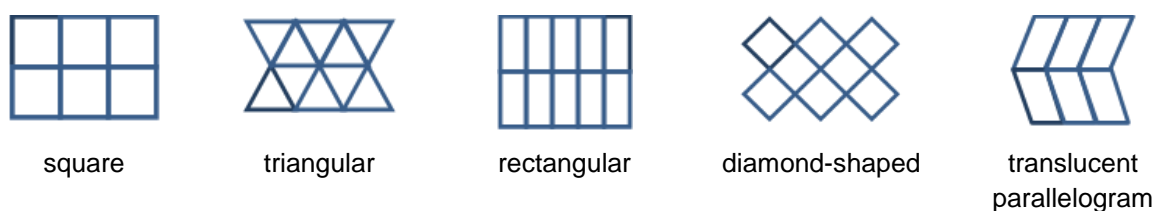


Figure 4. Types of grids for the development of ornaments

Transformation is carried out by means of scaling [6], (Figure 5).

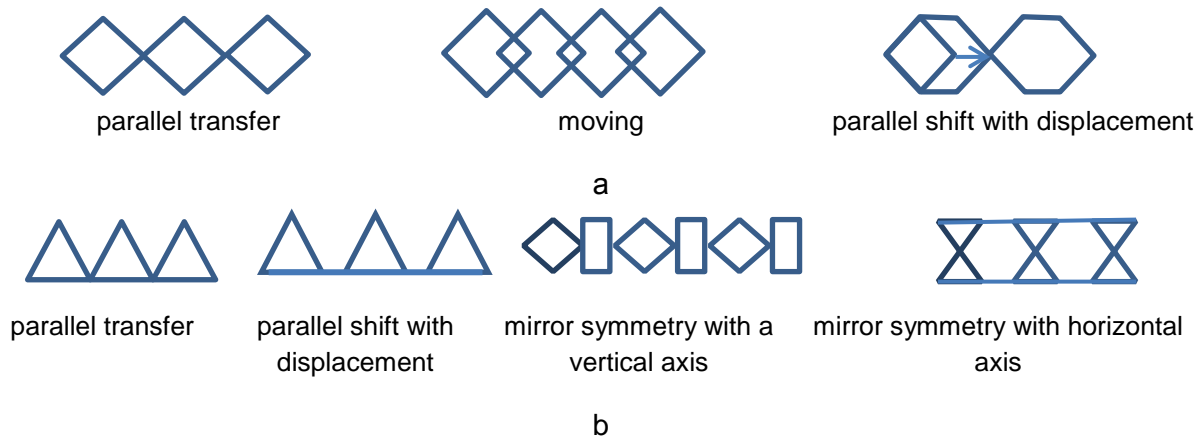


Figure 5. Schemes of transformations for the construction of the basis of the ornament:
 a - legacies; b - manche

Kineticism - the use of graphic illusion of the main drawing, which moves in the scheme of "birth-bloom-decay" [7], (Figure 6).

The transmission of constructive information on the formation of a motive is associated with such transformations of symmetry as bending, fracture, tension, compression, torsion. The organization of ornamental motifs in the closed structure of the monocomposition is based on ensuring a steady visual equilibrium of all components of the system. In particular, it is the shape, size, number of elements of the ornament, color, distance between motifs. Contrast in the distance between motifs, light and color contrast, the difference in scale shape - the most effective means of creating dynamic tension composition [7].

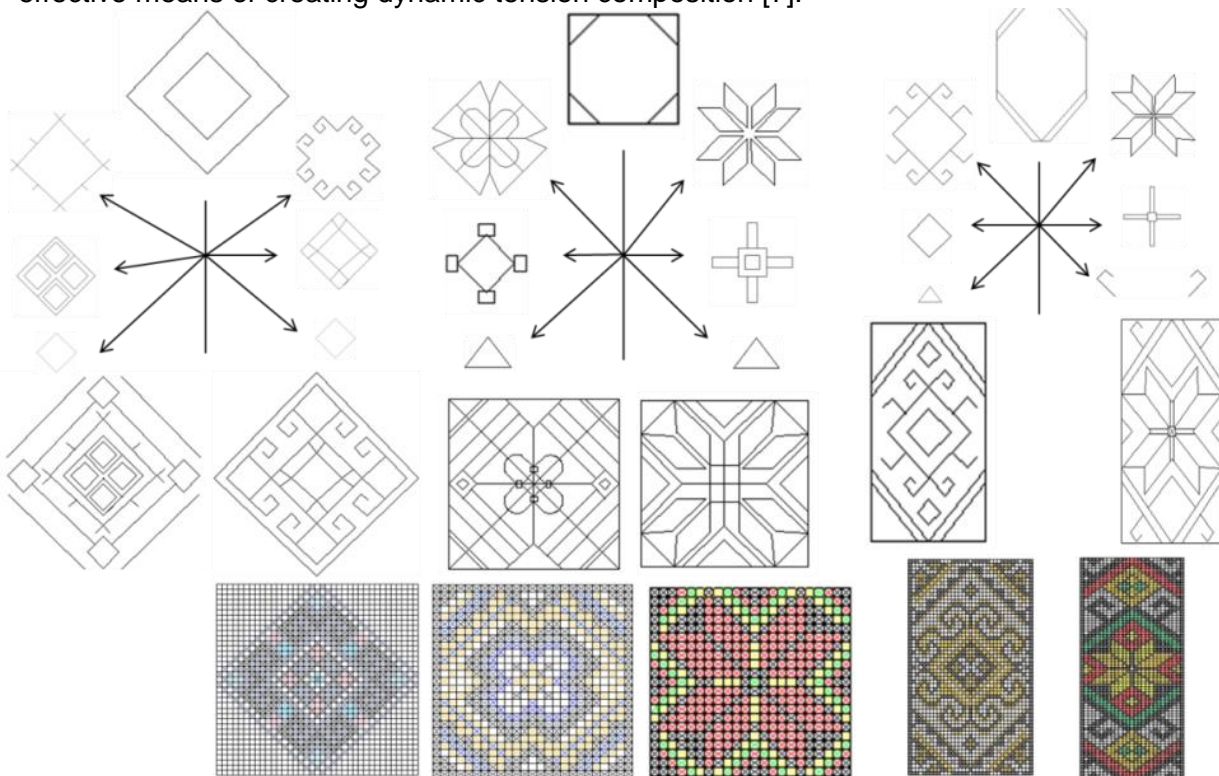


Figure 6. Schemes for the creation of modified versions of reports of Ukrainian national embroidery

3. EXPERIMENTAL

Information aspect of the signal component of the wardrobe capsule

The use of embroidery elements can be decorative and functional. Decorative is the decoration of sleeves, collar, inserts on the cuff or back, the belt, which emphasize the silhouette and the rhythmic expressiveness of the product.

Functionally, the embroidery can be used as a combination of shoulder, lateral seams, cochlear or relief seam, as the fixing of the neck skin, the lower section of the sleeve. There are three compositional variants of the static equilibrium of elements of the ornament on the product plane: the elements are focused on the central part; elements shifted to the top; the elements are located at the bottom.

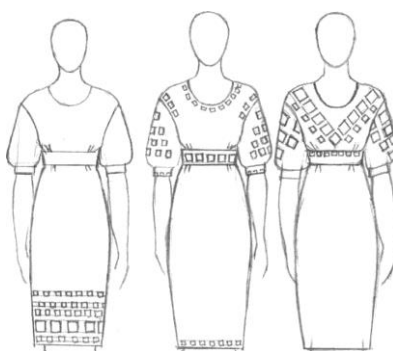


Figure 7. Composition filling with ornaments in the shape of a product

A peculiar ethnic symbol of embroidery in the mid-shoulder complex of Podillia is a shirt embroidery. Classifier of embroidery Ukrainian national clothes contains 8 classes [10] among which in national clothes are distinguished geometric and phytomorphic, which basically contain cross-shaped elements (CE).

The most common features of local traditions in the regional features of embroidery reproduce "sign" ornaments in the composition of embroidery (Figure 8).

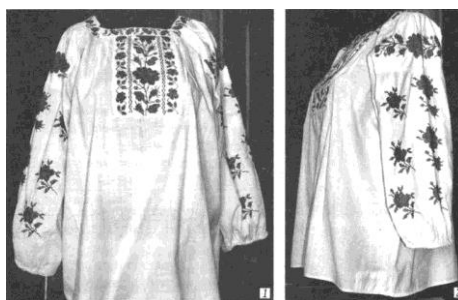


Figure 8. Women's shirt: 1 - front view; 2 - side view

The structure of geometric embroidery ornaments is structured from the outer contour of the basis of the report through the inner contour to the small elements and motifs. Pattern patterns for an ornament are shown on (Figure 9, a), collar ornament and cuffs on (Figure 9, b). The same form of elements and different sizes correspond to the principle of triptych within the individual product.

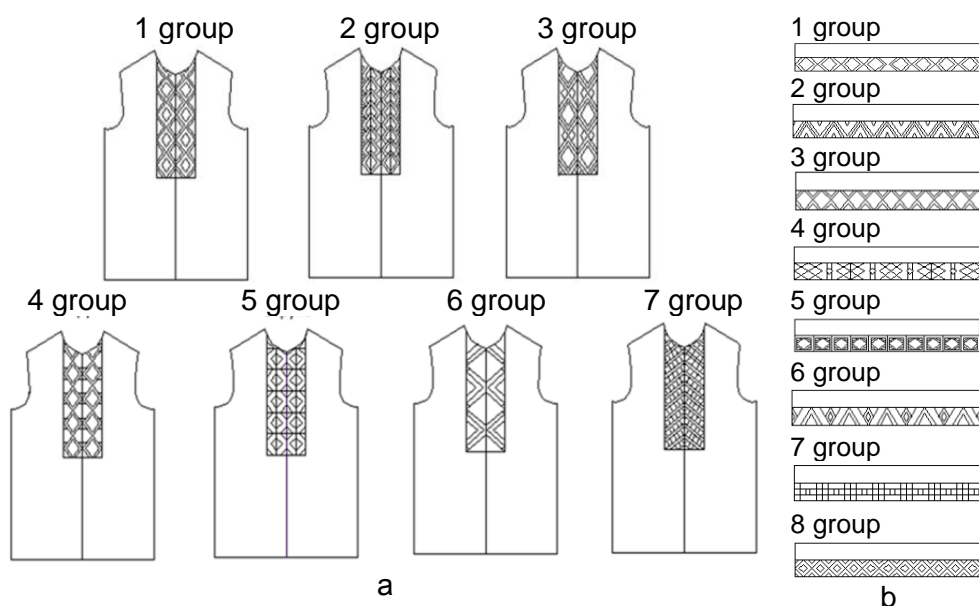


Figure 9. Typical structure of the base of the geometric ornaments of a man's shirt:
a - legs; b - collar and cuffs

At the beginning of the 20th century, on a considerable part of the northern region of the western region of Ukraine there is a proliferation of floral ornaments embroidered with CE technique with colorful threads, in which there is a tendency to naturalistic reproduction of plants on canvas. Distribution at the end of the nineteenth century, in the decorative art and architecture of the style "modern" appeared in the appendixes to the magazines of embroidery drawings CE in the style of "modern" (Figure 10).

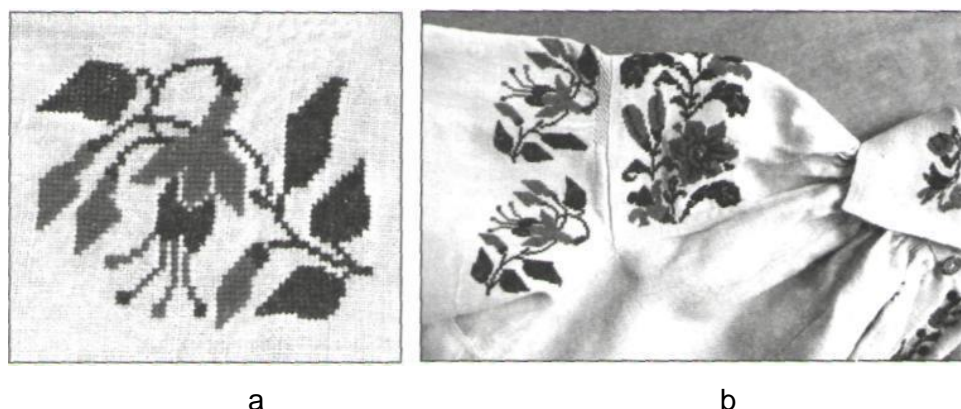


Figure 10. Ornaments made in the style of "modern"

The main element of the phytomorphic ornament of the embroidery of a female dress shirt is a fuchsia flower module embroidered with CE technique.

Decryption of ornaments by composition of a report in accordance with figurative graphic speech is carried out through icons and isomorphs [11].

Elemental icons have one heir. Isomorphema combines the same type of icons in the linguistic combination of a graphic image (Figure 10a) and serves as a module of ornamentation.

The isomorphic stem icons contain: 2,3,4,6,7 hee which can be placed horizontally, vertically, diagonally.

The isomorphs of the stork icon contains: 1,2,4,5,6,8 CE, placed horizontally, vertically, diagonally and in the form of a square.

The isomorphic of the icon of buds contains: 44,58,63 CE, placed horizontally and diagonally.

The isomorphic icon of the leaves contains: 82,91,111,113 CE, placed horizontally, vertically, diagonally.

The flower isomorphic (two-colored) contains: 79,19 CE, placed horizontally, vertically, diagonally, with a dismembered combination.

4. RESULTS

Significance of ornamentation of regional embroidery in capsule of representative wardrobe

Folk embroidery design of modern wardrobe is presented in three capsules: dress, costume, family embroidery (Figure 17). The model of the dress C (Figure 12), in accordance with the law of scale, demonstrates the broad possibilities for the emotional influence of decorating the ornament of the five zones on the shape equilibrium.

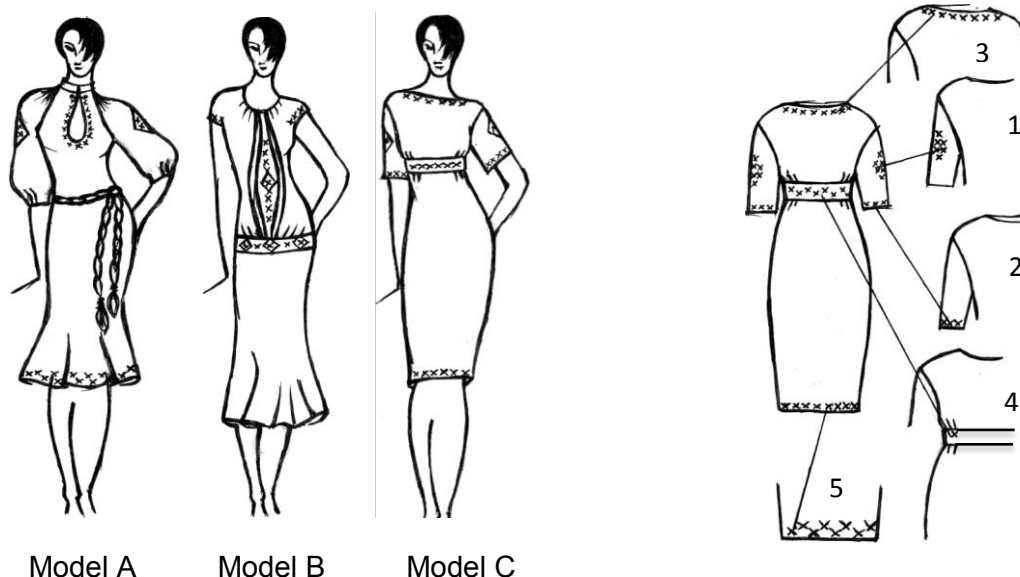


Figure 11. Industrial collection of women's dress with elements of Podillya embroidery

Figure 12. Thumbnail of the appearance of the model C for the areas of embroidery in the dress


Classifier of graphic rows of icons, provides reproduction of combinatorial cipher of elements of embroidery in the zones of placement (Table 2).

Table 1. Development of graphic series of structural elements of embroidery

№ row	The name of the icon	Graphic image	Cipher	№ of row	The name of the icon	Graphic image	Cipher
1	2	3	4	1	2	3	4
1	Graphic	X	1 M			x	2.4

row	icon of item			Isomorphic stamens 2.4	x x x x x x x x x x	
2 row	Structural isomorphs: Isomorphic stem 2.1	xx x x x x x xx xx xxxx xxxx	2.1			
	Isomorphic button 2.2	x x x x x x x x xxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxx xxx xx x	2.2	3 row A fragment association of isomorphs: Bud and leaf 3.1	x x x x x x x x xxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxx xxx xx x	3.1
	Isomorphic leaf 2.3	x x	2.3	Stem and stamina 3.2	x x x x x x x xx x xx x xxx xxx xxx xxx	3.2

Table 2. Catalog of embroidery modules according to application areas

Name of the area	Name of module	Code of elements	Graphic image	Name of the area	Name of module	Code of elements	Graphic image
1	2	3	4	1	2	3	4
1-Central part of the sleeve 2-Lower section of the sleeve	Fuchsia branch	2.1; 2.2; 2.3; 2.4; 3.1; 3.2;		4-Central part of the belt	Bud and leaf	3.1;	x x x x x x x x xxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxx xxx xx x
1-Central part of the sleeve	Stem and stamen	3.2;	x x x x x x x xx x xx x xxx xxx xxx xxx				x x x x x x x x xxxx xxxxx xxxxx xxxxx xxxxx xxxxx xxxx xxx xx x

3-neck and shoulder	Stem and stamen	3.2;	<pre> x x x x x x x x x x x x x x x x x x x x x x x x x </pre>	5-Lower section	Stem and stamen	3.2;	<pre> x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x </pre>
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The model of the dress is solved in the style of minimalism and holistically combines modules of a large size (the branch of fuchsia - on the sleeves), of medium size (bud and leaf - on the belt), small size (stalk and stamina - along the neck, bottom sleeves and dresses).

The female costume model contains ribbon ornaments, which are made with double cross-member elements (PCE) and created with the help of PM "Inkscape".



Figure 13. Image of a woman's suit made taking into account Ukrainian folk traditions

Existing in the graphic editor of Draw LLC, the filling function ensures, when changing the size of the CE, the change in the size of all ornaments on the details of cutting simultaneously: the board, the belt, the bottom of the sleeve, of the product.

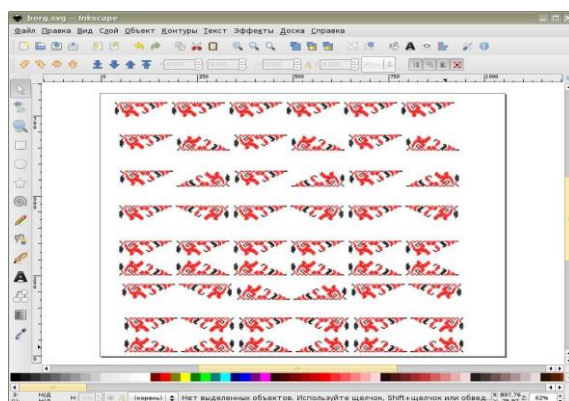


Figure 14. Screen form of PM "Inkscape" (curbs created by symmetry methods)
The graph of the machine for filling the plane 3x2 is given on (Figure 15).

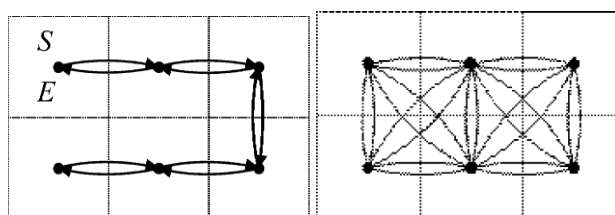


Figure 15. The graph of the machine for filling the rectangular area 3 × 2

A fragment of the way of ornamentation is given on (Figure 16).



Figure 16. Symbolic schemes for ornamentation and its transformation to fill the graph with the HE: a - complete pattern of the report of the ornament (where \$ - black color; + - red color); b - black ornament; c - the red color of the ornament

The family traditions of the embroidered shirt (Figure 17) are combined with the triptych of the geometric ornaments of the fourth group (Figure 9) around the head of the family. The shirt for the boy contains a proportionately shortened length of the embroidered loop. The ornament of a women's blouse is placed horizontally along the contour of the neck and bottom of the sleeve and emphasizes the reliability of family relationships.



Figure 17. Family Embroidery Capsule

5. CONCLUSIONS

The composition of embroidery is based on the combination of traditions of typical structures of combinations of motifs of ornament with regional differences in the creation of an ethnic

image. The theoretical bases of tape symmetry reproduce the kinetics of the modifications of reports of Ukrainian national embroidery taking into account stylistic features of clothing. The character of ethnic embroidery varies on the compositional level in modern clothes models, which is presented in the wardrobe capsules.

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STUDY OF FASHION TRENDS IN WOMEN'S CLOTHING WITH 3D ELEMENTS

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Abstract: *The paper presents an investigation of the latest fashion trends in ladies' dresses with 3D elements. The study is made with the help of the statistical method of conformity analysis. With the help of conformity analysis have been made connections between the type of 3D elements and other design features. The strongest connections show trends between fashion features for the latest season. The results of the study are applied in fashion design of ladies' dresses. An investigation of connections between different type of fashion features in the latest trends lead to facilitation of the creative process and variety of new successful designs.*

Key words: *fashion design, latest trends, ladies' dresses, 3D elements.*

1. INTRODUCTION

The current fashion trends for each season are presented by leading world designers and fashion houses. The successful design of the clothing follows the evolution of the fashion from previous fashion seasons. Studies represent fashion in shapes, lengths, colors, but individually, without interrelations between individual fashion elements. However, effective implementation of trends is only possible if the relationships between current elements are known [3]. In this study, the relationships between the types of three-dimensional elements and other fashion features in women's clothing are traced.

Principal Component Analysis (PCA) is a method of reducing input variables. The purpose is to detect and interpret latent interdependencies between characteristics in the data set. Features that are similar are merged and transformed into new features called latent factors or major components. In addition to discovering the data structure, through PCA the data set can be modeled, compressed, classified and visualized on a plane.

The results are presented graphically, which makes it very suitable for research in design and fashion [1, 2, 4, 6].

The purpose of this report is to cover as many models of well-known international fashion houses as possible through conformity analysis, which will facilitate the creation of new models of women's clothing based on the results of the conformity analysis [7].

The following relationships have been explored:

- ✓ Relationship between the three-dimensional element and the length of the dress;
- ✓ Relationship between 3D element and silhouette;
- ✓ Relationship between three-dimensional element and position;
- ✓ Relationship between direction of a three-dimensional element and silhouette
- ✓ Relationship between the silhouette and the length of the dress.

2. A STUDY OF FASHION TRENDS FOR SPRING-SUMMER 2018

The trends of dresses with three-dimensional elements were investigated using the conformity analysis. Models of 34 world-renowned fashion designers and fashion houses for Spring Summer 2018, ready-to-wear (Pret-a-Porter, Ready-to-Wear) clothing included in the Vogue database [4] were studied: Alberta Ferretti, Alexander McQueen, Antonio Beraroi,



Blumarine, Carolina Herrera, Chloe, Christian Dior, Christian Sirano, Dolce & Gabbana, Dsquared 2, Ellie Saab, Emanuel Ungaro, Ermano Scervino, Etro, Gucci, Gambattista Valli, John Galliano, Kenzo, Krizia, Lanvin, Marchesa, MSGM, Oscar de la Renta, Philosophy di Lorenzo Serafini, Roshas, Salvatore Ferragamo, Sportmax, V. Johnson, Valentino, Valentino Branquinho, Versace, Vivett, Wunderkind, Zuhair Murad. The sample includes all models of ladies' dresses with three-dimensional elements, ready-to-wear clothing for the season - a total of 132 models.

2.1. A study of the relationship between three-dimensional element and length

Dress length is one of the determining factors for its purpose and often determines the interior model development, therefore it is interesting to study the interrelated length - a three-dimensional element.

Table 1. Frequency of match between three-dimensional element and length of dress

3D element \ Length	Sets	Flounces	Creases	Pleats	Curls	Combined	Total
Medium to the thigh	1	7	0	0	0	2	10
Above the knee	1	1	0	0	2	2	6
To the knee	1	1	0	1	0	1	4
Under the knee	3	0	1	0	3	5	12
Medium to a calf	10	3	1	1	3	9	27
To the ankle	4	3	0	3	6	13	29
Up to went	8	9	3	1	0	12	33
Asymmetric	1	7	0	0	1	2	11
Total	29	31	5	6	15	46	132

Table 1 presents the frequency of coincidence between the type of three-dimensional element and the length of the dress. The results of the compliance analysis are shown in Figure 1.

Table 1 shows that the most recent season for spring - summer 2018 are the sets, wheels and combinations of two or more types of 3D elements in one model. Long dresses - lengths to the calves, ankles and soles are relevant. The graph in Figure 1 shows that in the fashion trends for the season, there is a strong relationship between pleats and ankles or knee lengths, frills and asymmetric hip or hip length, combined three-dimensional elements and knee-length sets and calf lengths and the soles, curls and lengths to the ankles or to the knees.

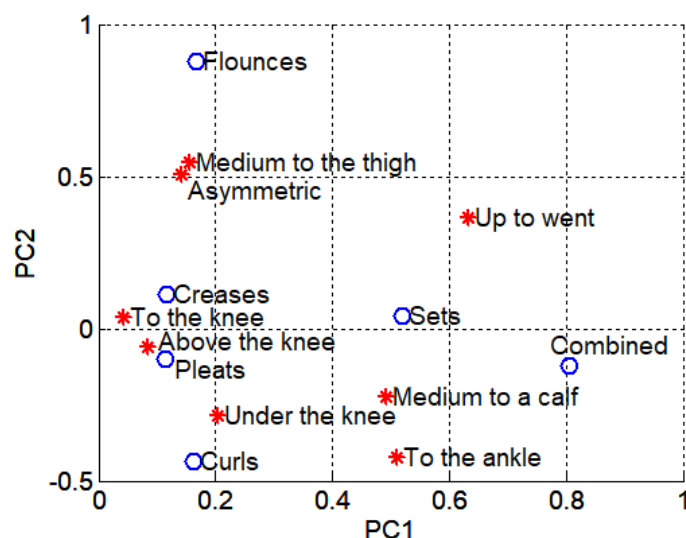


Figure 1. Results of PCA between the type of three-dimensional element and the length of the dress

It is preferable to carry out this study after studying the interconnected length of the dress, a three-dimensional element, because in determining the purpose and nature of women's clothing, length plays a more important role than silhouette.

2.2. A study of the relationship between a three-dimensional element and a silhouette

Table 2 presents the frequency of coincidence between the type of three-dimensional element and the silhouette of the dress. The results of the compliance analysis are shown graphically in Figure 2. Table 2 shows that the most recent season for spring - summer 2018 are the actual dresses with three-dimensional elements in X-shaped and Y-shaped inverted silhouettes. Also relevant for the season is the A-shaped silhouette. Less relevant are the silhouettes with expansive extensions in different areas of the body, those shaped with curved contours.

Table 2. Frequency of matching of three-dimensional elements and dress silhouettes

Silhouette \ 3D element	Sets	Flounces	Creases	Pleats	Curls	Combined	Total
Tight fit	0	0	0	0	2	0	2
Slim	6	2	1	0	3	3	15
Semi-slim	1	0	0	0	3	0	4
Straight	0	0	0	0	1	0	1
Y-shaped reversed	11	7	3	1	0	13	35
Y-shaped	0	3	0	0	0	3	6
A-shaped	3	6	0	3	4	13	29
O-shaped	1	0	0	0	0	0	1
X-shaped	6	11	1	1	2	13	34
U-shaped inverted under the waist (flower)	0	0	0	0	0	1	1
Combined	1	2	0	1	0	0	4
Total	29	31	5	6	15	46	132

The graph in Figure 2 shows that in the fashion trends for the season, there is a strong correlation between combinations of three-dimensional elements and X-shaped silhouettes, flower or combined, pleats and A-shaped silhouettes, recessed silhouette and breaks or sets, curls and straight, semi-wave or tight fitting silhouettes. Also important for the design is the positioning of the three-dimensional elements in the different sections of the dress. Positioning is important not only because of the role of the three-dimensional element as a purely decorative or shaping silhouette, but also because of the often combined decorative and decorative-structural functions.

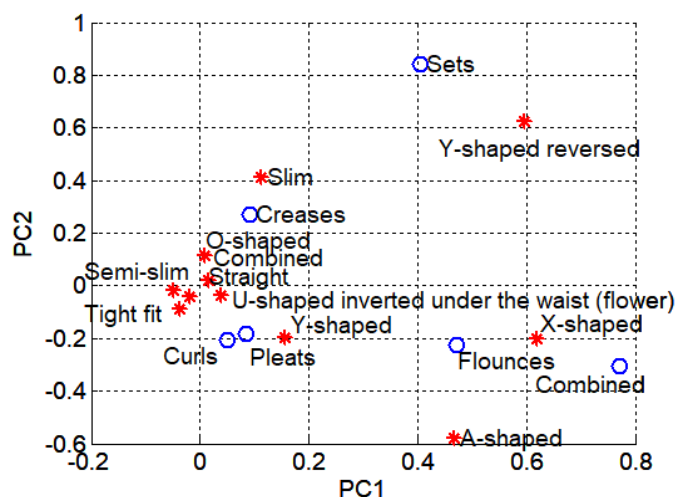


Figure 2. Results of PCA between a three-dimensional element type and a silhouette

2.3. A study of the relationship between a three-dimensional element and position

Table 3 presents the frequency of coincidence between a three-dimensional element type and its position in the interior design of the dress. The results of the compliance analysis are shown graphically in Figure 3.

The graph in Figure 3 shows that the ready-to-wear clothing trends in spring-summer 2018 are very strong interrelations between combinations of three-dimensional elements and their combined positioning in interior model development. Relationships between the combined location of three-dimensional elements and frills or curls, as well as sets positioned in the waist area, are relevant.

Table 3 shows that for women's spring - summer 2018 dresses ready-to-wear, there is no focus on the specific location of the three-dimensional element in the design. On the contrary, there is a predominance of positioning three-dimensional elements in two or more places. Elements in the waist area are also relevant for the season.

Table 3. Frequency of match between type and position of three-dimensional element

3D element \ Position of the element	Sets	Flounces	Creases	Pleats	Curls	Combined	Total
Upper part	0	0	0	0	1	0	1
Waist	11	0	1	0	0	0	12
Hips	0	1	0	0	0	0	1
Bottom part	0	2	0	0	0	0	2
Combined	18	28	4	6	14	46	116
Total	29	31	5	6	15	46	132

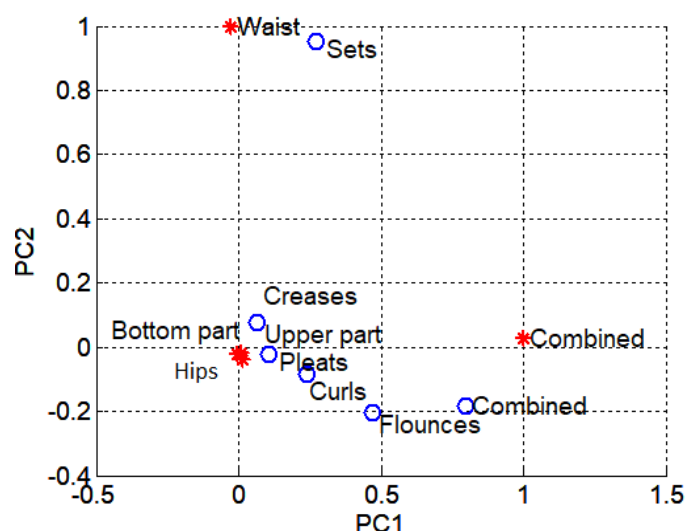


Figure 3. Results of PCA between the type and position of a three-dimensional element

2.4. A study of the relationship between the direction of a three-dimensional element and silhouette

Table 4 presents the frequency of coincidence between the direction of the three-dimensional element and the silhouette of the dress. This study is necessitated by the fact that not only the type of the three-dimensional element, but also its direction as a shaping element are related to the shaping of the silhouette. The results of the conformity analysis in the interaction between the direction of the three-dimensional element and the silhouette of the dress are shown graphically in Figure 4.

Table 4 shows that in the fashion trends of dresses for the spring - summer 2018 season, ready-to-wear clothing is dominated by dresses with three-dimensional elements in the combined direction. Three-dimensional elements oriented vertically are also relevant for the season.

Table 4. Frequency of coincidence between the direction of a three-dimensional element and a dress silhouette

Silhouettes \ Direction	Direction				Total
	Horizontal	Vertical	Diagonal	Combined	
Tight fit	0	0	0	2	2
Slim	0	0	1	14	15
Semi-slim	0	1	0	3	4
Straight	0	0	1	0	1
Y-shaped	1	0	0	5	6
Y-shaped reversed	3	8	0	24	35
X-shaped	3	9	0	22	34
A-shaped	3	5	0	21	29
O-shaped	0	0	0	1	1
Flower	0	0	0	1	1
Combined	0	0	1	3	4
Total	10	23	3	96	132

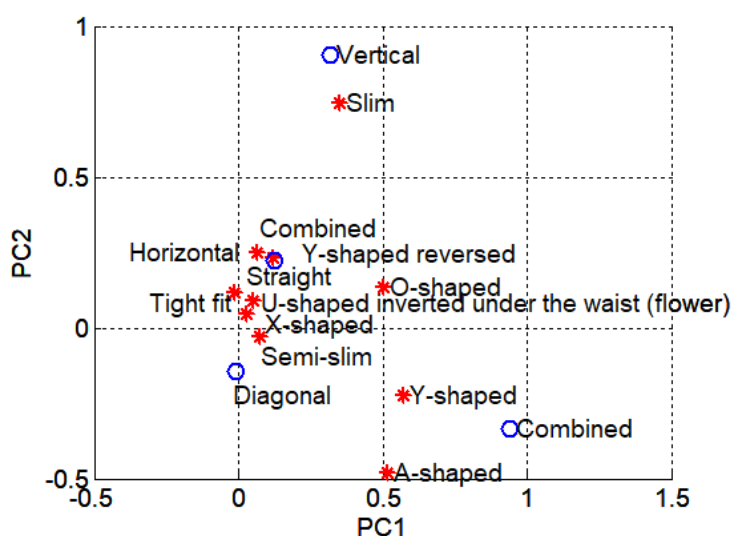


Figure 4. Results of PCA between the dress silhouette and the 3D element direction

The data in table 4 and the graph in Figure 4 show that in the trends for spring-summer 2018 ready-to-wear clothing, the strongest is the relationship between the horizontal direction of the three-dimensional element and the Y-shaped inverted or X-shaped silhouette. Very strong are the relationships between the vertical direction of the three-dimensional element and the Y-shaped inverted or X-shaped silhouette, the half-wave silhouette and the horizontal or combined direction of the three-dimensional element, the combined direction of the three-dimensional element and the Y-shaped, A-shaped or O-shaped silhouettes.

2.5. Investigation of the relationship between the silhouette and the length of the dress

Regardless of whether or not a three-dimensional element is involved in the design of a dress, it is always relevant to study the interconnected silhouette - the length of the dress. Table 5 shows the frequency of matching between the silhouette and the length of the dress. The results of the interaction analysis of the interaction are shown graphically in Figure 6.

Table 5. Frequency of matching between dress length and silhouette

Silhouette \ Length	Length								Total
	Medium to the thigh	Above the knee	To the knee	Under the knee	Mid-calf	To the ankle	Full length	Asymmetric	
Tight fit	0	0	0	2	0	0	0	0	2
Slim	0	0	1	4	1	2	4	3	15
Semi-slim	0	0	0	0	1	3	0	0	4
Straight	0	0	0	0	1	0	0	0	1
Y-shaped	0	0	0	0	2	1	2	1	6
Y-shaped reversed	2	0	1	2	8	8	14	0	35
X-shaped	6	0	1	4	7	7	7	2	34
A-shaped	2	5	1	0	7	8	1	5	29
O-shaped	0	0	1	0	0	0	0	0	1
Flower	0	0	0	0	1	0	0	0	1
Combined	0	0	0	0	0	0	4	0	4

Total	10	5	5	12	28	29	32	11	132
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The graph in Figure 5 shows that for women's spring-summer 2018 dresses, the strongest relationship is between the Y-shaped silhouette and the lengths to the calves or ankles, and the X-shaped silhouette and the length to the mid-thighs. There are strong interrelationships between bent silhouette and knee-length, A-shaped knee-length silhouette, and combined silhouette and foot-length.

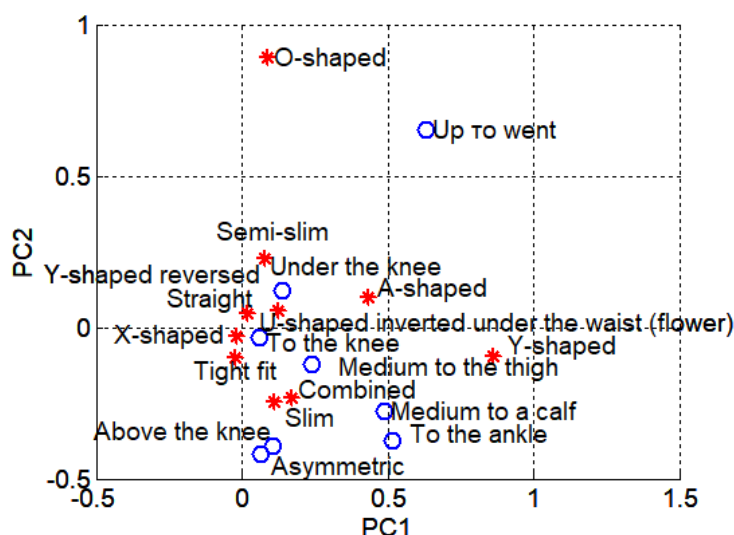


Figure 5. Results of PCA between the length and the silhouette of the dress

Statistical analysis was performed using the MatLab program environment [5]. The STATISTICA software product may be used for the same purpose.

3. DESIGN OF DRESSES WITH THE APPLICATION OF THE FASHION ANALYSIS RESULTS

Figures 6-15 show the design of dresses with the results of conformity analysis of the fashion trends for the spring-summer 2018 ready-to-wear garments. The design of the designed models reflects the results of all conformity graphs.

In accordance with the results of the conformity analysis, the model of Figure 6 was designed using the strong interconnection between the recessed silhouette and the three-dimensional breaker element. The dress is modeled in a fitting silhouette, characterized by a folding in the waist area, which is also emphasized with a decorative belt.

In the model of the dress of Figure 7, the relationship between the silhouette flower and the three-dimensional frill is reflected, as one of the most common in the conformity analysis. The model also includes the relationship between the X-shaped silhouette and the combined three-dimensional frill elements and pleats.

Using the results of the conformity analysis analysis, leading in the design of the models of Figures 8,9,14, and 15 is the relationship between the type of silhouettes, the type of three-dimensional element - the silhouette and the sets. The positions and directions of the kits are diverse, including waist, bust, shoulder, hip and neck areas, as well as directions - vertical, horizontal and diagonal. In all model developments, the waist and bust have been transformed from the main structure and modeled into sets.

Figure 10 shows the relationship between ankle length and pleating element. In the model, the function of three-dimensional elements is decorative and constructive.

Model 11 shows the relationship between the asymmetrical length of the dress and the three-dimensional frill. The folding of the frill is diagonal, positioned in the hips. The 3D elements have a decorative function. The model of the dress also has a three-dimensional element curls positioned vertically along the sleeve curves.

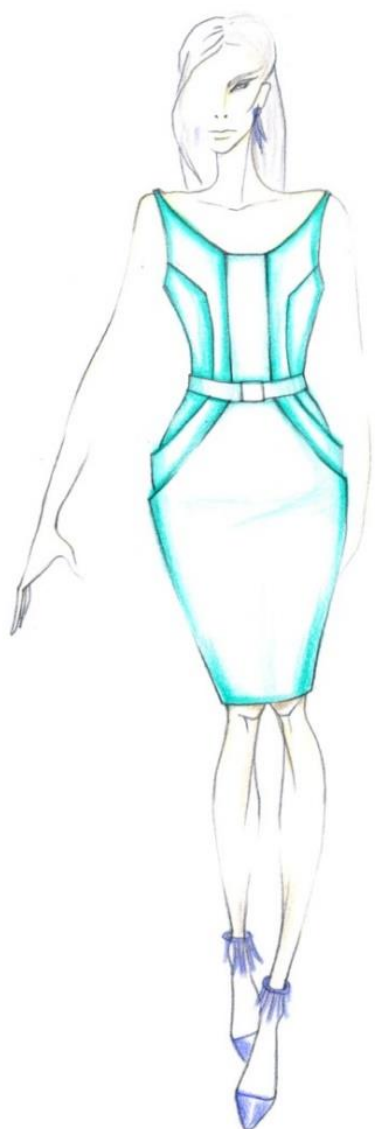


Figure 6

Fashionable design of dress with an emphasis on interconnected silhouette and element-breakers



Figure 7

Dress designed with the emphasis on the strong interplay between flower silhouette and three-dimensional frill

Figure 12 shows a model of a dress in a Y-shaped inverted silhouette with three-dimensional elements of the frill positioned in the waist, hips and lengths in horizontal direction. The frills are formed by means of sets and are positioned horizontally in the waist, hips and length areas. The top of the frill has a decorative and structural function, and underneath it has a decorative function.

Figure 13 shows a model of a dress in a beveled silhouette and a three-dimensional element of gathers, which are positioned in a horizontal and vertical direction. The elements in the model have a decorative function.

In designing the models in Figures 14,15 the strongest relationship is between the type of silhouettes, the type of three-dimensional element - the beveled silhouette and the sets. In the model developments, the waist and bust rolls were transformed from the basic structure and modeled into sets.



Figure 8

Fashion design of a dress with a strong interconnection between a slim silhouette and a three-dimensional element - sets positioned in a vertical and diagonal direction



Figure 9

dress designed with the interconnection between a slim silhouette and sets positioned vertically in the waist area

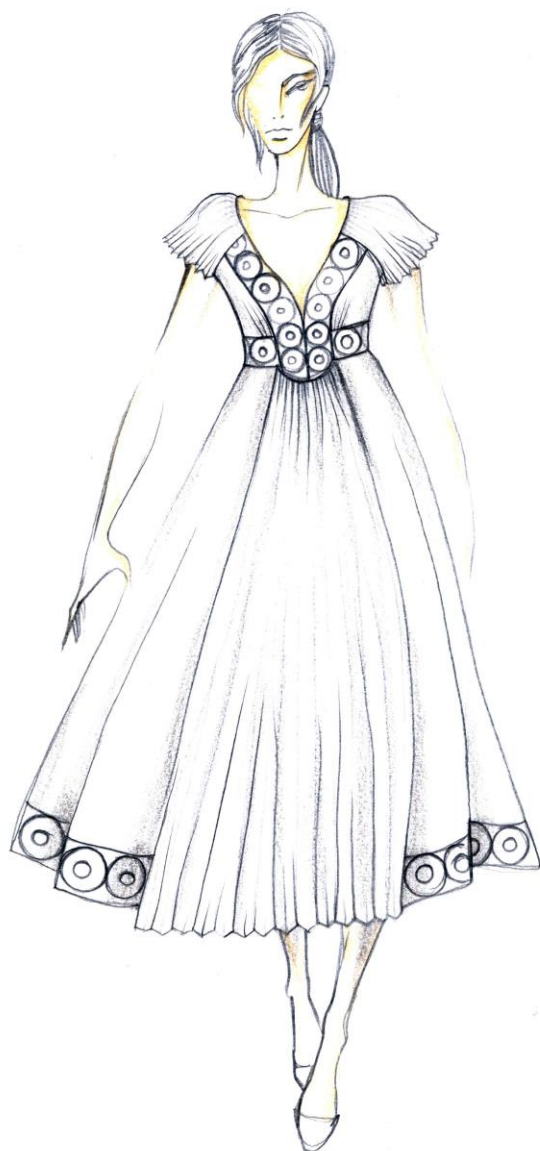


Figure 10

Fashion design of the dress with emphasis on the strong interrelation between the three-dimensional element - pleats and the length of the dress to the ankle

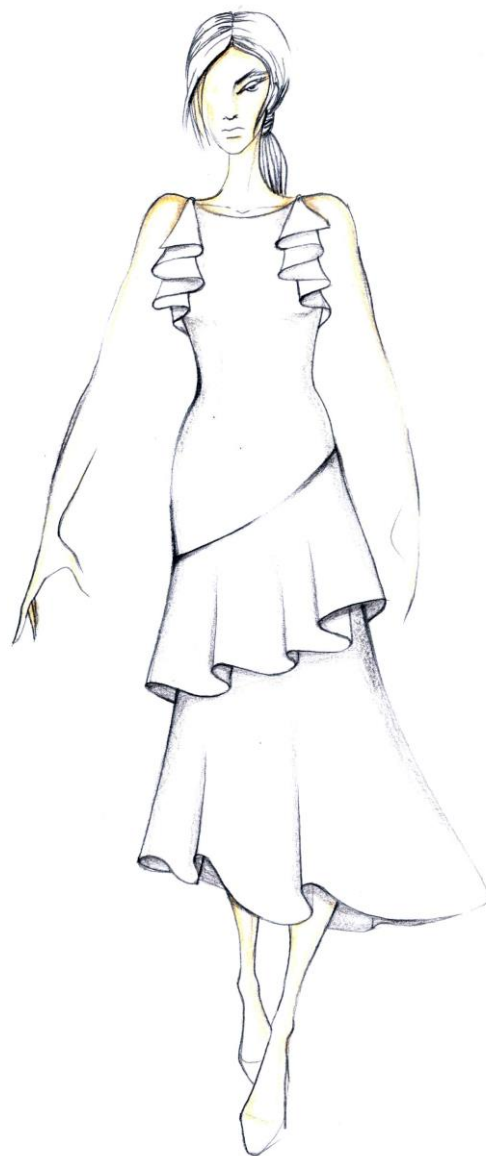


Figure 11

Model of a dress using the interconnection between the three-dimensional element - the frill and the asymmetric length of the dress



Figure 12

Fashion design of a dress with the application of the relationship between the Y-shaped inverted silhouette and the horizontal direction of the three-dimensional element sets

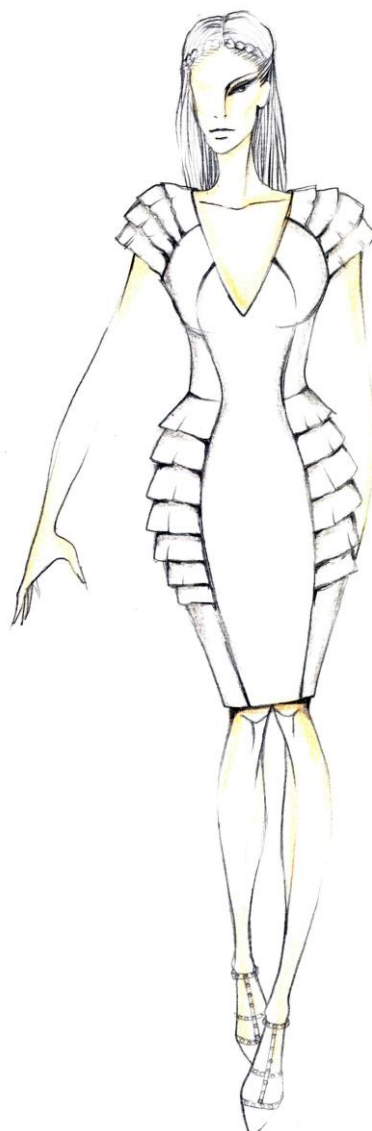


Figure 13

A model of a dress designed with the emphasis on the strong interrelation between the curved silhouette and the combined direction of the three-dimensional curling element



Figure 14

Design of a dress with the interconnection between a slim silhouette and an element - sets positioned in the neckline



Figure 15

Fashion design of the dress designed with interconnected silhouette and three-dimensional element - sets positioned in the neckline and hips in a diagonal direction

4.CONCLUSION

The following conclusions from the conformity analysis, which can also be considered as determining trends in the use of three-dimensional elements in the design of dresses:

- ✓ The strongest is the relationship between the workpiece with three-dimensional elements and the X-shaped silhouette;
- ✓ The length of the dresses is dominated by classic to mid calf and hemline;



- ✓ Most commonly, three-dimensional elements are used in waist shaping to give extra femininity to the silhouette or all possible lines;
- ✓ The direction is most pronounced as vertical in pleats, one-sided and double-sided, horizontally and diagonally in the frills and gathers;
- ✓ The application of the results of the research results in an easy creative process and diversity in the design of new models of women's dresses.

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MODELING OF LADIES' DRESSES IN DIFFERENT SILHOUETTES OF KNITTED FABRIC

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Abstract: *The present study presents a study and analysis of the properties of knitted fabrics and their influence in the process of modeling women's dresses in different silhouettes. We present model designs for the production of three models of ladies dresses from knitted cloth in different silhouettes. An analysis of „model of modeling” approaches has been made. The relationship between basic structure, model and properties of the textile material has been studied. The aim of the present study is to enable the fabric material, construction and model to be taken into account at the earliest stage in designing ladies' dresses made of knitted fabric.*

Keywords: *knitted fabric, modeling women's dresses, knit dresses, pattern-making.*

1. INTRODUCTION

Thanks to their movable loop structure, knitted fabrics have the qualities and properties that make them preferred by consumers for today's dynamic lifestyle. In recent years, there has been a trend of expanding the range of garments made from knitted fabric and replacing woven fabrics with knitted fabrics. This sets manufacturers a daunting task of producing new and diverse models.

The process that connects the model, the basic structure, the manufacturing technology and the textile material is modeling. In addition to all their qualities, knitted fabrics have a number of specific properties that must be taken into account when designing articles.

[1] The subject of this study is the influence of the elasticity and residual deformation of knitted fabrics on the modeling processes of women's dresses in different silhouettes.

The stretchability and restoration of knitted fabric were examined to achieve this goal. Based on the results presented in [7], the correction coefficients calculated in the present development are calculated and modeled on three models of women's dresses in different silhouettes.

2. EXPOSE

Clothing modeling is a process that provides the link between the conceptual design of the designer and the serving of the product. The model is the original idea, and the model is the process of creating it, as it is read for every opinion, there is information about materials, appearance of the future user. Assoc. Prof. Hindev and Prof. Hr. Petrov defines the models of clothing as decorative and applied art, whose task is the artistic design and design of various in shape and design garments [3].

It is widely accepted that clothing modeling is a means of obtaining the details of a particular model's product based on the basic structure, through a number of transformations. [9,11] This is the so-called. structural modeling, which is the basis of modern clothing production.

2.1. STRUCTURAL MODELING

Structural modeling of clothing consists in the partial or complete transformation of the basic structural basis. Depending on the degree of transformation, some authors [9,10] define conditional modeling into four types:

- Without changing the silhouette and the shape, while maintaining the basic structural lines and configuration of the basic details of the original basic structure;
- By changing the silhouette while maintaining the basic shape in the area of the supporting surfaces. The main techniques for changing the silhouette are the different types of draperies, conical extensions or narrowing in certain structural sections. Additional structural cuts of the parts are possible;
- Complete change in volume forms, change of sleeve oval and curve, redistribution of freedom allowances, transformation of sleeve and bust rolls. Changing the design of the sleeve, which implies its joining with the parts of the back and the ancestors;
- Modeling clothes of a new kind – the so-called hybrid construction. It incorporates the above three methods in order to produce complex models, with the aim of achieving a good fit of the article to the figure.

The four types of structural modeling described are useful in the manufacture of knitwear. Knitted fabrics have specific properties that complicate the design and modeling processes and must be taken into account at the stage of product model selection. The choice of modeling approach, the transformation of the rolls into different types of structural cuts, the shaping of the details and the silhouette are directly dependent on the properties of the material used. The high torsional and intertwining nature of some types of skeleton structures determine the possibilities for transformation of the structural base and greatly limit the choice of model for construction.

On the other hand, new knitting techniques and machines allow for the production of knitted fabrics combining the qualities of a dynamic tensile structure with physical properties similar to those of the woven fabrics, which is a prerequisite for greater freedom in model selection and modeling approach. of articles. The specific properties of knitted fabrics and their great structural diversity necessitate the need for an individual approach in the modeling of garments. The properties of the knitted fabric need to be taken into account in a comprehensive way and to be directly reflected in the design of the basic construction, model development and technology for the manufacture of the product.

It should be noted that there is an important difference between the modeling of fabrics and knitted fabrics and it consists in the following: Model designs of cloth garments are applicable for the manufacture of articles of different fiber composition and fabric structure, whereas for knitted fabrics this is impossible without prior studies of certain physical properties such as elasticity, elasticity, etc. The results of these studies should not be machined, but should be realistically expressed through the application of correction coefficients, taking into account the particularities of model development. Models of women's dresses designed according to the four types of approaches for designing clothing are described in Figure 1.



Figure 1 Knitted women's dresses modeled with different design approaches

3. MODELING WOMEN'S DRESSES IN DIFFERENT SILOUETS

It has been found that the most influential feature on the design of knitwear is the elasticity and residual deformation of the knit fabric [6,5,8]. Clothing modeling is a process that is carried out on the basis of the structural basis of the article, and it can therefore be assumed that the properties that affect the design will also be decisive in the modeling process.

In the fabric of knitted garments, the properties of elasticity and elasticity are mainly reflected by reducing the transverse dimensions of the articles. The study of finding the optimal parameters for reducing the transverse dimensions is devoted to the research of a number of scientists [10,11,15]. These methods produce good results when the object of design is products in a tight fitting silhouette. In recent years, there has been a trend in the production of knitwear garments in a variety of silhouettes, styles and uses. All this necessitates a qualitatively new approach in the design and modeling of products. The approach considered in the present development is to design a basic basic structure that is designed with zero freedom allowances. The stretchability of the knitted fabric is taken into account during the modeling process and depends on the required fit in the respective structural section. This would help to facilitate the design process by using a basic structure to model knitwear with different extensions.

The article [7] presents a study of the stretchability of a knitted fabric with the following characteristics: 65% viscose, 30% polyester, 5% elastane with a surface mass of 240g / m². Punto di Roma). The standard NEXT TM 21a (knit), a method used to measure the stretchability and return of a knitted fabric, was used to conduct the study. This method was developed by manufacturers of clothing and retail chains in Europe and is applied in the accredited laboratory of E. Miroglio Ltd. The essence of the method consists in a dynamic two-cycle load with a constant tensile speed of 500 mm / minute and a loading force equal to 2 kg. Based on the results of the study, the following correction coefficients are calculated:

$$x_n = x_i(1 - K_{y.o.d}) = x_i \cdot (1 - 0,12) = x_i \cdot 0,88 \quad (1)$$

$$y_n = y_i(1 - K_{y.o.d}) = y_i \cdot (1 - 0,07) = y_i \cdot 0,93 \tag{2}$$

$$z_n = z_i(1 - K_{y.o.d}) = z_i \cdot (1 - 0,10) = z_i \cdot 0,90 \tag{3}$$

Where x_i , y_i and z_i are the coordinates of the i - th point of the workpiece contour without taking into account the deformation properties of the fabric.[1]

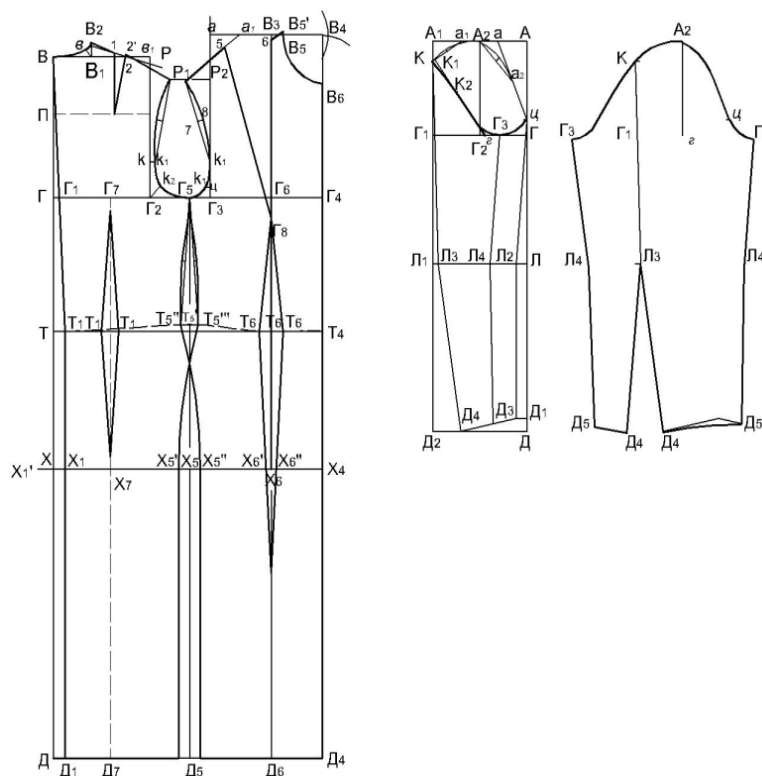


Figure 2 Basic structure

In order to study the effect of the stretchability of the knitted fabric on the modeling process, three models of women's dresses in different silhouettes were designed. The choice of a modeling article is determined by the fact that the women's dress covers three structural belts and will allow a more complete monitoring of the effect of the stretchability of the knitted fabric on the modeling process. [2]As a basic structural base, a basic design of a lady's dress of standard size 164/88/96 according to BDS [1] was constructed. The methodology of Assoc. Prof. Gindev [2,4,3] was used to elaborate the basic structure. Given that the designed products will have a silhouette other than a tight fitte construction is made without negative freedom allowances, with the freedom allowance in the various construction belts being zero. The base structure is presented in Figure 2



3.1. Model №1

Fig. 3 presents a lady's cocktail dress in a slim silhouette with a length up to the middle of the knee. Deposition of the silhouette is formed by structural cuts. The compositional center of the model is the décolleté and the back. The modeling of the drapes is by the system of Tomoko Nakamichi [15].

Initially, the neck curvature was deepened along the line of the shoulder seam, the front, and the back. The busts and shoulder rolls were transformed into the open contour of the neckline, the drapery unfolded in a fan-shaped manner. After their geometrical expansion, the details are adjusted with the correction coefficients obtained during the test. The transverse dimensions along the waist, hips and length of the article are adjusted for better fit.

It has been shown that the transverse stretching of the knitwear leads to a decrease in the length length [11,12], in which case the length correction coefficients can be ignored. In Figure 4 shows model modeling and Figure 5 shows the corrected details.

Figure 3 Model №1

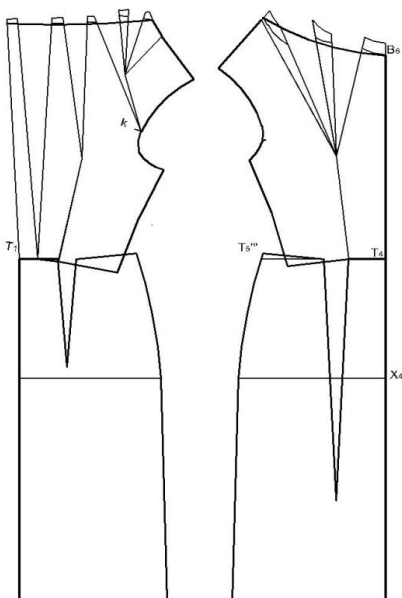


Figure 4 Model development

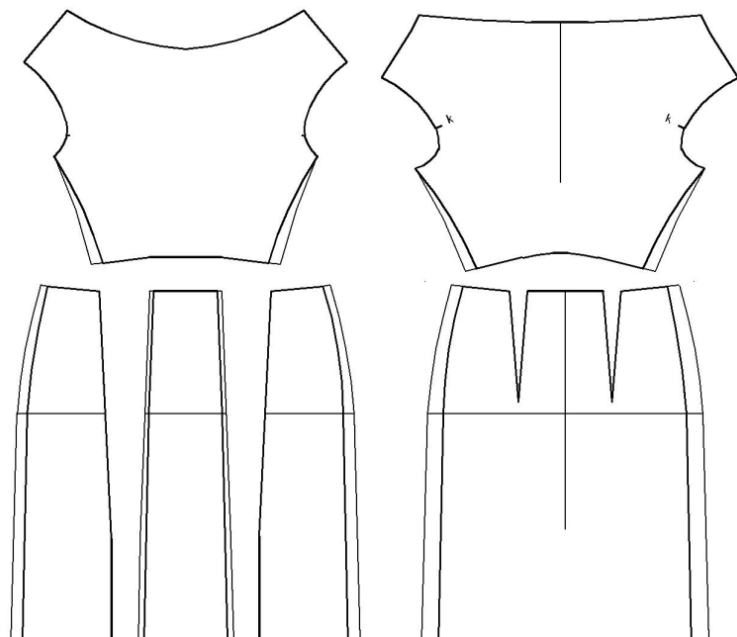


Figure 5 Details of model №1



3.2. Model №2

A lady's party or cocktail dress in Y-inverted silhouette is presented - Fig. 6. The dress is symmetrical with an irregularly shaped hemline. The top is shaped like a bust. The neckline of the front is formed by a smooth, almost horizontal line, the back is formed by a smooth indentation. Silhouette insertion is achieved through vertical, ornamental cuts. Due to the stretchability of the knitted fabric, the dress is made without a zipper. To achieve a better fit in the area of the bust, the shoulder roll is enlarged by 1.5 cm, the lateral sutures are displaced by 1 cm inward, the armpit is widened by 2 cm. The hem has a difference in length of front and back 25 cm.

After geometric expansion of the parts, they are resized with the corresponding correction coefficients. The determining factor in resizing is the required fit of the product to the appropriate structural section. In order to achieve a better fit, the parameters of the waist and chest lines have been adjusted. Due to the large volume of the underside, the length line has been adjusted to avoid possible sagging of the product. Modeling of the product is presented in Fig. 7 and details in Fig. 8.

Figure 6 Model №2

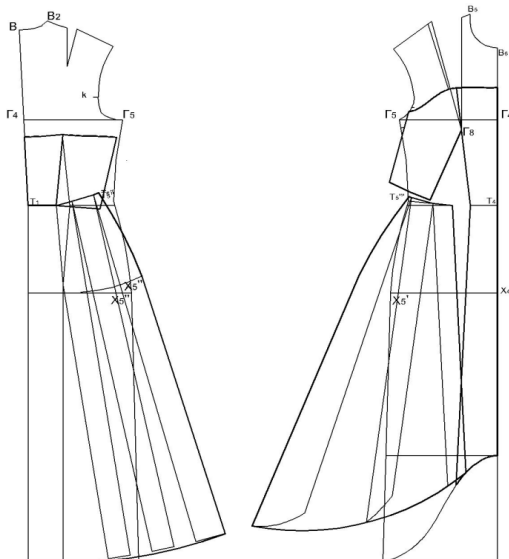


Figure 7 Model development

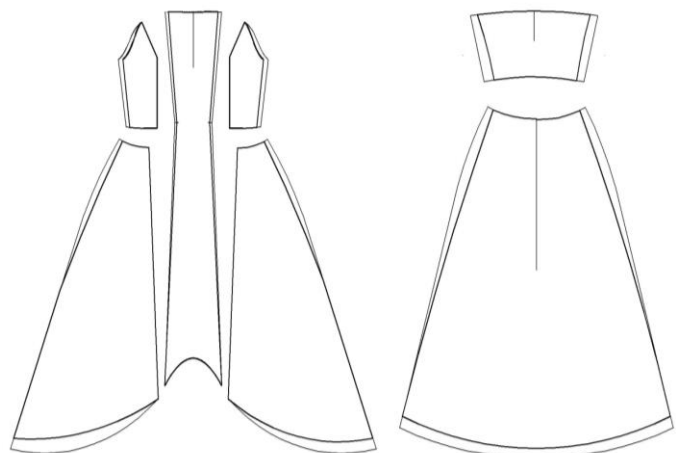


Figure 8 Details of model №2



3.3. Model №3

Model №3 presents an asymmetrical, feminine dress in a combined silhouette that combines two distinctive features of knitted fabrics - stretchability and drape. The model can be divided into two parts - upper and lower or internal. The upper part of the model is made in A-shaped silhouette, which is formed by free-falling drapery, the lower part of the dress is in a tight-fitting silhouette. The model is asymmetrical and is made on a fully unfolded basic structure. Initially, the neck curvature of the shoulder suture was deepened by 2 cm, the shoulder curls were transformed into a sleeve curvature. The length of the upper part of the dress is asymmetrical, with the longest part of the hemline going down 10 cm below the hips and the shortest being 10 cm above it. The neckline is shaped with a smooth curve. The drapery of the upper part is achieved by ventilation. The model development is presented in Figure 10

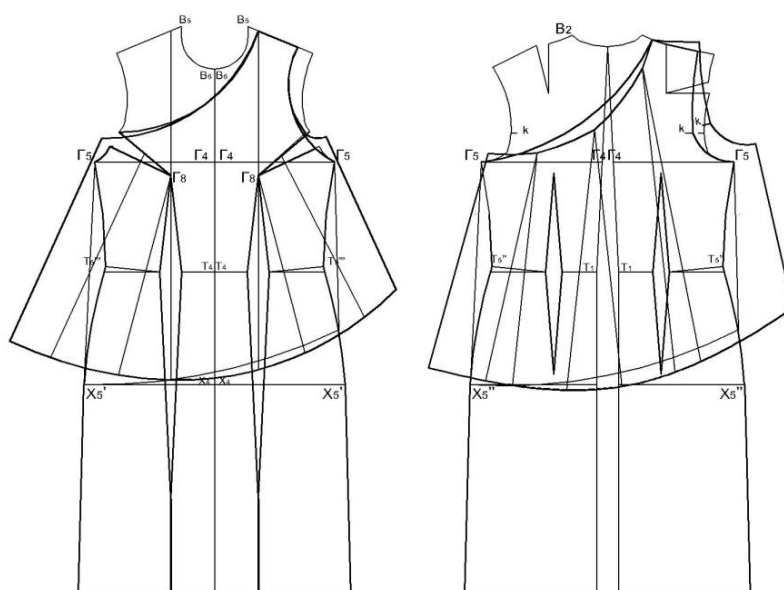


Fig.9 Model №3

Fig. 10 Model development of model №3

The geometrically unfolded parts are resized with the corresponding coefficients. Due to the large volume of the upper part of the dress and the ability of the skeleton structures to change their geometric parameters under the action of their own weight [11,12], the details are corrected only in the direction of the tungsten pole. In order to achieve a tight fit, the details of the inner part of the dress are adjusted along the line of the chest, waist, hips and the length of the article with the correction coefficients in a loop. The details of the article are presented in fig. 11

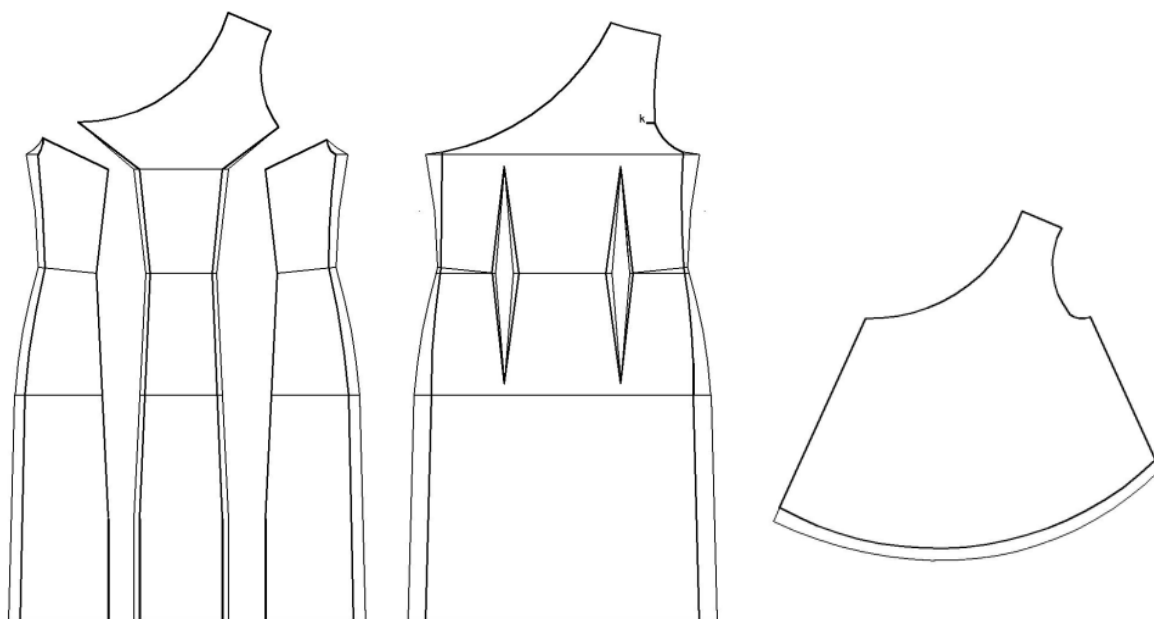


Fig. 11 Details of model №3

4. CONCLUSIONS

Model designs of three women's dresses in different silhouettes were subjected to research. The silhouettes are chosen in order to more clearly represent the relationship between the properties of the knit fabric and the process of modeling the article. Models with different fitting in the structural belts are selected, which require a different approach in their modeling. The residual deformation of the investigated knit fabric is reported by correction coefficients in the various construction belts. Following analysis of model developments, the following conclusions are drawn:

- The stretchability of the knitted fabrics makes it possible to transform the shoulder and waist rolls into different open loops, which in turn facilitates the production process and leads to a reduction in the cost of the products;
- The stretchability of the knitted fabrics makes it possible to transform the shoulder and waist rolls into different open loops, which in turn facilitates the production process and leads to a reduction in the cost of the products;
- The residual deformation of the knitted fabric is reflected in the modeling of the products by correction coefficients, which should not be automatically applied but tailored to the specific model development.
- The application of the correction coefficients depends on the product silhouette and is determined by the necessary fit in the respective structural section;
- Due to the stretchability and elasticity of the knitted fabrics, it is possible to cut down certain technological units, such as the manufacture of zippers, slots, splits, fastenings, etc., which in turn facilitates the production process;
- The specific properties of knitted fabrics influence the choice of product modeling approach and should be taken into account integrated, taking care of their interaction in product modeling;
- An individual approach is required in the model development of each product, which requires a more in-depth study of the relationship between the shaping properties of knitted fabrics and the silhouettes of women's dresses.

- The proposed product modeling approach enables the basic structural base to be used to model women's dresses of knitted fabrics of different extensibility, which facilitates the production process and results in reduced costs.

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ANALYSIS OF THE CHOICE OF TECHNOLOGY FOR PROCESSING OF WELT POCKET

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Abstract: *Cut pocket is widely used in clothing. The variety of pocket-making technologies is great. Depending on the type of clothing, the process is different. This requires a thorough knowledge of the different technological options.*

The choice of a particular technological variant in the preparation of the details entails the execution of a specific technological variant for processing the other part from the pocket and its complete production. The relationships between the individual details of a cut pocket with one fillet were investigated. The appropriate variants for the appropriate clothing are indicated.

The article analyzes the various options for making a single-fillet slit pocket. Knowing the different options for making pockets allows you to choose the right one for the product.

Keywords: *garment, technology, making, pocket*

АНАЛИЗ НА ИЗБОРА НА ТЕХНОЛОГИЯ ЗА ИЗРАБОТВАНЕ НА ПРОРЯЗАН ДЖОБ

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1. ВЪВЕДЕНИЕ

Джобовете са основен завършващ детайл в облеклото. Те се изработват във всички видове горни и връхни облекла. В зависимост от изработката могат да се групират, като външно пришити, непрорязани, прорязани и комбинирани. Голямото разнообразие обуславя необходимостта от познаване на технологията за изработването им и избора на подходящ джоб за съответното изделие.

Целта на настоящия доклад да се анализира избора на технологичен вариант за изработване на прорязан джоб с една филетка. За постигане на целта са разгледани и анализирани връзките между детайлите на прорязан джоб с една филетка и цялостното му изработване.

2. ЕТАПИ НА ОБРАБОТКА НА ДЖОБ

Джобовете са необходим детайл в облеклото, зависещ в голяма степен от редица фактори:

- Вид на изделието, на което ще се изработват: поясно или раменно изделие, връхно или горно облекло;
- Вид и свойства на текстилния материал;

- Място върху изделието, на което ще се изработват;
- Начин на изпълнение;
- Вида на използваното оборудване - универсална машина за двуконечен затворен бод, шевен автомат за изработване на прорязани джобове, шевен автомат за изработване на допълнителни детайли към джобовете и др.;
- Функцията и предназначението, което изпълнява. Джобът може да служи за декорация на изделието или да е с определено предназначение. Актуални са тъй наречените „функционални джобове“ в рокля тип „мъжка риза“ предпочитани от млади жени [3];
- Модните тенденции.

В облеклото джобовете се използват в търсене на различни визуални ефекти. В голяма степен те се решават в контраст с останалите детайли или са подчинени на една форма [2].

Изработването на прорязан джоб преминава през три етапа на обработка.



Фигура 1. Етапи на изработка на джоб

Връзката между детайлите през отделните етапи на изработване са разнообразни. Те зависят от модела и от избрания технологичен вариант за изработване.

Изборът на определен технологичен вариант във втория етап при подготовка на детайлите води след себе си изпълнението на точно определен технологичен вариант за обработване на другия детайл от джоба и цялостната му изработване. Изследването на връзките между обработването на отделните детайли, може да се улесни посредством графично изобразяване на технологичната последователност за изработване на отделните детайли от облеклото [4].

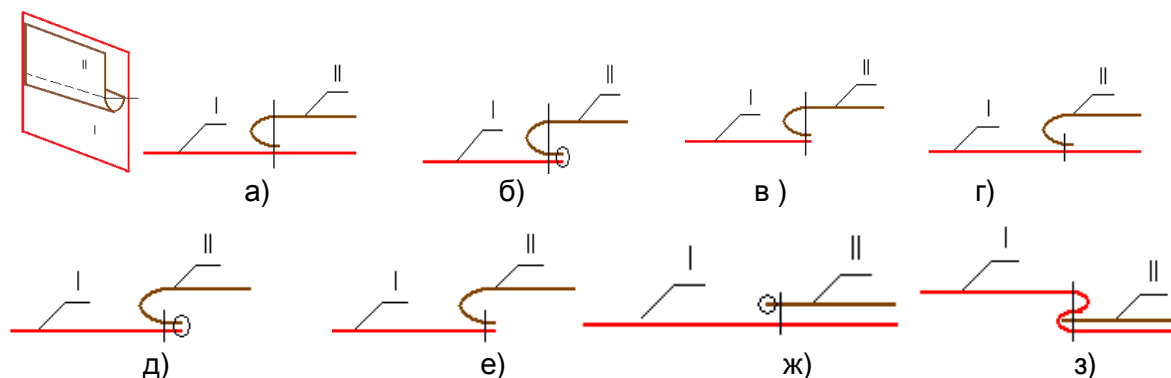
3. ОБРАБОТКА НА ДЕТАЙЛИТЕ НА ДЖОБА

В процеса на изработването на прорязан джоб с една филетка участват следните детайли: филетка, торба, насрещна мостра, подлепваща материал и изделие. Основните операции при изработване и съединяване на отделните детайли са представени в табл.1.

Операциите в технологичната последователност съединяващи отделните детайли са:

3.1. Съединяване на насрещната мостра с долната торба на джоба.

Насрещната мостра може да се прикачи към долната торба по следните технологични варианти показани графично на фигура 2.

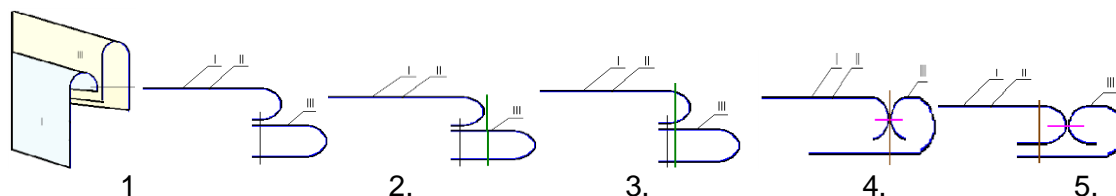


Фигура 2. Напречен разрез на прикачване на насрещна мостра с долната торба на джоба- I- торба на джоба, II-насрещна мостра

Изборът на определен вариант зависи от изделието, върху което се изработва, от предназначението на джоба. За изработване на прорязан джоб с една филетка като заден джоб на мъжки панталон може да се изберат от фигура 2 вариант а), ж) или г). Варианти в) и е) са подходящи за изработване върху горно облекло, което е с хастар, тъй като от структурната схема на фигура 2 се вижда, че резервите на детайлите не са общити. Възможни варианти са а), ж), г) и з), но при тях поради това, че долната торба достига до края на насрещната мостра става натрупване на текстилен материал, прилагането става в зависимост от дебелината на текстилния материал и по-преценка на технолога. Когато прорязан джоб с една филетка е предназначен за горно облекло без хастар, задължително се избират варианти, на които резервите са общити. Операцията обшиване на резервите се предвижда в технологията за изработване на изделието.

3.2. Варианти на прикачване на филетка с изделието

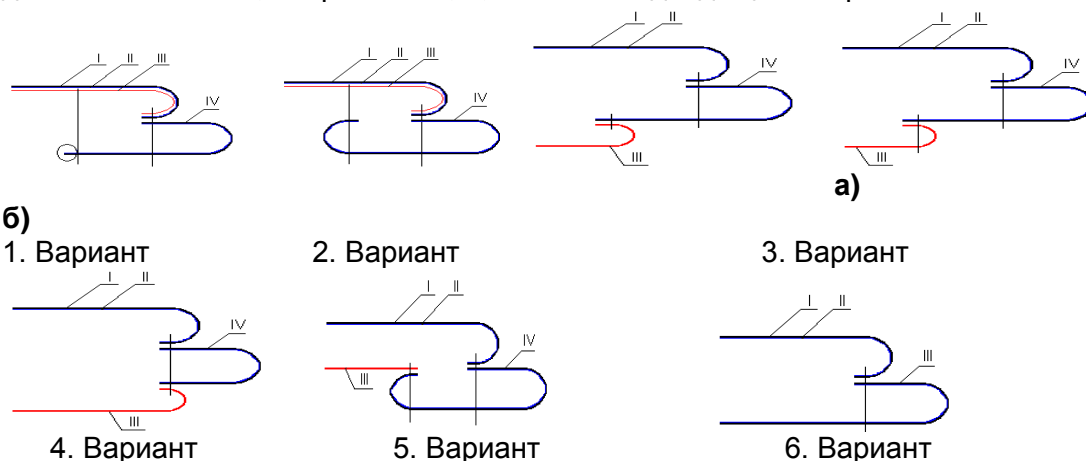
Филетката, изделието или мястото на отвора на джоба задължително се подлепват. Филетката може да се прикачи към изделието в затворено /вариант 1, 2, 3 / или в отворено положение /4 и 5 вариант/. При затворено положение положение на филетката, тя предварително се пречупва, като двата и края могат да бъдат изравнени или долния край да е по-дълъг, към който се зашива торбата с цел да не се натрупва текстилен материал по линията на прикачване. Изборът на вариант за изработване зависи от свойствата на текстилния материал, от вида на изделието, оборудването и т.н.



Фигура 3. Напречен разрез на прикачване на филетката с изделието I-изделие, II-подлепващо, III- филетка.

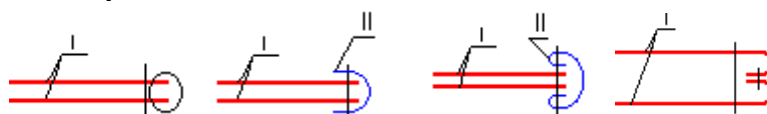
3.3. Варианти за зашиване филетка с горна торба

В зависимост от вида на изделието филетката може да бъде прикачена към изделието едновременно с горната торба фиг.5 вариант 1, 2 и 4 или самостоятелно – вариант 3 и 5. В някои случаи филетката може да изпълнява функцията на горна торба - вариант 6. Вариант 1 и 2 са подходящи при изработване на джоба за заден джоб на панталон, а варианти 3, 4, 5 и 6 са подходящи за горно облекло.



Фигура 4. Напречен разрез на прикачване на филетката с изделието- I-изделие, II-подлепващо, III- горна торба, IV- филетка.

3.4. Затваряне на торбата



Фигура 6. Напречен разрез на затваряне на торбата- I-торба, II-окантовачна лента.

4. ТЕХНОЛОГИЧНИ ВАРИАНТИ ЗА ИЗРАБОТКА НА ПРОРЯЗАН ДЖОБ С ЕДНА ФИЛЕТКА

Един от факторите определящ избора на вариант за изработване на прорязан джоб с една филетка е вида на изделието- горно или поясно.

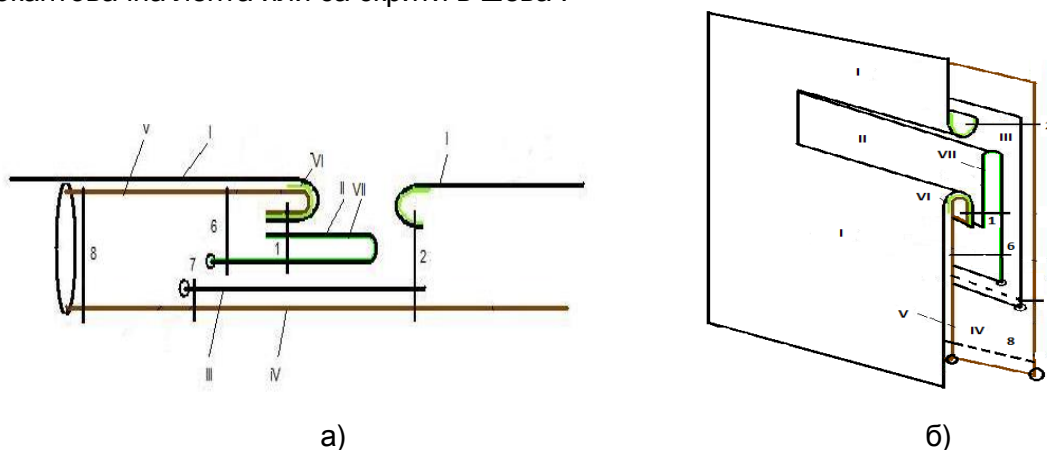
4.1. Изработване на прорязан джоб с една филетка като заден джоб на мъжки панталон

В случая могат да се изберат от фиг.2 следните варианти - а, г, ж; от фиг.3 вариант 1,2, 3; от фиг.4 вариант 1; от фиг.5 всички варианти.

Необходими изисквания при изработване на прорязан джоб, като заден джоб на мъжки панталон са:

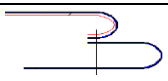

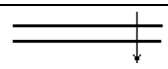



- За устойчивост по линията на отвора на джоба, се подлепва с подлепваща лента;
- Горната торба се поставя под основния детайл, филетката се поставя над основния детайл по съответните центрове и се изминава шев на филетката, основния детайл и горната торба (фиг.4 вариант 1, фиг.3 вариант 1);
- Долната торба трябва да е с дължина такава, че горния и край да достига до линията на талията на панталона. Тя се зашива заедно с колана и панталона (фиг.1 а);

- На джоба се зашива гайка или се изработва илик и зашива копче;
- Торбата се затваря и резервите на торбата се обшиват или се обработват с окантовачна лента или са скрити в шева .



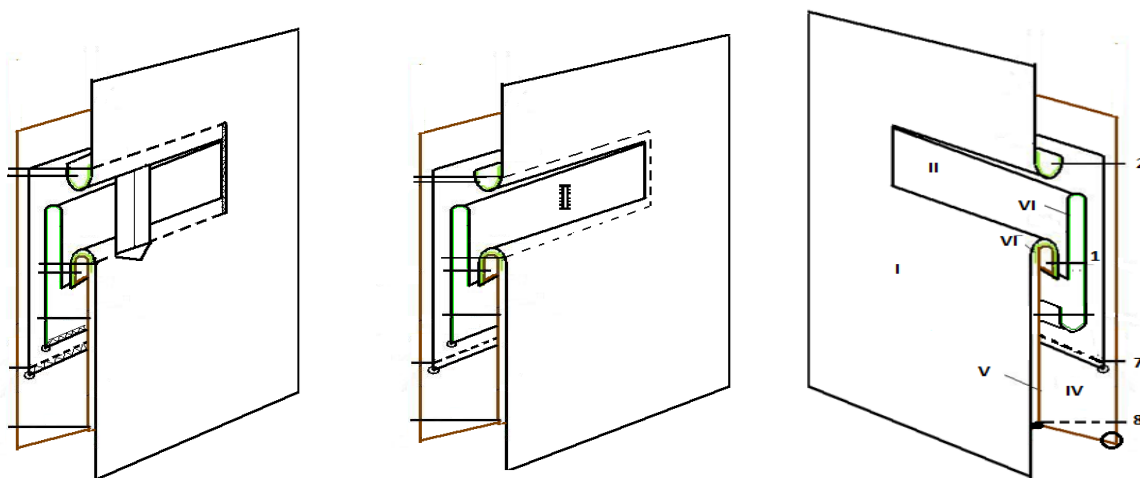
Фигура 5. Напречен разрез на прорязан джоб с една филетка подходящ за заден джоб на панталон – а) структурна схема и б) аксинометрия: I – задна част на панталона; II- филетка; III- насрещна мостра; IV-долна торба; V- горна торба; VI и VII – подлепваща лента.

Таблица1

№	Наименование на операцията	Символ шев	Тип бод	Вид на работ а
1	Изминаване на съединителен шев на филетката към основния детайл и горната торба фиг.3.2 вар.1		301	УМ
2	Изминаване на съединителен шев на насрещната мостра, горна торба и основния плат		301	УМ
3	Срязване на отвора на джоба			ръчно
4	Обръщане на филетката и насрещната мостра			ръчно
5	Затягане на ъглите в края на отвора		301	УМ
6	Изминаване на съединителен шев на филетката с горната торба фиг.3.3 вариант 1		301	УМ
7	Изминаване на съединителен шев на насрещната мостра с торбата на джоба-фиг3.1.вар. ж		301	УМ
8	Затваряне на торбата		301,401	СМ
9	Затягане на двата края на отвора		304	СМ

Изборът на вариант и технология за изработване на прорязан джоб се определя от наличната техника и оборудването в шевното производство. В представената технология таблица 1. се използва машина за двуконечен затворен бодов ред означена с УМ. С развитието на автоматизацията в шевното производство за изработването на прорязани джобове масово навлизат шевни автомати в конфекционното производство. С тях значително се подобрява качеството на изделията, увеличава се производителността на труда, увеличава се обема на произведената продукция, намаляват се разходите за производство [1], [4].

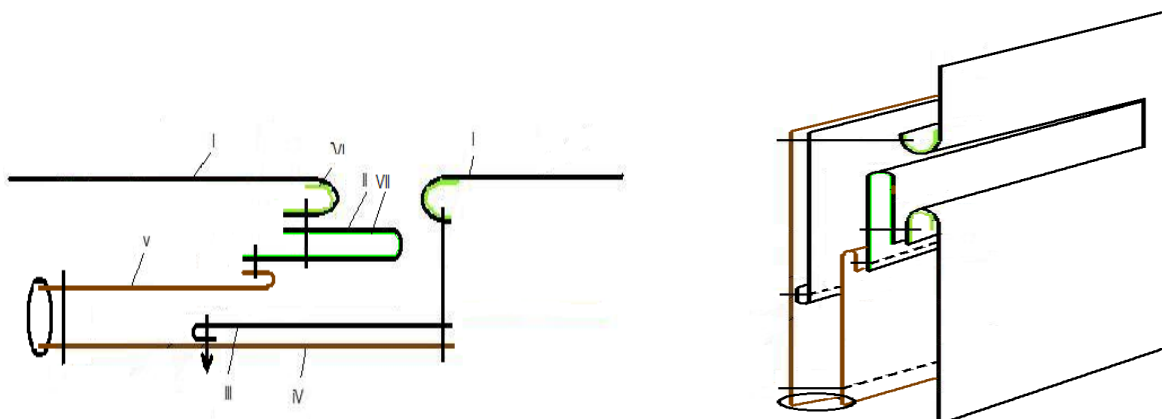
На фигура 7 са представени варианти на прорязан джоб с една филетка подходящи за заден джоб на мъжки панталон.



Фиг. 7. Напречен разрез на моделни варианти на прорязан джоб с една филетка подходящи за заден джоб на мъжки панталон

4.2. Изработване на прорязан джоб с една филетка за горно облекло

На фигура 8 е представен напречен разрез на моделен вариант на прорязан джоб с една филетка подходящ за горно облекло. Връзките между детайлите са избрани от горе посочените варианти, съобразно определящите фактори. На фигура 8 се вижда, че торбата е обшита, което означава, че избраното изделие е без хастар.



Фиг.8. Напречен разрез на моделен вариант на прорязан джоб с една филетка подходящ за горно облекло

5. ИЗВОДИ

1. Голямо е разнообразието на джобовете в облеклото, като вид, структура, модели, начин на изработване и др.

2. Редица са факторите определящи технологичното обработване на отделните детайли, тяхното съединяване и монтиране върху изделието.

3. Това определя необходимостта от задълбочено познаване на технологичните варианти и факторите от които зависят.

4. Познаването на различните варианти за изработване на джобовете дава възможност да се избере най- подходящия за съответното изделие .

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THE EFFECTS OF A CULTIVATION METHOD ON TOMATO YIELD *SOLANUM LYCOPERSICUM* L.

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Abstract: investigated the effect of different forms of training system the yield of tomatoes in greenhouses. The study involved the genetic forms of tomatoes with one, two and three trees. The influence of training system on the number of fruits per plant, fruit weight, fruit yield per plant and fruit yield per m². The highest average yield per plant was achieved by growing tomatoes in the three trees, planting a tree in the form given by the average large fruit, and the highest number of fruits per plant was obtained with the training system with three trees, and the lowest in the training system on a tree. When growing on a tree reaches maturity at the earliest, and larger fruits, and the growing maturation of the two trees is a little later, the fruits are slightly smaller, but higher total yield of tomatoes. Growth on three trees achieved the highest yield, but the fruit is considerably smaller, which reduces their market value.

Keywords: tomato, training system, fruit weight.

1. INTRODUCTION

In recent years tomato production has shown expanding tendencies, especially in protected areas where it occupies the largest surface in the production structure. Tomato production is mostly organised in facilities without supplemental heating and in two cycles (spring and autumn), while there is a rather small number of modern facilities with supplemental heating which allows one to organise production throughout the year [1]. Within production technology one of the major factors is the right choice of hybrids and of cultivation methods if one wishes to develop a desired product with all the characteristics aspired to such as yield, fruit uniformity, maturation dynamics, tolerance and resistance, fruit shape and diameter, transportability, storage potential, etc [2].

In order for tomato to normally grow and produce a high yield one needs to resort to the appropriate planting density. Too dense a plant arrangement causes the plants to mutually overshadow each other, which interrupts photosynthesis in their leaves. Densely arranged plants fail to absorb water or elements of mineral nutrition in a proper manner, which further impedes photosynthesis. On the other hand, tomatoes should not be planted in too sparse a manner either, because in that event there remains ample of unused space between the plants which renders the greenhouse exploitation rather costly [3].

The aim of this paper was to determine the effects of a cultivation method on the yield of tomatoes produced in a greenhouse.

2. THE MATERIAL AND METHOD OF WORK

The experiment was conducted in the village of Podina, in the vicinity of the town of Prokuplje. The authors observed effects of various production methods on tomato yield in a protected environment. The experimental research lasted for a whole season (from January

to July, 2017). The used hybrid, Melody F1, originates from the Netherlands, and it is a selection of the *Seminis* seed company. It is an early hybrid of large fruits and high growth (indeterminant type). The plant exhibits a powerful and fast growth with short internodes, the fruits weigh between 200 g and 250 g, and they are characterised by a good taste, colour and balance. The hybrid possesses high tolerance to low temperatures and it is adaptable to various conditions and methods of production. It is resistant to ToMV, V, F1, F2, N.

Replanting was managed on March 14th. The space between rows was consistently 120 cm, while the space within the rows was 33 cm. Thus, we have obtained the plant density of 2,9 plants per m². We have resorted to the usual agriculture standards. Fertilisation was performed by means of NPK 16:16:16 formula, while feeding was performed through the irrigation system with KSC, 300 g per are and through foliar feeding by using Murtonik 10g/m². The plants were placed against the support (a rope). The tomato blossomed on April 3rd when it also was fertilised. Fertilisation was performed by means of a chemical substance Ortomone. The first inflorescence appeared after 8 to 10 leaves. The crop was cultivated up to 5 blossomed trusses, when apical buds were pruned. The harvest began on May 19th. There were 15 harvests with four to five days between each harvest. The last harvest was on July 10th.

The authors observed 10 tomato stems of the same space but of different cultivation method with one, two or three stems. On tomato plants grown with one stem every side shoot was removed. On tomato plants grown with two stems only the first side shoot was left under the first inflorescence. On tomato plants grown with three stems only the first side shoot was left as a third stem above the first inflorescence. All hybrids were grown on the main stem, by applying an espalier system of breeding.

3. RESEARCH RESULTS AND DISCUSSION

Fruit weight is an important yield component and it is genetically conditioned. Likewise, fruit weight determines the purpose of the variety, whereby varieties with small fruits are suitable for industrial processing, while varieties with large fruits are intended for fresh consumption. The effects of applied production technology on the fruit size are considerable, since proper mineral nutrition increases fruit weight in most varieties and hybrids [4].

The highest tomato yield of 4.7 kg was produced with three-stem cultivation during the ninth harvest, and the lowest of 0.8 kg with one-stem cultivation during the last harvest. The highest total yield of 48.1 kg was produced with three-stem cultivation, while the lowest total yield of 39.9 kg was produced with one-stem cultivation. During the fifteen aforementioned harvests the lowest average yield was 2.66 kg with one-stem cultivation, and the highest was 3.21 kg with three-stem cultivation (Table 1).

Research results show significant differences between the examined hybrids with respect to fruit weight (Table 2). The number of fruits per plant ranged from 16 to 45. These results are in accordance with the Beneton results, where average number of fruits per plant was 31.4 [5].

Table 1. The yield of tomatoes in various forms of breeding in kg

Number of harvest	On a tree	The two trees	The three trees
1.	1.9	1.5	1.3
2.	2.3	1.9	1.8
3.	2.9	2.5	2.3
4.	3.0	3.1	3.0
5.	3.2	3.5	3.3
6.	3.6	3.8	4.0

7.		3.6	4.1	4,3
8.		4.1	4.6	4.6
9.		4.0	4.2	4.7
10.		3.8	4.1	4.4
11.		2.9	3.5	4.2
12.		1.8	3.0	3.6
13.		1.1	2.1	3.1
14.		0.9	1.2	2.1
15.		0.8	1.1	1.4
Average		2.66	2.95	3.21
The total yield		39.9	44.2	48.1
LSD	0.05	0.42		
	0.01	0.53		
Cv		4.21		

The fruit weight was in the range between 0.120 kg for tomatoes with three stems and 0.200 kg for tomatoes with one stem. Similar results for this tomato property were obtained by various researchers [5], [6].

Table 2. The average yield depending on the training system

Breeding form	Number of fruits per plant	The average number of fruits per plant	The average fruit weight in kg	Average fruit yield per plant in kg
on a tree	16-24	20	0.200	4.0
the two trees	30-40	35	0.130	4.6
the three trees	35-45	40	0.120	4.8

The average yield per plant was in the range between 4 kg for tomatoes with one stem, 4.4 kg for tomatoes with two stems and 4.8 kg for tomatoes with three stems (Table 3). Bjelić and Moravčević [3] point to a somewhat lower yield of fruits per plant which were in the range between 3.13 and 3.31kg.

Table 3. The yield of tomatoes per square meter greenhouse, and depending on the training system

Breeding form	Average yield in kg per plant	Average yield in kg/m ² (2.9 plants)	Average yield per greenhouse (1175 plants) in kg
on a tree	4.0	11.6	4700
the two trees	4.6	12.8	5405
the three trees	4.8	13.9	5640

The tomato yield depended to a large extent on the method of cultivation. After translating the produced yield to a surface of 1 m² with a set of 2.9 plants we have obtained the lowest average yield of 11.6 kg for tomatoes with one stem, and the highest average yield of 13.9 kg

for tomatoes with three stems. These results are in accordance with the research by Tudžarov when the registered yield was 10.73 kg/m² [7].

4. CONCLUSION

On the basis of results obtained in the conducted research studies one can assert that the highest average yield per plant was obtained from tomatoes with three stems, while tomatoes with one stem produced the biggest average fruit. The largest number of fruits per plant was obtained from tomatoes with three stems, and the smallest from tomatoes with one stem. When cultivating tomatoes with one stem one obtains the earliest maturation and big fruits, while when cultivating tomatoes with two stems maturation comes somewhat later, fruits are a bit smaller, but the total yield is higher. By cultivating tomatoes with three stems one obtains the largest yield, but fruits are significantly smaller which decreases their market value.

Bearing in mind that the market value of tomato is determined by the appearance and size of fruit, it is necessary to grow the hybrid Melodia F1 in greenhouse conditions with two stems, because the difference in yield in comparison with a three-stem growth can be compensated by a bigger price of larger fruits.

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SPECTROPHOTOMETRIC DETERMINATION OF COPPER COMPLEXES OF CHLOROPHYLLINS (E141II)

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Abstract: In this study, the water-soluble green food colorant copper complexes of chlorophyllins, E141ii, as one of the most popular within the food industry was investigated. First, the spectroscopic parameters, absorbance maximum, $\lambda_{max-vis}$, and molar absorptivities, ϵ , of E141ii dye were determined. The impact of the presence of aspartame, citric acid and vitamin C on the change in the positions of the absorbance maximum and change of its intensity in the visible range of the E141ii spectra also was investigated. Recorded absorption spectra was show that this dye had two absorbance maxima. The average molar absorptivities were calculated. These values of molar absorptivities were later used to quantify the unknown dye concentration in the analyzed food samples. It was found that the use of additives (vitamin C, citric acid and aspartame) does not cause a change in the positions of the absorbance maximum and change of its intensity in the visible range of the E141ii spectra. Therefore, it can be concluded that it is possible to quantify the E141ii by UV-Vis spectrophotometric method in the presence of these additives. Based on determined spectroscopic parameters, the dye concentration was calculated in green rubber candy colored with E141ii.

Keywords: food colorant, food additives, copper complexes of chlorophyllins, E141ii, spectrophotometry.

1. INTRODUCTION

The consumers' concern about the safety of artificial food colorants, reinforced by the possible health benefits of natural pigments, have induced the food industry to withdraw artificial colorants [1]. Recently, chlorophylls and their derivatives have been shown to exert antimutagenic and anticarcinogenic activity. [2]. European current legislation (Regulation (EC) No 1333/2008 and its amendments) has allowed the use of two natural green colorants, E140 and E141, which are structurally related with the chlorophylls. The E140 is rather unstable, and the color is prone to experience a drastic change from green to brown. Therefore, the food industry favors the use of the colorant E141, which results from the addition of copper to the corresponding lipid or water-soluble chlorophyll solutions. E141 is mainly composed of copper complexes of chlorophyll derivatives, with E141i (or copper chlorophylls) being the lipid-soluble option and E141ii (copper chlorophyllins) the water-soluble alternative [1].

Among the green food colorants, E-141ii is the most used in food technologies due to its hydrophilic character and its high green color stability [4]. In this paper the impact of the

presence of aspartame, citric acid and vitamin C on the changes in the positions of the absorbance maximum and change of its intensity in the visible range of E141ii spectra was investigated. These results enabled us to evaluate the possibility of using UV-Vis spectrophotometric method for easily identifying and quantifying E141ii present in a wide variety of foodstuffs in the presence of additives.

2. EXPERIMENTAL

2.1. Material

The copper complexes of chlorophyllins, E141ii, vitamin C (E300), citric acid (E330) and aspartame (E951) used as standards for the quantitative analysis were from Tovarna arom in etericnih olj (Celje, Slovenia).

2.2. Method

Preparation of the standard solution of copper complexes of chlorophyllins and additives: A sample of E141ii was used as a standard for quantitative analysis. The standard solution of E141ii was prepared by the dissolution of dry, pure substance in the distilled water. By diluting the standard solution, a series of solutions with different concentrations were prepared. The absorption spectra of the series of solutions were recorded in the range 190-900 nm using a UV-Vis spectrophotometer (Perkin Elmer Lambda 15 UV/VIS, Waltham, Massachusetts, USA).

The influence of vitamin C as an additive on the changes in the positions of the absorbance maximum and change of its intensity in the visible range of the E141ii spectra ($\lambda_{\max\text{-vis}}$) was investigated. The series of solutions were made by the dissolution of dry, pure substance in the distilled water. The solutions had the constant concentration of E141ii and different concentrations of vitamin C. Solution containing the only E141ii (the same concentration) without vitamin C was used as the control solution. The absorption spectra of prepared solutions were recorded (190-900 nm) and absorbance at 405 nm and 630 nm were measured (immediately after solutions preparations) using a UV-Vis spectrophotometer.

The influence of citric acid, as an additive on the changes in the positions of the absorbance maximum and change of its intensity in the visible range of the E141ii spectra ($\lambda_{\max\text{-vis}}$) was also investigated. The series of solutions was made by the dissolution of dry, pure substance in the distilled water. The solutions had the constant concentration of E141ii and different concentrations of citric acid. Solution containing the only E141ii (the same concentration) without citric acid was used as the control solution. The absorption spectra of prepared solutions were recorded (190-900 nm) and absorbance at 405 nm and 630 nm were measured (immediately after solutions preparations) using a UV-Vis spectrophotometer.

The influence of aspartame, as an additive on the changes in the positions of the absorbance maximum and a change of its intensity in the visible range of the E141ii spectra ($\lambda_{\max\text{-vis}}$) was also investigated. The series of solutions were made. The solutions had the constant concentration of E141ii and different concentrations of aspartame. Solution containing the only E141ii (the same concentration) without aspartame was used as the control solution. The absorption spectra of prepared solutions were recorded (190-900 nm) and absorbance at 405 nm and 630 nm were measured (immediately after solutions preparations) using a UV-visible spectrophotometer (Perkin Elmer Lambda 15 UV/VIS, Waltham, Massachusetts, USA).

Preparation of the sample of green gummy candies: A sample of green gummy candies was measured on the analytical scale. Candies is crushed and dissolved with water. The resulting solution was filtered through a filter paper on Bihner's funnel. The filtrate was

quantitatively transferred to a normal vessel and diluted. The absorption spectra and the measurement of absorbance are measured at two wavelengths, at 405 nm and 630 nm.

3. RESULTS

Recorded absorption spectra of E141ii shows that this dye had two absorbance maxima at 405 and 630 nm, which is in accordance to literature spectroscopic data. The absorption maximum at of 405 nm had a significantly higher intensity compared to the absorption maximum at a 630 nm. In order to examine whether both absorption maximums can be used for the quantitative determination of color content with sufficient accuracy, the determination of the molar absorption coefficient for both absorption of the maximum was performed. The average molar absorptivity of E141ii, ϵ , at 405 nm was $790.28 \pm 90.57 \text{ dm}^3/\text{mol}\cdot\text{cm}$ (Table 1) while at 630 nm was $256.14 \pm 16.63 \text{ dm}^3/\text{mol}\cdot\text{cm}$ (Table 2). These values of molar absorptivities were later used to quantify the unknown dye concentration in the analyzed food samples.

Absorbencies of series of solutions with the constant concentration of E141ii and different concentrations of vitamin C, citric acid and aspartame, respectively as well as control solution which contains only E141ii without additives were measured at 405 and 630 nm and represented in Table 3-5.

From Table 3 it can be concluded that vitamin C as an additive neither affect the change of intensity of absorbance maximum at 405 nm nor at 630 nm, nor the change of their position.

Measurements of absorbances of series solutions containing the constant concentration of E141ii dye and different concentrations of citric acid, as well as control solution contained only dye the same concentration without citric acid show that absorbances of these solutions are almost equal on both measured wavelengths (405 nm and 630 nm) (Table 4).

Measurements of absorbances of series of solutions containing the constant concentration of E141ii dye and different concentrations of aspartame at 405 nm and 630 nm revealed that absorbances of these solutions are almost equal (Table 5).

Table 1. Molar absorptivities of E141ii dye and corresponding statistical parameters at 405 nm: average value ($\epsilon_{\text{average}}$), median (ϵ_{median}), range of variation (ϵ_R), mean deviation (ϵ_D) and standard deviation (ϵ_{SD})

E141ii						
No	V_{dye} [cm ³]	$A_{\lambda=405\text{nm}}$	C [g/dm ³]	$C \cdot 10^{-4}$ [mol/dm ³]	$\epsilon_{\lambda=405\text{nm}}$ [dm ³ /mol·cm]	
1	13.40	0.965	0.075	1.16	832.72	
2	17.90	1.388	0.100	1.55	898.30	
3	22.40	1.582	0.125	1.93	819.08	
4	26.90	1.705	0.150	2.32	735.64	
5	31.30	1.800	0.175	2.70	665.68	
Statistical parameters						
Dye	$\epsilon_{\text{average}}$	ϵ_{median}	ϵ_R	ϵ_D	ϵ_{SD}	ϵ_D
E141ii	[dm ³ /mol·cm]					
$\lambda = 405 \text{ nm}$	790.28	819.08	232.62	71.70	90.57	790.28±90.57

Table 2. Molar absorptivities of E141ii dye and corresponding statistical parameters at 630 nm: average value ($\epsilon_{\text{average}}$), median (ϵ_{median}), range of variation (ϵ_R), mean deviation (ϵ_D) and standard deviation (ϵ_{SD})

E141ii					
No	V_{dye} [cm ³]	$A_{\lambda=630\text{nm}}$	C [g/dm ³]	$C \cdot 10^{-4}$ [mol/dm ³]	$\epsilon_{\lambda=630\text{nm}}$ [dm ³ /mol·cm]
1	13.40	0.265	0.075	1.16	228.67
2	17.90	0.420	0.100	1.55	271.82

3	22.40	0.503	0.125	1.93	260.43
4	26.90	0.615	0.150	2.32	265.35
5	31.30	0.688	0.175	2.70	254.44
<i>Statistical parameters</i>					
Dye	$\epsilon_{average}$	ϵ_{median}	ϵ_R	ϵ_D	ϵ_{SD}
E141ii	[dm ³ /mol·cm]				
$\lambda = 630 \text{ nm}$	256.14	260.43	43.15	11.67	16.63
	256.14±16.63				

Table 3. Absorbances of the series of solutions containing constant concentration of E141ii dye and different concentrations of vitamin C, as well as control solution which contains only E141ii dye without vitamin C measured at 405 nm and 630 nm

E141ii and vitamin C							
No.	V_{dye} [cm ³]	C_{dye} [g/dm ³]	$V_{vitamin\ C}$ [cm ³]	$C_{vitamin\ C} \cdot 10^{-2}$ [g/dm ³]	$C_{vitamin\ C} \cdot 10^{-4}$ [mol/dm ³]	$A_{\lambda=405nm}$	$A_{\lambda=630nm}$
1	17.90	0.100	5.00	0.75	0.43	1.295	0.386
2	17.90	0.100	10.00	1.50	0.85	1.278	0.380
3	17.90	0.100	15.00	2.25	1.28	1.284	0.381
4	17.90	0.100	0.00	0.00	0.00	1.316	0.384

Table 4. Absorbances of the series of solutions containing constant concentration of E141ii dye and different concentrations of citric acid, as well as control solution which contains only E141ii dye without citric acid measured at 405 nm and 630 nm

E141ii and citric acid							
No.	V_{dye} [cm ³]	C_{dye} [g/dm ³]	$V_{citric\ acid}$ [cm ³]	$C_{citric\ acid} \cdot 10^{-2}$ [g/dm ³]	$C_{citric\ acid} \cdot 10^{-4}$ [mol/dm ³]	$A_{\lambda=405nm}$	$A_{\lambda=630nm}$
1	17.90	0.100	5.00	3.13	1.63	1.317	0.403
2	17.90	0.100	10.00	6.26	3.26	1.338	0.415
3	17.90	0.100	15.00	9.39	4.86	1.324	0.421
4	17.90	0.100	0.00	0.00	0.00	1.325	0.405

Table 5. Absorbances of the series of solutions containing constant concentration of E141ii dye and different concentrations of aspartame, as well as control solution which contains only E141ii dye without aspartame measured at 405 nm and 630 nm

E141ii and aspartame							
No.	V_{dye} [cm ³]	C_{dye} [g/dm ³]	$V_{aspartame}$ [cm ³]	$C_{aspartame} \cdot 10^{-2}$ [g/dm ³]	$C_{aspartame} \cdot 10^{-4}$ [mol/dm ³]	$A_{\lambda=405nm}$	$A_{\lambda=630nm}$
1	17.90	0.100	5.00	3.04	1.03	1.327	0.403
2	17.90	0.100	10.00	6.09	2.07	1.335	0.411
3	17.90	0.100	15.00	9.13	3.10	1.329	0.400
4	17.90	0.100	0.00	0.00	0.00	1.343	0.405

The analyzed sample was green rubber candies dyed with E141ii and which among other additives contain citric acid.

The values of E141ii color concentration in the analyzed sample of green gummy candies, calculated on the basis of the molar absorption coefficient value at a wavelength of 405 nm where the color E141ii has the first absorption maximum is shown in Table 6. From the table it can be seen that the average color concentration E141ii in the test a sample of gummy candies, calculated on the basis of the molar absorption coefficient value at a wavelength of 405 nm, was $2.0941 \pm 0.1007 \text{ g/kg}$.

Table 6. Absorbances and concentrations of E141ii dye in analyzed sample, green gummy candies and corresponding statistical parameters at 405 nm: average value ($C_{average}$), median (C_{median}), range of variation (C_R), mean deviation (C_D) and standard deviation (C_{SD})

E141ii						
No	$V_{\text{dye}} [\text{cm}^3]$	$A_{\lambda=405\text{nm}}$	$C [\text{g}/\text{dm}^3]$	$C \cdot 10^{-4} [\text{mol}/\text{dm}^3]$	g_{dye}/kg	
1	5.00	0.519	0.8501	1.31	2.21	
2	10.00	1.003	0.8214	1.27	2.14	
3	15.00	1.414	0.7720	1.19	2.01	
4	20.00	1.885	0.7718	1.19	2.01	
Statistical parameters						
Dye	C_{average}	C_{median}	C_R	C_D	C_{SD}	C_D
E141ii	$[g_{\text{dye}}/\text{kg}]$					
$\lambda = 405 \text{ nm}$	2.0941	2.0756	0.2038	0.0831	0.1007	2.0941±0.1007

The color concentration values E E141ii in the analyzed sample of green gummy candies, calculated on the basis of the molar absorption coefficient value at a wavelength of 630 nm, in which the color E141ii has the second absorption maximum, are shown in Table 7. From the table it can be seen that the average color concentration E141ii in samples of gummy candies calculated on the basis of the molar absorption coefficient at a wavelength of 630 nm, was $2.2186 \pm 0.0226 \text{ g/kg}$.

Table 7. Absorbances and concentrations of E141ii dye in analyzed sample, green gummy candies and corresponding statistical parameters at 630 nm: average value (C_{average}), median (C_{median}), range of variation (C_R), mean deviation (C_D) and standard deviation (C_{SD})

E141ii						
No	$V_{\text{dye}} [\text{cm}^3]$	$A_{\lambda=630\text{nm}}$	$C [\text{g}/\text{dm}^3]$	$C \cdot 10^{-3} [\text{mol}/\text{dm}^3]$	g_{dye}/kg	
1	5.00	0.171	0.8641	1.34	2.25	
2	10.00	0.335	0.8464	1.31	2.21	
3	15.00	0.505	0.8507	1.31	2.22	
4	20.00	0.669	0.8452	1.31	2.20	
Statistical parameters						
Dye	C_{average}	C_{median}	C_R	C_D	C_{SD}	C_D
E141ii	$[g_{\text{dye}}/\text{kg}]$					
$\lambda = 630 \text{ nm}$	2.2186	2.2107	0.0494	0.0163	0.0226	2.2186±0.0226

FT IR spectra of the E141ii dye is shown at Figure 2.

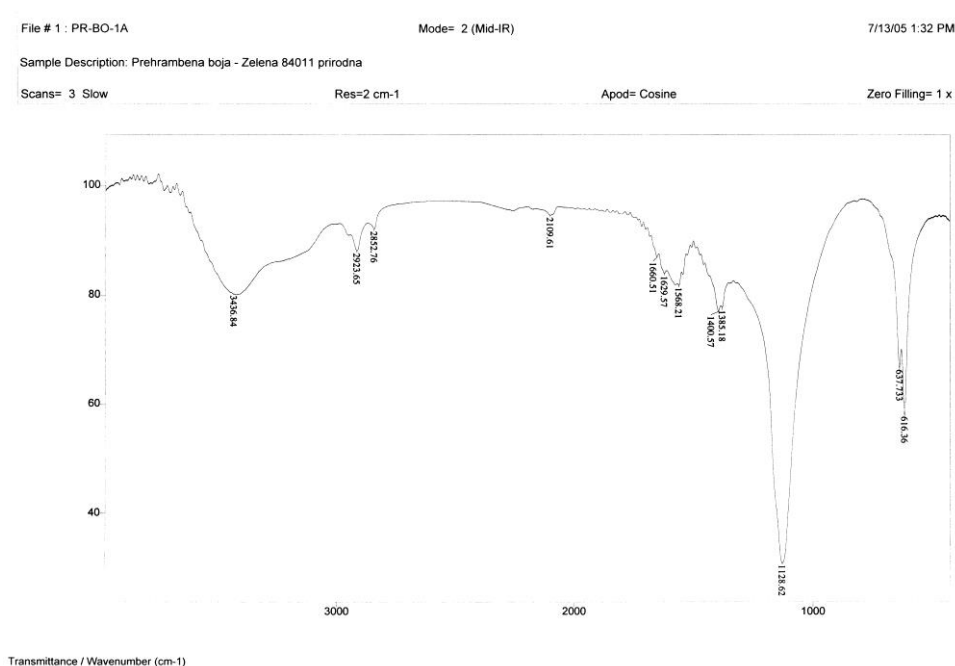


Figure 2. FT IR specter of the E141ii dye

Recorded FT IR spectra can be used for qualitative determination of the presence of E141ii in different food samples.

4. CONCLUSIONS

The recorded absorption specter of natural green color E141ii, showed that this color has two absorption peaks at 405 nm and at 630 nm. The values of the molar absorption coefficients were $790.28 \pm 90.57 \text{ dm}^3/\text{mol} \cdot \text{cm}$ at 405 nm and $256.14 \pm 16.63 \text{ dm}^3/\text{mol} \cdot \text{cm}$ at 630 nm. The use of additives (vitamin C, citric acid and aspartame) does not cause a change in the positions of the absorbance maximum and change of its intensity in the visible range of the E141ii dye spectra. Therefore, it can be concluded that it is possible to quantify the E141ii by UV-Vis spectrophotometric methods in the presence of these additives. The color concentration E141ii in the analyzed sample of green gummy candies, determined based on the molar absorption coefficient value at 405 nm, was $2.0941 \pm 0.1007 \text{ g/kg}$. The color concentration E141ii in the same sample, determined based on the molar absorption coefficient value at 630 nm, was $2.2186 \pm 0.0226 \text{ g/kg}$. The obtained concentration values differed indistinctly, with more precise results giving a measurement of absorbance at a wavelength of 405 nm, at which the values of the molar absorption coefficient were greater.

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ADSORPTION OF MALACHITE GREEN DYE ON CLAY AND MODIFIED CLAY

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Abstract: The goal of this study was to investigate the possibility of using natural materials based on clay and polysaccharides of carboxymethylcellulose as adsorbents for removing the textile dye malachite green from its solution. In this article, adsorption of dye on native clay and modified clay containing 3% carboxymethylcellulose was compared. The experimental results of dye adsorption with native and modified clay were interpreted using theoretical models of adsorption isotherms. The best match of the experimental results for native clay was achieved with the Langmuir model, and a slightly lower degree of correlation existed for the Freundlich's model. A good matching with the Langmuir's model indicates monolayer dye adsorption as well as certain energy homogeneity of the surface. After modification of the clay with carboxymethylcellulose, a better matching with the Freundlich's model was observed. This indicated that, as a consequence of the application of carboxymethylcellulose, the surface of the clay was changed in chemical and energy terms. The native clay had a lower adsorption capacity compared to clay modified with carboxymethylcellulose. The use of modified clay to remove the dye of malachite green was advisable in very concentrated solutions, because it showed obvious advantages compared to native clay.

Keywords: dye, malachite green, clay, carboxymethylcellulose, adsorption.

1. INTRODUCTION

Discharge dyes industries (paper, textile, printing, etc.) during their production/manufacturing processes impart colour to aquatic life in rivers and lakes and affect its aesthetic value. This has motivated studies in the last decade towards the development of new processes for the removal of coloured and organic pollutants from the industrial effluents [1]. Extensive investigations are being carried out annually to identify alternative (and low cost) absorbents able to remove the dye colours [2]. There is growing interest in construction of adsorbents based on environmentally friendly biodegradable materials of natural origin [3].

Malachite green (Basic Green 4, C.I. 42000; C₂₃H₂₅ClN₂) classified as a basic dye, is extensively used in many industrial applications [4]. The chemical structure of malachite green is shown in Figure 1.

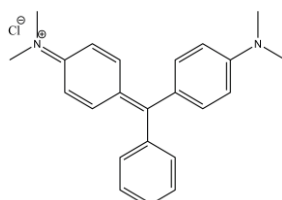


Figure 1. Chemical structure of malachite green [4]

Various technologies have been developed for water decontamination. Among all possible techniques, adsorption is one of the most attractive methods due to its high efficiency, simple and safe treating processes, and low cost, flexibility and simplicity and the high-quality of the treated effluents.

The goal of this study was to investigate the possibility of using natural materials based on clay and polysaccharides of carboxymethylcellulose as adsorbents for removing the malachite green textile dye from its solution. In this article, adsorption of dye on native clay and modified clay containing 3% carboxymethylcellulose was compared. Obtained data provides useful information to environmental scientists/engineers for designing effective and low cost wastewater treatment.

2. METHODS

2.1. Materials

The clay was from Riznica Prirode, Serbia. The malachite green (*N,N,N',N'*-Tetramethyl-4,4'-diaminotriphenylcarbenium chloride, Chemical formula: $C_{23}H_{25}ClN_2$; Molecular weight = $364.91 \text{ g mol}^{-1}$; $\lambda_{\max} = 618 \text{ nm}$; CAS Number: 569-64-2) used in the present study is a monovalent cationic dye and is classified as C.I. Basic green 4. It was purchased from Sigma-Aldrich Chemie GmbH (Steinheim, Germany) and was used without any further purification. Sodium salt of carboxymethylcellulose and potassium bromide (FT-IR grade, $\geq 99\%$ trace metals basis) were obtained from Sigma-Aldrich Chemie GmbH (Steinheim, Germany). Hydrochloric acid was purchased from Zorka (Šabac, Serbia).

2.2. Preparation of modified clay

The modified clay was prepared as follows: a powder of clay (15 g) was gradually dispersed into 300 mL of deionized water using a magnetic stirrer, for 1 h. Then, 3% (0.45 g) of carboxymethylcellulose was added to the dispersion. The resulting mixture was stirred on magnetic stirrer with heating at $90 \text{ }^\circ\text{C}$ and adds 5 ml of concentrated HCl. The prepared dispersion was left overnight. Then filtered through the Bihner funnel, and was washed with a large amount of deionized water in order to remove residual HCl. The modified clay was dried a 7 hours in drying pan (Trade Raura, Spain) and was ground into powder using agate mortar. Prior to the addition of carboxymethylcellulose, the pH value was 9.2 ± 0.1 . After the addition of carboxymethyl cellulose and HCl, the pH value was 1.35 ± 0.1 . The pH was measured using a pH meter InoLab pH 7110 (Xylem Analytics, WTW, Weilheim Germany).

2.3. Recording FT-IR spectra

FT-IR study was carried out using a using a Bomem MB-100 (Hartmann & Braun, Canada) instrument. FT-IR spectra were recorded in the range of $400\text{--}4000 \text{ cm}^{-1}$, at a resolution of 2 cm^{-1} , with KBr pellets technique. The samples of carboxymethylcellulose, native clay and clay modified with carboxymethylcellulose were dried and mixed with potassium bromide, grounded and pressed to form pellets (with a ratio of KBr/dried bead powder equal to 1–2% by mass). The FT-IR spectroscopy was acquired to detect the changes in the structure of clay.

2.4. Adsorption studies

A Stock solution (3 g/L) was prepared by dissolving into brown flasks the appropriate amount of malachite green in deionized water. Preparation was performed at room temperature (20 ± 2 °C). All experimental solutions were obtained by successive dilutions in deionized water at room temperature (20 ± 2 °C) and were stored at 4 °C in the dark to prevent any dye photodegradation. Using the spectrophotometer, the absorbance of the obtained solution series was measured at 618 nm.

The solution concentrations that were used for the examination of dye absorption were 50, 100, 200, 300 i 500 mg/L. An amount (0.1 g) of adsorbent (clay or clay modified with carboxymethylcellulose) was dispersed in 50 mL of malachite green aqueous solutions, different initial concentration (50, 100, 200, 300 i 500 mg/L). To determine the equilibrium state, samples at various time intervals (from 0 to 24 h) were extracted from the beaker. The dispersions were then transferred to the cuvettes and the solid phase was separated by centrifugation at 2800 rpm (Tehtnica Železniki LC-321, Slovenija) for 7 minutes. The malachite green concentrations were determined using UV–Vis spectrophotometer at $\lambda = 618$ nm.

2.5. Adsorption isotherms

Malachite green was removed on examined adsorbents. The amount of malachite green adsorbed was derived from initial and final concentrations of malachite green in the liquid phases. All experiments were run in triplicate to ensure reproducibility. The malachite green uptake by adsorbents was calculated by the Freundlich's and Langmuir's equations.

The adsorption isotherm is a key to describing the relationship between adsorbate and adsorption. Freundlich's isotherm is an empirical model that assumes adsorption on heterogeneous surfaces with diverse affinities; it is based on the fact that the stronger binding sites are occupied first and moreover that binding strength decreases as the degree of site occupation increases, according to the equation (1) [4,5]:

$$q_e = K_F C_e^{1/n} \quad (1)$$

The constant K_F ($\text{mg}^{1-1/n} \text{L}^{1/n} \text{g}^{-1}$) is the Freundlich's adsorption coefficient, while $1/n$ is the exponential coefficient correlated with adsorption intensity.

The Langmuir's isotherm is applicable to homogeneous adsorption surface, where adsorption of each adsorbate molecule onto the surface has equal adsorption activation energy. The Langmuir's model explains the monolayer adsorption process [5]. Langmuir's isotherm is given by equation 2:

$$q_e = q_{\max} K_L C_e / (1 + K_L q_{\max}) \quad (2)$$

where q_e (mg/g) and C_e (mg/L), are respectively, the dye concentration adsorbed and in solution, q_{\max} (mg/g), K_L (mg^{-1}) are the Langmuir's constants related to the sorption capacity and energy, respectively [5,6].

The adsorption degree depends on the phase contact time. For the examined system, the time required for reaching equilibrium absorption was 3 hours.

3. RESULTS AND DISCUSSION

3.1. FT-IR analysis

The FT-IR spectra of native clay, clay modified with carboxymethylcellulose and carboxymethylcellulose are shown on Figure 2-4. The broad peak at 3430 cm^{-1} is due to stretching vibration of -OH bond [5]. The two bands at 1038 cm^{-1} and 520 cm^{-1} in native clay and modified clay (Figure 2 and 3) have been attributed to the stretching and bending vibrations of the SiO , SiO-Al in the montmorillonite structure, respectively as previously reported [4,5]. In the modified clay spectra, the peaks at 2974 cm^{-1} and 2924 cm^{-1} were observed, resulting from C-H vibrations and the presence of carboxymethylcellulose.

The FT-IR specter of carboxymethylcellulose is shown in Figure 4. The bands at 1420 cm^{-1} is due carboxyl vibrations (COH bending) [3]. The peaks at 2924 cm^{-1} was assigned to CH_2 antisymmetric stretching vibration bands [3].

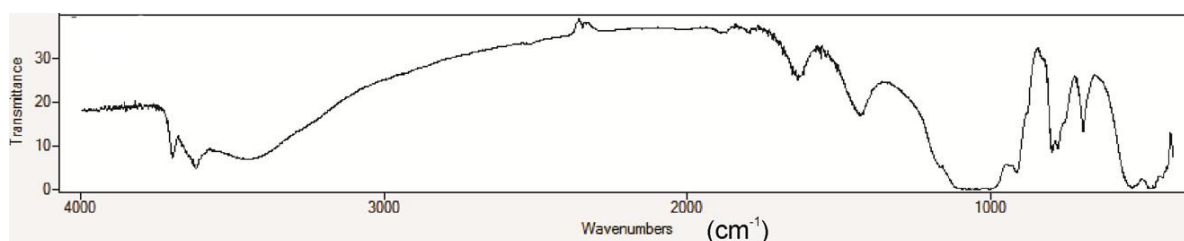


Figure 2. FT-IR specter of native clay

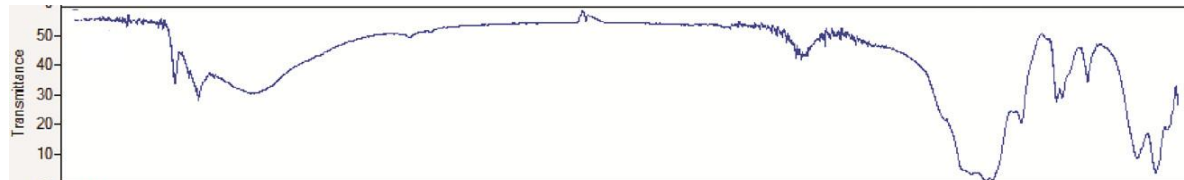


Figure 3. FT-IR specter of clay modified with 3% carboxymethylcellulose

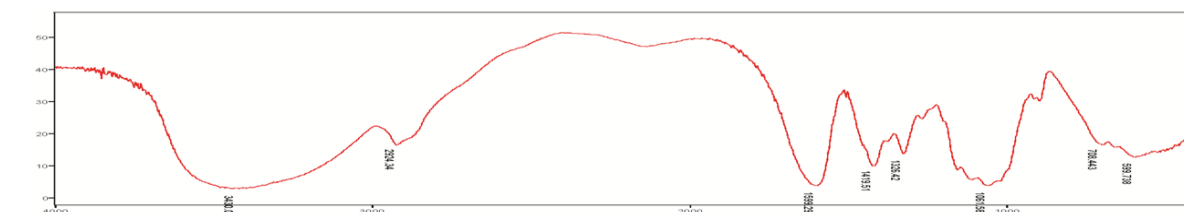


Figure 4. FT-IR specter of carboxymethylcellulose

3.2. Adsorption studies

To select the better adsorbents, adsorption of malachite green onto native clay and modified clay were studied. The adsorption data obtained were analyzed with the non-linear Langmuir's and Freudlich's isotherm equations. The best matching of the experimental results was achieved with the Langmuir's model, and a slightly lower degree of correlation

existed for the Freundlich's model. This is confirmed by the corresponding correlation coefficients given in Table 3.

The analysis of the adsorption parameters for native clay indicated that this was a favorable adsorption and a strong interaction between dye and clay. The Langmuir's isotherm is applicable to homogeneous adsorption surface, where adsorption of each adsorbate molecule onto the surface has equal adsorption activation energy. The Langmuir's model explains the monolayer adsorption process [5]. The Langmuir's isotherm model fitted well the isotherm data, indicating a monolayer homogeneous adsorption (Figure 5). However, regardless of the fact that the surface in the chemical and energy sense was relatively homogeneous, the existence of several different minerals was manifested by the relatively good matching of the experimental results of adsorption with Freundlich's model. An analysis of the adsorption parameters for native clay (given in Table 1) indicated that it is a favorable adsorption and a very strong interaction between dye and clay. The maximum quantities of malachite green fixed onto native clay obtained by Langmuir's isotherm (Table 1) was 26.43 mg/g.

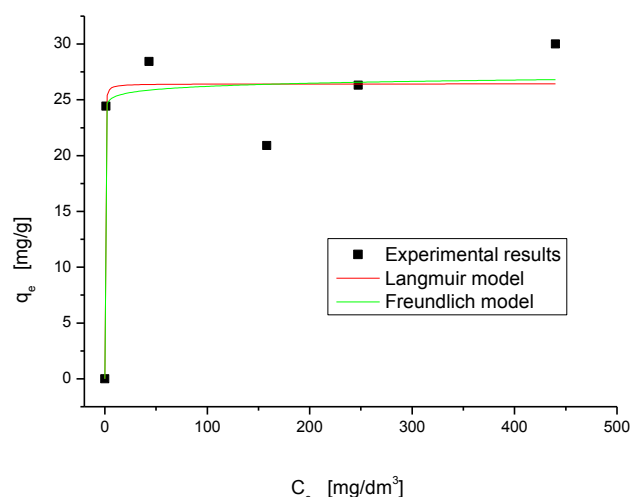


Figure 5. Adsorption isotherms of malachite green onto native clay

The Freundlich's isotherm presumes that the multilayer of the adsorption process occurs on a heterogeneous surface [5]. After modification of the clay by carboxymethylcellulose, a better matching with the Freundlich's model was observed (Figure 6). This indicated that, as a consequence of the application of carboxymethylcellulose, the surface of the clay was changed in chemical and energy terms. The surface became heterogeneous and the interaction with malachite green is significantly different from the previously analyzed native clay. The adsorption parameters indicated that adsorption was favorable in this case, but the dye-surface interaction of the material was considerably weaker than in the case of native clay.

At lower initial concentrations, there were no significant differences in adsorption capacity between the modified and the native clay, while at higher initial concentrations of dye, a higher maximum adsorption capacity was observed in favor of the modified clay. The theoretical maximum adsorption capacity per Langmuir was 32.36 mg/g. This material has the highest maximum adsorption capacity, which is consistent with the results of the FT-IR analysis, which confirmed that it contains the large proportion of carboxymethylcellulose.

Adsorption is due in the great part to the hydrophobic-hydrophobic interactions between the organophilic surface (carboxymethylcellulose) and the organic compound malachite green, so when the quantity of organophilic-carboxymethylcellulose in the clay increases, the hydrophobic-hydrophobic interactions increase and the adsorption of the malachite green increases.

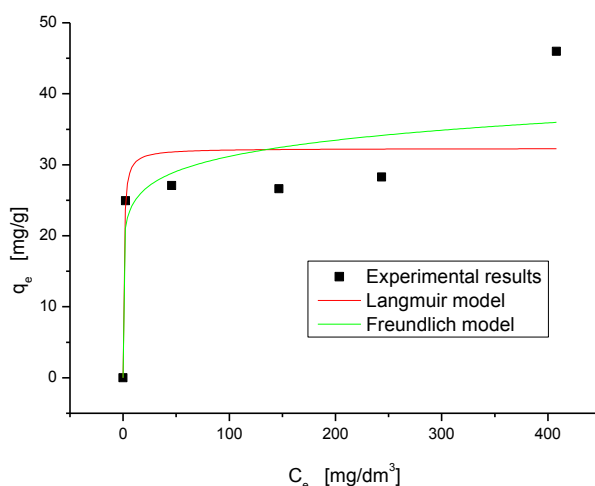


Figure 6. Adsorption isotherms of malachite green onto clay modified with addition of 3% carboxymethylcellulose

Table 1. Parameters of adsorption isotherms

Adsorbents	Langmuir					Freundlich		
	K_L	α_L	q_m	R_L	r^2	K_F	n	r^2
	(L/g)	(L/mg)	(mg/g)	/	/	($\text{mg}^{1-1/n} \text{L}^{1/n} \text{g}^{-1}$)	/	/
native clay	292.33	11.06	26.43	0.0018-0.00018	0.9033	24.40	64.78	0.9043
modified clay	43.37	1.34	32.36	0.015-0.0015	0.7030	19.52	9.83	0.7869

The values of the constants obtained for the two models are shown in Table 1. The maximum adsorption capacity was found 32.36 mg/g for modified clay. According to the information provided by Table 1, modified clay is the potential and the better adsorbent for the removal of the malachite green.

4. CONCLUSION

The FT-IR spectra of native clay and clay modified with carboxymethylcellulose showed common peaks for clay minerals. The native clay exhibits a significantly stronger bond with adsorbed dye, as indicated by the parameters of adsorption isotherms. The R_L values indicate that in both examined cases, favorable adsorption is concerned. The native clay had a lower adsorption capacity compared to clay modified by carboxymethylcellulose. The use of modified clay to remove the dye of malachite green was advisable in very concentrated solutions, because it showed obvious advantages compared to native clay. Native and modified clay are natural, no pollutant and low cost adsorbent, and it can be used for water purification and it can preserved environment.



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WEED FLORA IN ALFAFLA CROPS

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Abstract: *Alfalfa is a perennial crop that is grown several years on the same surface and because of this there are specificities in the composition and structure of the weed community. This leads to difficulties in suppresses and reduction of pests, diseases and weeds at the yield of alfalfa. The basic harmful effect of weeds is reflected through the competitiveness of water, nutrients and light. Weeds generally have low nutritional value, unpleasant smell and taste, and also affect the quality of alfalfa seeds. The most common types of economy effective perennial weed are *Cirsium arvense* (L.), *Sorghum halapense* (L.), *Convolvulus arvensis* (L.) and *Cuscuta* genus. All agro-technical measures, which enable good soil, quality sowing, as well as plant protection later, are the basic measures for the protection of alfalfa from long-lasting weed species. This paper is based on analysis of weeds flora in alfalfa crops in the Nis district. The presence of the fifteen most important types of weed plants was found in all nine analyzed areas of alfalfa crops. Among the weeds, most common are *Agropyrum repens*(L.), *Amaranthus retroflexus*(L.), *Chenopodium hybridum*(L.), *Cuscuta* sp.(L.), *Sorghum halapense*(L.).*

Keywords: *weeds, alfalfa, Nis district, perennial weed*

1. INTRODUCTION

Alfalfa (*Medicago sativa* L.) is one of the most important perennial fodder crops which is used for making first-class of soilage suitable for all kinds of domestic animals. There are different reasons which can effect on quality and quantity of this fodder crop, but weed plants have the biggest impact on reducing yield and quality and shorten the time of exploitation [6]. Furthermore, many weeds can be harmful, dangerous or even poisonous if they appear in hay or silage. The biggest problem at alfalfa crops is the appearance of weed which accumulates nitrates. This can lead to different diseases or even death of fed animals [3]. It has been established that spaces *Amaranthus*, *Chenopodium* and *Solanum* can contain nitrates with potential toxic concentration values [1]. Taking into consideration that weed plants have numerous negative effects on the quality of feed there are reasonable needs of studying its appearance in alfalfa crops. Especially interesting are alternative systems of weed control, without or with reduced consumption of herbicides. Before chousing methods of weed control and suppression, it is necessary to have knowledge about biology and ecology of weed flora and a better understanding of competition betwine grown and weed plant. Analysis at Nis district can have a big influence on defining right measures on monitoring and suppression of weed cultures in this region, taking into account that all researches so far are very frugally.

2. METHODS

The shooting had included 9 sites in the Nisava district (Trnava, Draževac, Katun, Moravac, Nozrina, Tešica, Glogovica. Toponica i Trupale), plots under the Alfalfa crop. The presence

and representation of 15 weeds were observed. The applied method of assessing the representation of mapped species was as follows:

- method of evaluation: visual
- evaluation time: 2 measurements per season
- the size of the assessed area: 0.5 ha, 1 parcel, 100m bound to the npp.
- the number of recordings per crop: 3.

The representation of the mapped species was done on scale 1-4:

1 - the species is shown individually and occupies up to 5% of the surface;

2 - shown and occupies 5-25% of the surface;

3 - shown often 25-50% of the surface;

4 - the species prevails over the cultivated plant and occupies over 50% of the area [4,5].

The phase of the weed (PW):

P – from cotyledons up to 5.6 plant leaf,

V – plant,

G – phase of fertility.

3. EXPERIMENTAL RESULTS

The results of phytocoenological shootings are shown in the tables.

Table 1. shows average values of presence and number of monitoring weeds in the phase from cotyledons up to 5.6 plant leaf (p) and adult plant (V) on nine plots. Alfalfa was in the phase of an adult plant (V). Weeds were present with representation rating of 1-3 at all monitored plots. Weeds *Agropyrum repens*, *Amaranthus retroflexus*, *Cirsium arvense*, *Chenopodium*, and *Cuscuta sp.* took 5-25% of Alfalfa surface (rating 2), till *Sorghum halepense* was present on 25-50% surface (rating 3).

Table 2. shows data from the second monitoring of weed plants distribution on nine locations. Most of the weeds were in V (adult plant) and G (phase of fertility) phase, while alfalfa was in a phase of the adult plant. Big presence of weeds was seen at all localities with representation score from 1 to 3. Weed plants *Agropyrum repens*, *Amaranthus retroflexus*, *Cirsium arvense* and *Chenopodium album* and *Convolvulus arvensis* were found on all locations with representation score 2 and 3, taking 25-50% of alfalfa crop.

This very high degree of weed presence in alfalfa crops in Nišava district shows that it is necessary to start taking measures with the goal of weeds suppression. Alfalfa is perennial crop and in conditions like in Nišava district exploitation time can reach five years. Suppression of weeds is of crucial importance on the lifetime of alfalfa crop. Besides the time of exploitation different species and the presence of weed can also affect the quality of hay and silage used for soilage. Weed flora in alfalfa crop is specific. The crop is not mechanically cultivated in years so weed can grow in any part of the year [2]. Chemical treatments against weed can be performed before vegetation if it is known which weed species are present. Appropriate herbicides are the one with metribuzin active base in the concentration of 0.5-1kg/ha.

Table 1. Distribution of weed species in alfalfa crop (the first shooting, average from nine locations)

Ordinal number	Weed species	Repre mark	PW
1.	<i>Agropyrum repens</i>	2	v-g
2.	<i>Amaranthus retroflexus</i>	2-3	v-g
3.	<i>Amaranthus hybridus</i>	1	v

Ordinal number	Weed species	Repre mark	PW
4.	<i>Avena fatua</i>	1	v
5.	<i>Calystegia sepium</i>	2	v
6.	<i>Cirsium arvense</i>	2-3	v
7.	<i>Chenopodium album</i>	2-3	v
8.	<i>Chenopodium hybridum</i>	1-2	v
9.	<i>Convolvulus arvensis</i>	2-3	v
10.	<i>Cuscuta spp.</i>	1-2	v
11.	<i>Cynodon dactylon</i>	2	v
12.	<i>Galium aparine</i>	1	p-v
13.	<i>Sonchus arvensis</i>	2	v
14.	<i>Sorghum halepense</i>	1	g
15.	<i>Xanthium strumarium</i>	2	v

Herbicides for the suppression of one-year broad-leaved weeds are Mistral, Velton WG, etc. On the other hand, herbicides with imazamox active base like Passat 1-1,25 l/ha are good for weeds like *Capsella bursa-pastoris*, *Chenopodium album*, *Sorghum halepense*, *Stelaria media* ect.

Chemical treatments in new alfalfa crops are performed when the crop is in phase 3, or when plans are in high of 8-15 cm. For one-year grass and broad-leaved weeds, appropriate herbicides are Pulsar – 40 and Passat with dose od 1-1,25 l/ha. These herbicides can be used and after first swath in older crops. Herbicide Butoxone-DB based on active substance 2,4-DB is used in phase after sprouting till three in a dose of 1,5-3 l/ha. For alfalfa crops appropriate herbicides are *Capsella bursa -pastoris*, *Chenopodium album*, *Cirsium arvense*, *Sorghum halepense*, *Stelaria media* etc.

Table 2. Distribution of weed species in alfalfa crop (the second shooting, average on nine locations)

Ordinal number	Weed species	Repre mark	PW
1.	<i>Agropyrum repens</i>	1-2	p-v
2.	<i>Amaranthus retroflexus</i>	1-2	v
3.	<i>Amaranthus hybridus</i>	1	v

Ordinal number	Weed species	Repre mark	PW
4.	<i>Avena fatua</i>	1	v
5.	<i>Calystegia sepium</i>	1	p-v
6.	<i>Cirsium arvense</i>	1-2	v
7.	<i>Chenopodium album</i>	1	v
8.	<i>Chenopodium hybridum</i>	1-2	v
9.	<i>Convolvulus arvensis</i>	1	p-v
10.	<i>Cuscuta</i> spp.	1-2	v
11.	<i>Cynodon dactylon</i>	1	v
12.	<i>Galium aparine</i>	1	p-v
13.	<i>Sonchus arvensis</i>	1	v
14.	<i>Sorghum halepense</i>	1-3	p-v
15.	<i>Xanthium strumarium</i>	1	p-v

For older alfalfa crops, two and three years old, depending on spice and numerous of weeds herbicides can be used in combination, which increases the effect on weeds on which standard herbicides don't have influence. For suppression of perennial and annual grass weeds effective herbicides are the one with clethodim active base like Selekt super, Nikas, Rafal 120 in dose 1,5-2 l/ha for *Sorghum halepense* and *Agropyrum repens*.

4. CONCLUSIONS

Based on all presented date from two shootings of distribution and representation of most important weed spices on Nišava district, it can be concluded:

- The significant presence of weed plats were found at all nine localities in alfalfa crops;
- On first shooting most of the weeds were in the phase of adult plant, while their presents were scored with average mark 1-2, besides weed *Sorghum halepense*(mark 3);
- Perennial weeds covered most of the alfalfa crops in the first shooting;
- Second shooting of the same localities shows presence on a significantly bigger variety of different weed spices on all localities in Nišava district;
- On second shooting weed plants were in phases V and G (adult plant and phase of fertility), while their presents were scored with mark 2 to 3;
- High level of weed presence in alfalfa crops in Nišava district leads to the conclusion it is necessary to take measures on suppression of weeds and maintenance of alfalfa crops;
- Presented results are a good base on finding appropriate measures on suppression of weeds to the tolerant level in alfalfa crops, as knowledge in biological characteristics of weeds is really important. The main goal is to reduce herbicide usage and to create health safe soilage and while simultaneously saving energy and protect the environment.



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USE OF STARCH SYRUPS IN THE PRODUCTION OF JELLY

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Abstract: *In the presented work the choice of starch syrup for the jelly products production has been substantiated. It was based on the analysis of the starch syrup carbohydrate profiles and recipes of jelly products. The influence of syrup on the rheological and structural-mechanical properties of jelly and aerated masses for a two-layer jelly has been determined. The expediency of polydextrose usage has been demonstrated. Its adding leads to the regulation of the jelly structure and foam layer for the samples with more than 50% of sugar replaced by starch syrup. Depending on the ratio of carbohydrates in jelly it was determined the amount of polydextrose adding of which provides the required firming and prebiotic properties of finish products. The change of physical-chemical, structural-mechanical, and organoleptic quality indices of two-layer jelly with modified carbohydrate composition has been investigated during storage.*

Keywords: *starch syrups, agar, polydextrose, aerated mass, two-layer jelly*

1. INTRODUCTION

Compared to the other confectionery products types, jellies are more responded to healthy nutrition requirements. This type of product is fat-free, has a low energy value (260-320 kcal), contains food fibers, such as hydrocolloids, and characterized with positive physiological effects.

However, their main disadvantage is the high sucrose content in the recipe (the range of 50% to 65%). It is the main component which forms the bulk of jelly candies. Some agar-based jelly candies contain the crystalline glucose which provides a great texture and taste properties. At the same time this raw material has some disadvantage which is its high cost. Currently, new types of starch syrups are widely used instead of sugar in confectionary and food production. Their difference depends on the various ways of their treatment with acids, enzymes or the combination of both. As a result, it is possible to produce syrups with the same dextrose equivalent but modified carbohydrate profiles and performance characteristics. The use of corn syrup effects on the final flavor profile, texture of product, its quality stabilization during shelf-life and leads to the cloudiness retardation due to the crystallization. [3, 5]. Starch syrups are widely used as viable alternative to sugar in the food industry. The substitution of sugar in the jelly formulation is complicated due to the production process features, particularly, the gel forming process, which essentially depends on the presence of sugar. For example, high sugar content which controls hydration is necessary for gelation of HM pectin. Sugar addition in agar based candies mass enhances the strength of the candy products.

The aim of the research is to evaluate the possibility of sugar replacement with corn starch syrup usage for high quality jelly production. The effect of starch syrups with different saccharides composition on the quality of semi-finished products and jelly products based on different hydrocolloids, and its changes during storage was studied. Due to the significant effect of sugar on the jelly products texture forming it is needed to investigate the ways of its regulation for samples with reduce sugar content.

2. METHODS

The quality parameters of raw material semi-finished and finished products were studied by generally accepted methods in Ukraine [2].

The limiting shear stress for jelly products (firming) was determined using the penetrometer AR-4/1 by the method of actual penetration. In this case a cone with angle (α) at the top 60° was used.

The viscosity of the jelly syrups at different temperatures was studied using Reotest-2 rotary viscometer (Germany).

The amount of reducing sugars was determined by a Fehling's titration test.

Dry matters were determined by the most common way through the evaporation of water from the product, leaving only the dry contents behind.

Density of an aerated candy masses was defined as the ratio of its mass per unit of volume.

3. EXPERIMENTAL AND RESULTS

The possibility of the sugar replacement with corn syrups in the agar and pectin-based formulation of jelly was studied. Considering the significant influence of sucrose on the physical characteristics of High Methoxyl Pectin, the influence of starch syrups with different saccharide composition on the gel firmness has been determined. The obtained results have shown that an increase of maltose and fructose mass fractions leads to decreasing of this indicator. It has been obtained that samples with syrup IG-42 characterized with the highest firmness, due to this it was chosen as an object for the further research [1].

For the quality improvement and cost reduction of the agar-based jelly products which contains glucose it is suggested to use IG-60 syrup with a high glucose contain.

The analysis of the main physico-chemical properties of syrup which was produced by acid hydrolysis and the proposed syrups showed that syrups with similar DE have different saccharide composition and, consequently, different technological properties as a result of their different ways of their production. For example, the of temperature of Browning Reactions of syrup IG-42 is lower compared with compared whit syrup produced by acid hydrolysis, which is also characterized by the negative overall acceptability. Distinctive features of the IG-60 syrup are due to its high DE (Table 1).

Table 1. Physico-chemical properties and saccharide composition of starch syrups

Indicators	Standard acid-converted corn syrup (SACS)	starch syrup	
		Syrup IG-42	Syrup IG-60
Water content, %	21,8	22,2	22,6
relative density at 20 °C	1,41	1,38	1,42
temperature of Browning Reactions , °C	142	160	148
content of reducing substances, %	46	43	55
acidity, degree	2,5	2,1	2,2
pH	4,56	4,62	4,57
viscosity, Pa·c at $j=3,0 \text{ c}^{-1}$, $t=40 \text{ }^\circ\text{C}$.	12,7	9,8	5,8
saccharide content			
Glucose dextrins, %	22	18	34
maltose , %	19	16	15
maltotriose, %	9	20	13
dextrins, %	50	46	38
Dextrose equivalent	42	43	60

relative sweetness	39	36	47
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A two-layered jelly was chosen as an object for research work. It consists of a layer with a clear gel and an aerated one. This combination provides a soft, tender mouthfeel and provides a unique texture and organoleptic properties to the candy.

In the formulation of jelly with pectin and agar, starch syrup produced by acid hydrolysis and glucose was substituted with corresponding syrups (models 1, 2 and 6), in models 3 and 7 was used syrups instead of half of the sugar, then in models 4 and 8, we replace 75% of the sugar, and models 5 and 9 contain only syrups (Table 2).

Table 2. The sweeteners ratio in jelly products

sweeteners	Agar-based jellies						Pectin-based jellies					
	Typical formulation	model 1	model 2	model 3	model 4	model 5	Typical formulation	model 6	model 7	model 8	model 9	
sugar syrup	+	+	+	½+	¼+	-	+	+	½+	¼+	-	
Syrup from acid hydrolysis	+	+	-	-	-	-	+	-	-	-	-	
glucose	+	-	-	-	-	-	-	-	-	-	-	
Syrup IG-60	-	+	+	+	+	+	-	-	-	-	-	
Syrup IG-42	-	-	-	-	-	-	-	+	+	+	+	

The study of the candy syrup rheological properties shows that increasing content of G - 60 starch syrup in the agar-based jelly syrup leads to a viscosity increase for all samples. The viscosity for samples with the full replacement of all sweeteners with IG-60 was determined higher in 2,5 times compared with control sample. For pectin-based jelly syrup the viscosity increasing was observed only for models 7 and 8. For sucrose free model (model 9) viscosity of candy syrup decreased in 1,8 times compared with control sample. (Fig. 1).

The temperature of candy syrup is the main factor which influence on their rheological characteristics. Jelly syrup temperature and consequently viscosity is crucial for such processes as pumping, mixing, molding (pouring) and whipping for the aerated layer production. The common jelly syrup temperature for these processes is 52±5°C for agar-based jelly, and 82±5°C for pectin-based.

Considering the viscosity increase of agar-based models, the temperature for such technological processes as mixing with colors, flavors or acid and molding the should be provided in the 65 ± 2.5°C range for models 4 and 5. For pectin-based jelly syrup, it is necessary to increase temperature slightly to 85 ± 2.5°C only for models 7 and 8 with partial replacement of sugar, which are distinguished by higher viscosity then control simple.

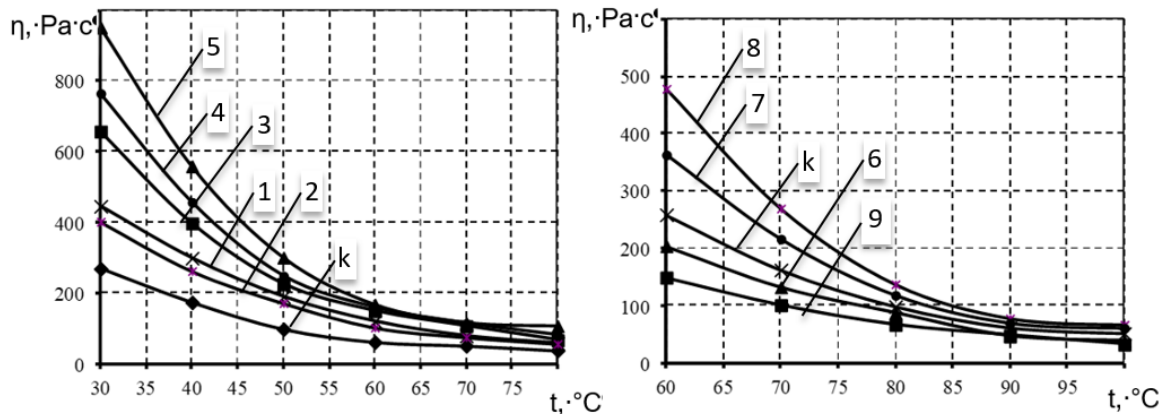


Figure 1. Effect of temperature on the viscosity of agar-based (a) and pectin-based (b) jelly syrups: k – control sample, 1 – 9 – models 1 -9.

Used hydrocolloids and sweeteners have a significant influence on the curing time and texture of the finish products. Curing time was defined as the time required for solidify candy for remove from the mold when the firming is 4,5 и 6,5 κPa for pectin- based and agar-based jellies respectively. According to the typically used technology the Curing time is 80 min for agar-based jellies and 12 min for pectin-based jellies. For the samples with proposed starch syrups instead of standard acid-converted corn syrup, glucose and half of sugar, curing time was 75-95 min till the necessary firmness forming and 11-13 min for the samples with agar and pectin, respectively (Tab.3)

Curing time for candy produced by typical formulation is 80 min for agar-based jellies and 12 min for pectin-based jellies. When we used proposed starch syrups instead of starch SPAH, glucose and half of sugar, curing time to achieve necessary firmness was 75-95 min and 11-13 min in the case of the use of agar and pectin, respectively (Table 3).

Table 3. Structural properties of jellies

sweeteners	Agar-based jellies						Pectin-based jellies				
	Typical formulation	Model 1	Model 2	Model 3	Model 4	Model 5	Typical formulation	Model 6	Model 7	Model 8	Model 9
Curing time, min	80	70	75	92	120	-	12	11	13	19	-
Max firming, kPa	10,4	11,2	11,5	8,8	6,8	5,7	6,4	6,6	6,2	4,5	4,2

Replacement of 75 and 100% of sugar does not provide the required firmness comparing with control sample. To improve the firmness of these models it was suggested to use the polydextrose as a balking and water-binding agent. It is known that polydextrose is a rich source of soluble fiber, containing only 1 kcal/g. Also it characterized with low Glycemic index. The polydextrose selectively stimulates the growth of intestinal bacteria and their activity and provide physiological and prebiotic effect to elaborated samples [4, 6]. The rational mass fraction of polydextrose, which provides the desired textural properties, was determined experimentally. It was 6% and 9% for pectin-based and the agar-based jellies respectively in case of replacement 75% sugar with starch syrups.

The adding of 9% of polydextrose for agar- based jelly and 12% for pectin based jelly provide the strength of jellies with replacement of all sweeteners components (sugar, glucose and standard acid-converted corn syrup) by the proposed syrups (Fig. 2).

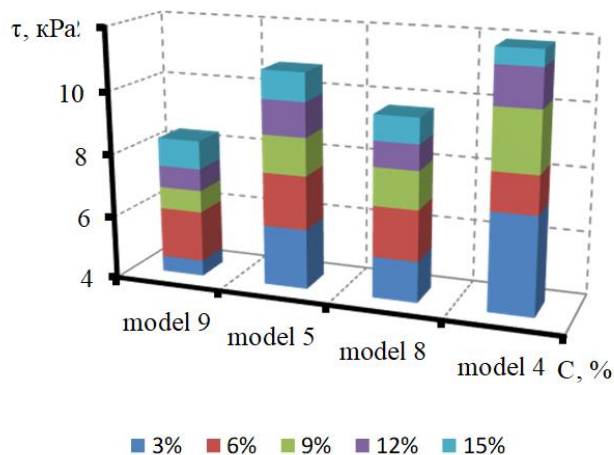


Figure 2. The influence of polydextrose content on firming of jellies

To produce an aerated layer, the candy syrup, prepared as for the jelly layer, was whipping in the presence of eggs albumen. The mixing device helps to introduce air cells in slurry and reduce air bubble size. As a result, the volume of the mass increases, a density decreases. The results of recipe ingredients ratio study on the aerated layer saturation process showed that the replacement of half of sugar with starch syrups leads to a certain increase of its density. The full replacement of sugar with starch syrups and polydextrose yield to the an aerated layer formation, which characterized with similar density value compared with control samples (655-700 kg/m³ for agar-based models, 560-570 kg/m³ for pectin-based models). It is known that the quality of the jelly products during storage is significantly influenced not only by the environmental conditions of their storage, but also by their recipe. This factor determines the ratio of free and bound moisture, which basically regulate (activate) the speed of spoilage process throughout the entire storage period. The loss of moisture occurred during storage of jelly products effects on their textural properties [3]. Measurement of the control samples (models 1 and 2) firmness during storage showed that this indicator increases practically in 2 times (on 43.9% and 46.3%) (Table 4). The moisture loss retardation for the samples with 50% starch syrups is leads to the less intensive increase of the finish products firmness during storage (35,4% for model 3 and 29,4%for model 7).

The use of PD in the recipe of jellies slows down the drying process for candies due to its higher moisture binding and holding capacity.

This leads to the slower increase of the finish products firmness containing PD - by 17,0 ... 24,2% for agar-based jellies and 20,6 ... 23,4% for pectin-based jellies.

On the basis of the obtained results, it can be concluded that replacing of more than 50% of sugar in the two-layer jelly formulation with starch syrups and polydextrose reduces the growth rate of dry matter during storage, jellies do not grain and, as a result, slow down the processes of deterioration of finished products. This leads to the better preservation of their organoleptic and structural characteristics during their shelf-life.

Table 4. Changes in physico-chemical parameters during storage

sweeteners	Agar-based jellies						Pectin-based jellies				
	formulation n	Model 1	Model 2	Model 3	Model 4	Model 5	formulation n	Model 6	Model 7	Model 8	Model 9
Δ dry matter, %	5,7	6,8	6,2	3,1	2,2	1,8	4,9	5,0	4,1	2,3	2,0
Δ Firming, kPa	4,2	4,3	4,3	2,9	2,2	1,4	2,2	2,6	1,4	1,3	0,2

4. CONCLUSIONS

The use of starch syrups leads to the expansion of the raw material range for jelly based on different hydrocolloids with reduced sugar content or sugar-free. Syrup IG-42 is recommended for the production of pectin-based jellies and IG-60 for agar-based samples.

It is shown that a full replacement of sugar for starch syrups in agar-based jelly leads to a viscosity increase in 2,5 times compared with control sample, while a viscosity pectin-based jelly syrup decreased in 1,8 times compared with control sample in case of use starch syrup instead of sugar. Considering the change in the rheological properties of the models, an increase the temperature on 10-15°C for agar-based and on 5-10°C for pectin-based jelly syrups was proposed.

The feasibility of the use of polydextrose for regulation of the firming of the products was found. The adding of 9% polydextrose for agar-based jelly and 12% - for pectin-based jelly provides the increasing of firmness which is equal to the control value for the samples with the full replacement of sugar on starch syrups.

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THE RECIPE MODIFICATION OF SUGAR-FREE BAKERY GOODS FOR REDUCING GLYCEMIC INDEX AND ENHANCING THE NUTRITION AND FUNCTIONAL FEATURES

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Abstract: *Wheat flour-based products are the most popular and desirable of all bakery goods. In the same time, they give the heights glycemc response so this type of products are banned for people with metabolic disorders as well as consumers who have a tendency to live a healthy lifestyle. In the same time the increasing consumption of sugars has resulted in several nutritional and medical problems, such as obesity, diabetes, and cardiovascular diseases. The uses of a combination of various ingredients in range (such as rye flour – 40...60, dry gluten – 5...15, oat dietary fibre – 1...6 % and lentil flour - 5...20 %) that may modify the glycemc index of baked products, enhance the nutrition and functional features have shown in the article. Water Stevia extract demonstrated no effect on the baking quality and suggested the use of it to improve palatability and nutritional properties of developed new sugar-free bakery products.*

It was found the optimum ratio of these ingredients as a result of a series of studies and processing of the obtained data by multicriteria optimization. Results have shown that lentil flour can be used in the amount 12.5 % for the achieving optimum ratio "low glycemc index-high taste". It is shown that due to lentil flour it is possible to reduce the glycemc index to a greater extent than rye flour, dry gluten, but in terms of the taste characteristics, these products were less attractive with an increasing amount of flour in formula.

The coefficients of the regression model were given as a result, it has helped to find out the patterns of influence of selected components and their dosage on the glycemc index, energy value and sensory characteristics of the product. The article represents the results, which can be used to create recipe compositions using selected ingredients.

Keywords: *bakery products, Stevia, lentil flour, glycemc index, optimization formula*

1. INTRODUCTION

Nowadays, we have the increasing tendency and strong interest to the development of functional foods, which are able to influence the metabolic processes in the body. Many scientists have proved the direct connection between metabolic disorders and the development of chronic diseases such as cardiovascular diseases and diabetes [7].

Currently, there is a shortage of cereal-based products with a low glycemc index, especially in the category of bakery products. Therefore, the development of such products, the modification of recipes based on wheat flour is an important issue. Recent studies have shown that such an index as the glycemc index closely associated with the risk of developing type 2 diabetes and coronary heart disease [4, 10]. Because of the above-mentioned reasons, the products with a low glycemc index can be considered functional foods.

A number of scientists in our country and abroad have studied and established the possibility of using high-value plant raw materials in breadmaking technology, for example - seeds of legumes and their processed products. Different type of legumes can be used as a great source of complex carbohydrates, protein and dietary fibre [1,14]; they also have significant amounts of vitamins and minerals [16].

The combination of lentil flour protein with proteins of wheat flour, in which there is little lysine, but many sulfur-containing amino acids, can improve the qualitative composition of the final product. They contain high amounts of lysine, aspartic acid, glutamic acid and arginine and provide well balanced essential amino acid profiles when consumed with cereals and other foods rich in sulphur-containing amino acids and tryptophan [12]. In addition that, a high proportion of non-digestible carbohydrates in its composition, such as resistant starch, non-starch poly- and oligosaccharides, contribute to the formation of a low glycemic response from the body when they are consumed. The low digestibility of legume starch is attributed to branched amylose with a high molecular weight [13]. All this makes lentils an appropriate ingredient for use in bakery in order to reduce the glycemic index of products and increase their biological value.

Consequently, the use of flour obtained from the seeds of legumes in the production of bakery products from wheat flour of the highest and first grades will contribute to a significant improvement in the nutritional value of products. The possibility of use lentils flour in a multicomponent recipe for the production of sweet bakery goods with a low glycemic index was investigated. To develop a prescription formula for products with low moisture content and low glycemic index, high protein and dietary fiber.

A rusk is a hard twice-baked bread so the moisture content no higher than 12 %. This product is popular in many countries with different names and shapes. They can be considered as a up-and-coming group of bakery products and low moisture content give an opportunity to consider them even as a group of products with long-term life so they can be imported.

2. METHODS

In order to develop the recipe formula for bakery goods low-moisture content with the reduced level of GI, high level of protein and dietary fiber, blends were prepared using rye wholemeal flour, buckwheat flour, dry gluten, oat bran to substitute wheat flour as much as possible. Currently, more and more attention is being paid to finding new sugar substitutes. The urgency of this problem is due to the need to meet the needs of the population in low-calorie sweeteners, on the one hand, and solutions to rational nutrition, on the other. As sweetener was used water extract of Stevia, parameters of Stevia water extraction were used due to the study of D.B. Kovačević [9]. Water was replaced with Stevia extract. The quantity of rye wholemeal flour varied within 15...60 %, lentil flour – 5...20 % dry wheat gluten - 5...15%, bran - 2...6 % of the total amount of flour component. Leaves *S. rebaudiana* contain 0.46 % of fructooligosaccharides. These are natural polysaccharides with important functional properties that relate to prebiotics, so the dry matter after extraction was used in the recipe too.

Duration of dough mixing was 5 min, the dough temperature after the kneading was 26-28 °C, moisture content - 45±1 %, dough fermentation – 60 min at 32±1 °C. After fermentation, the dough was formed into a long and thin cylinder (weigh 0.5±0.05 kg) and was proofed at 35±1 °C with humidity – 45 % during 40 min.

Semi-finished product for rusks was baked at 220 °C during 30 min, it was left for 24 hours and was cut into paces (weight 10±1 g). It was dried at 120 °C during 20...30 min till moisture content of the rusk was on the level 12 %. Sensory characteristics were evaluated by 20 persons (both males and females), who had experience in sensory evaluation. For sensory evaluation used the method of preferential scale. This method of quality evaluation based on a 10-point scale.

To determine the physical and chemical characteristics of semi-finished product for rusks and rusks, was used DSTU 7045: 2009. Bakery products. Methods of determination of physical and chemical characteristics

Statistical methods for planning an active experiment are one of the empirical methods for obtaining a mathematical description of the relation equation of an object and input variables (factors). At the same time, the mathematical description is represented in the form of a certain polynomial - a segment of the Taylor series, into which an unknown relation expands in a neighborhood of the main point.

Optimization was made using the Design expert pro 11. To develop a new recipe, it was necessary to apply a modern mathematical tool, build a mathematical model of the process, optimize it and get the best parameters. Design-Expert Software Version 11 was used for data processing, it allows you to correctly construct an experiment, analyze the interaction between factors, apply optimization methods and find the optimal composition of products.

The calculation of the chemical composition and energy value of the products was carried out basing on the determined chemical composition of flour materials and on reference tables of the chemical composition of food products [14].

The glycemic index was calculated according to [3] and using International table of glycemic index [6].

3. EXPERIMENTAL AND RESULTS

Before planning the experiment in the area containing the «extremum» of the optimization parameter, when there was not enough a priori information, the first stage was carried out - the search, «pre-planning» of the experiment, finding the region of «extremum» and obtaining a qualitative idea about the shape of the response surface. After that, the design of experiment was made on desirable factors – to reduce the GI and to maximize the mark for sensory evaluation.

Table 1 - Design of experiment

Number	№	Content of lentils flour	Content of dry gluten	Content of oat bran	GI	Sensory evaluation	Energy value
		%	%	%	-	point	kcal
7	1	5	15	5	60.5	8,8	242.8
8	2	20	15	5	56.0	6	248.2
16	3	12.5	10	3	62.4	8.1	240.8
6	4	20	5	5	57.5	6.5	240.1
1	5	5	5	1	70.8	6.8	237.1
12	6	12.5	18.4	3	56.9	7.8	246.7
2	7	20	5	1	64.3	6	238.9
5	8	5	5	5	68.0	6.0	236.1
14	9	12.5	10	6.3	60.1	7.8	240.3
10	10	25.1	10	3	58.1	7.1	244.4
9	11	0	10	3	67.7	8.5	239.0
13	12	12.5	10	0	63.8	7.9	239.7
17	13	12.5	10	3	61.4	7.6	238.9
11	14	12.5	1.6	3	70.6	7.5	238.6
15	15	12.5	10	3	61.8	7.4	239.7
3	16	5	15	1	62.3	6.7	241.9
4	17	20	15	1	56.8	6.5	243.2

The images (Fig. 1) make it possible to evaluate the nonlinearity of a particular model (for example, the dependence of the «Glycemic index» on «Dry gluten» is almost proportional).

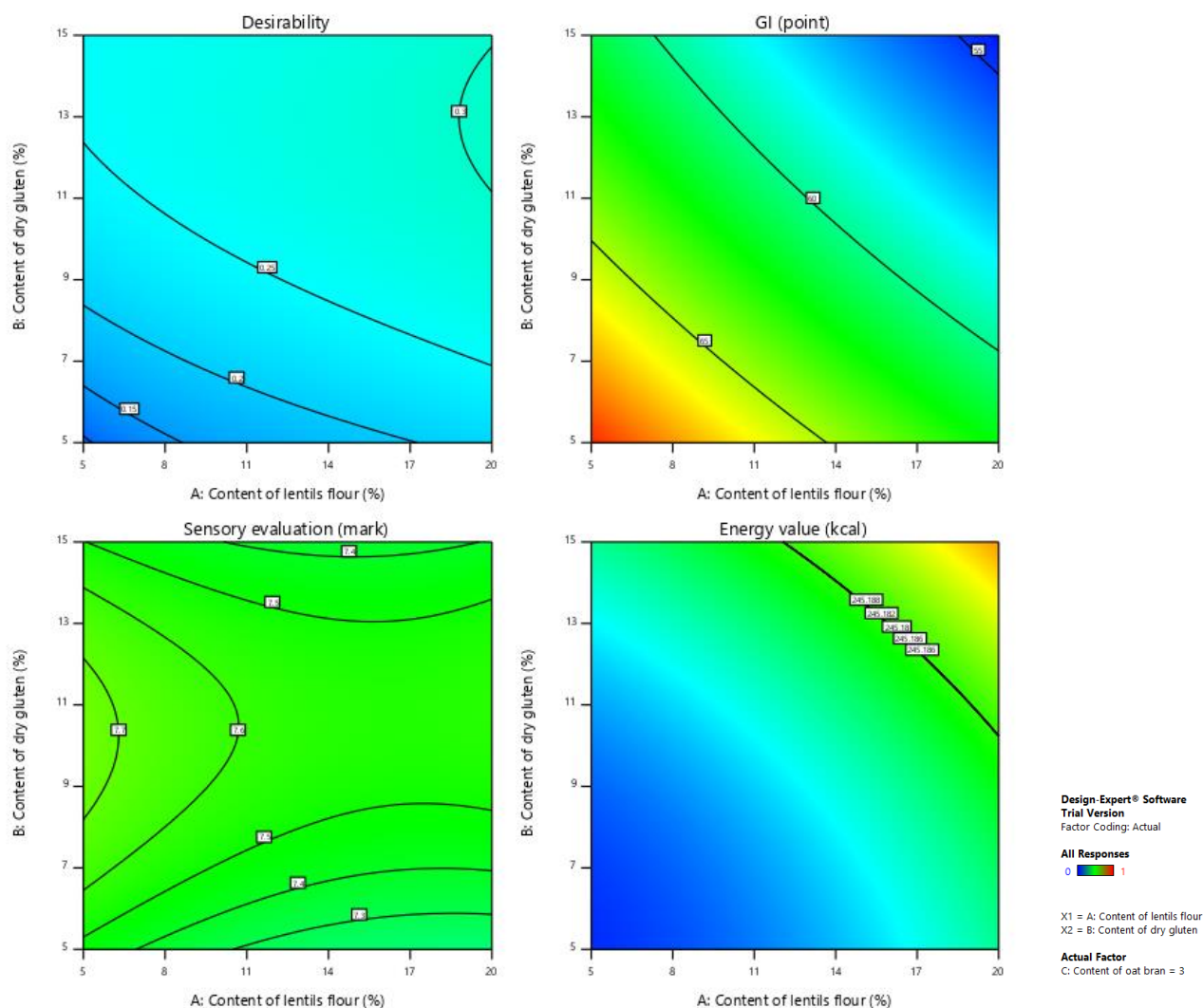


Figure 1 – Results of optimization

It was predictable that increasing the content of gluten in the recipe lead to decreasing the glycemic index, which would allow receiving the formulation with the given sensory, physical and chemical parameters. The same tendency was found for adding lentils flour. There is the same information regarding in vitro studies [5] of the mixture with partial substitution of wheat flour by a mixture of resistant starch, dextrin and lentil flour and was used to make muffins and bread. Pulses, especially when blended with cereal proteins, may offer a promising alternative source for nutritional and functional proteins [1].

There was an unexpected fact that there was no significant effect of dosage choosing ingredient as an object of optimization on sensory evaluation.

The fact that with the increase in the dosage of the flour of lentils flour, dry gluten and oat bran was increased by the calculated glycemic index, it was the most logical and expected that it was the smallest containing. Some work [11] confirms the negative effects of bran on gluten network formation which may lead to the reduction in gluten viscoelasticity and quality deterioration of fiber enriched flour products and as the result – sensory characteristics.

It has been established that adding more than 19.2 % lentils flour to the recipe adversely affects the organoleptic properties of the finished products, there was a strong taste of lentils and bitterness when chewing. Using Design Expert 11 software, the optimum dosing of

lentils flour was found, namely 12.5%, which provided the necessary taste characteristics. As the results the coefficient of optimization was received (Table 2). The study of Kohajdová, Z. [8] also concluded that baked rolls prepared from wheat–legume blended flour containing 10 mass % of legume flours as the most acceptable. Similar findings were observed by Bojňanská et al. [2] for chickpea and lentil flour-supplemented breads.

We have noted that the incorporation in recipe lentils flour in the range of 5...20% made it possible to obtain semi-finished products with the necessary structural and mechanical properties for the production of products with low-moisture content.

Table 2 – Coefficients of optimization

Index	Intercept	A	B	C	AB	AC	BC	A ²	B ²	C ²
GI	60.6998	-3.52199	-3.97111	-0.939266	0.225	0.275	0.225	0.345676	0.533059	-0.0441171
p-values		< 0.0001	< 0.0001	0.0001	0.1955	0.1238	0.1955	0.0349	0.0050	0.7488
Sensory evaluation	7.60182	0.0275927	0.065901	0.0896294	0.0425	0.355	0.02	0.0772315	-0.253341	-0.00408579
p-values		0.9032	0.7720	0.6943	0.8860	0.2543	0.9462	0.7578	0.3277	0.9869
Energy value	241.799	2.80237	2.79905	0.445049	0.624549	0.296001	0.20395	0.660923	0.98757	0.0657193
p-values		< 0.0001	< 0.0001	0.0707	0.0560	0.3142	0.4794	0.0239	0.0036	0.7833

According to the analysis of the obtained coefficients of the regression equation, it was found that all the prescription ingredients, lentils flour and dry wheat gluten have the greatest influence on the glycemic index of products.

4. CONCLUSIONS

Since in the light of recent advances in nutrition science, the creation of a range of low humidity products for diet and special nutrition is a priority. Received model of optimization will allow predicting the response from the model and create appropriate recipe for sweet bakery goods low moisture content. The sweet bakery product with low-moisture that based on optimization was estimated by the expert committee at 8.1 and has had calculated glycemic index - 62 and energy value 240.8 kcal per 100 g.

The result of sensory evaluation have showed possibility of development the sweet bakery goods with low-moisture content based on multicomponent recipe that successfully combine wheat, rye and lentils flour and contain oat bran and dry leaf of Stevia as a source of prebiotic, dry gluten – as one of the factor that reduce the glycemic index and water extract of Stevia – as a natural sweetener.

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STUDY ON THE ETHANOL EXTRACTS OF BULGARIAN WHITE OREGANO (*Origanum heracleoticum* L.)

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Abstract: The influence of technological parameters - temperature, hydromodule (proportion between row material/solvent (g/cm^3)) and duration of extraction, on the yield and composition of ethanol extracts from bulgarian white oregano (*Origanum heracleoticum* L.) whit 70 % ethanol was studied. The quantity of tannins in extracts were defined.

The highest yield and content of tannins in ethanol oregano extracts was determined in the following parameters: hydromodule 1:10, 60 °C and the duration of the process 6 hours.

Keywords: white oregano, *Origanum heracleoticum* L., ethanol extracts, yield, tannins

ПРОУЧВАНЕ ВЪРХУ ЕТАНОЛОВИ ЕКСТРАКТИ ОТ БЪЛГАРСКИ БЯЛ РИГАН (*Origanum heracleoticum* L.)

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Абстракт: Проследено е влиянието на технологичните параметри - температура, хидромодул (съотношение между суровина/разтворител (g/cm^3)) и продължителност на екстракция върху добива и състава на етаноловите екстракти от български бял риган (*Origanum heracleoticum* L.) със 70% етанол. Определено е количеството на дъбилни вещества в екстрактите. Най-висок добив и най-високо съдържание на дъбилни вещества са отчетени при хидромодул 1:10, температура 60 °C и продължителност на процеса 6 часа.

Ключови думи: бял риган, *Origanum heracleoticum* L., етанолови екстракти, добив, дъбилни вещества

1. ВЪВЕДЕНИЕ

Растителните екстракти все по-масово навлизат в хранителната, фармацевтичната и козметичната промишленост поради антимикробните и антиоксидантните им свойства, както и поради нарастващото негативно отношение на потребителите към използването на синтетични консерванти. Високата концентрация на органолептични съставки в екстрактите обуславят по-богат им химичен състав и по-ясно изразената

вкусово-ароматична стойност в сравнение с изходните суровини. Освен това те са бактериално чисти, осигуряват стабилност при съхранение на хранителни продукти, лесно се съхраняват и стандартизират и са по-подходящи за влагане в различни храни.

Екстрактите съдържат летливи и нелетливи компоненти на изходната суровина, разтворими в избрания разтворител. Често се използват при производството на комбинирани и обогатени хранителни продукти [6]. Екстрахираните летливите съставки (етерично масло) придават аромат и мирис на продукта, а нелетливите (каротеноиди, стероиди, алкалоиди, антоцианини, гликозиди и др.) - вкус, цвят, консистенция, пикантност, антиоксидантни свойства [11].

Най-често използван екстрагент в хранително-вкусовата промишленост е етиловият алкохол поради способността му да извлича ефективно редица биологично активни вещества от растителните суровини – флавоноиди, пигменти, етерични масла, витамини и дъбилни вещества [7,9].

Доказаните антиоксидантни и противовъзпалителни свойства на екстрактите от бял риган, дължащи се на съдържанието на дъбилни вещества и фенолни съединения, определят използването на лечебното растение като профилактично средство в борбата с раковите и сърдечно-съдовите заболявания [14,16,18], както и за подобряване на вкуса и аромата на диети, прилагани при пациенти, страдащи от стомашно-чревни заболявания [13].

Целта на настоящото изследване е получаване на етанолови екстракти от българския бял риган (диворастящ и култивиран): проучване влиянието на параметрите хидромодул, температура, и продължителност на екстракционния процес върху добива на екстракт; съдържанието на дъбилни вещества в получените екстракти и степента на тяхното извличане от изходните суровини.

2. МАТЕРИАЛИ И МЕТОДИ

Обект на изследването е български бял риган (*Origanum heracleoticum* L.):

✓ Диворастящ, избран във фаза цъфтеж от южните склонове на Източните Родопи (360 m надм. в.), региона на гр. Ивайловград, обл. Хасково, в края на месец юли 2018 г. Суровината е изсушена при стайна температура, без пряка слънчева светлина, до достигане на влагосъдържание под 10 %. Преди обработка суровината е смилана с лабораторна мелница.

✓ Култивиран (ронен лист), от землището на гр. Първомай, обл. Пловдив, закупен от търговската мрежа, придружен със сертификат за физико-химични и микробиологични показатели.

Влажността на изходните суровини е определена чрез ацеотропна дестилация в лабораторен апарат на Дин и Старк, % [1].

Съдържанието на дъбилни вещества в изходните суровини е определено чрез изчерпваща екстракция с гореща вода при обратен хладник и титруване на получения извлек с 0,1 N KMnO_4 при индикатор индигокармин, % [4].

Като разтворител за екстракцията е използван етилов алкохол (химически чист за анализ) с концентрация 70 %.

Екстракцията е проведена като периодичен процес, без разбъркване при два хидромодула (ХМ) - 1:8 и 1:10. Проследено е влиянието на технологичните параметри температура ($^{\circ}\text{C}$) и продължителност (h) върху добива на екстрактите и върху съдържанието на дъбилни вещества. Стойностите на изследваните технологични параметри са избрани по литературни данни и предварителни наши изследвания.

Суровината е отделена от получените мисцели чрез филтруване на вакуумфилтър. За отделянето на разтворителя от получените мисцели е използван ротационен вакуум-изпарител с водна вакуум-помпа.

Получените екстракти са съхранявани при 4 - 6 °С до анализите. Окачествявани са по добив и съдържание на дъбилни вещества. Добивите са приведени към абсолютно суха маса и сравнени с получените от изчерпваща екстракция при температура на процеса 60 °С. Съдържанието на дъбилни вещества в екстрактите е сравнено с количеството им в изходната суровина.

Технологичните изследвания са проведени в лабораториите на Факултет „Техника и Технологии“ – Ямбол.

Всички опити са проведени в трикратна повтораемост, като стойностите в таблиците и графиките са средно аритметични, представени със стандартното си отклонение. Получените данни от измерванията и изчисленията са обработени в програмен продукт MS Excel ver. 2016 (Microsoft Inc.) при ниво на значимост $\alpha = 0,05$.

3. РЕЗУЛТАТИ И ДИСКУСИЯ

3.1. Окачествяване на изходните суровини

Стойностите, получени при определяне на влажността и съдържанието на дъбилни вещества на изходните суровини са представени в таблица 1.

Таблица 1. Влажност и съдържание на дъбилни вещества в диворастящ и култивиран български бял риган

Показатели	Стойности за диворастящ	Стойности за култивиран
Влажност, %	6,65 ± 0,06	5,98 ± 0,03
Дъбилни вещества, %	20,59 ± 0,12	13,84 ± 0,09

Ниската влажност на изследвания бял риган (под 10 %) е предпоставка за по-дългото му съхранение при запазване на биологично-активните му вещества.

Установено е по-ниско количество на дъбилни вещества в култивираното растение в сравнение с диворастящото, което се дължи на факта, че се преработват само листа от култивиран бял риган.

3.2. Екстракция на диворастящ бял риган

Схемата на проведените изследвания и получените резултати са представени в табл.2. За сравнение на добивите е проведена изчерпваща екстракция на диворастящ бял риган при температура 60 °С (43,83 % ± 0,07).

Таблица 2. Добив на екстракт при екстракция на диворастящ бял риган

№	Температура, °С	Продължителност, h	Добив към изчерпваща екстракция, %	
			Хидромодул 1:8	Хидромодул 1:10
1	20	2	33,65 ± 0,28	40,50 ± 0,26
2	20	4	42,12 ± 0,19	44,99 ± 0,35
3	20	6	43,24 ± 0,29	45,36 ± 0,38
4	20	24	36,57 ± 0,18	41,87 ± 0,16

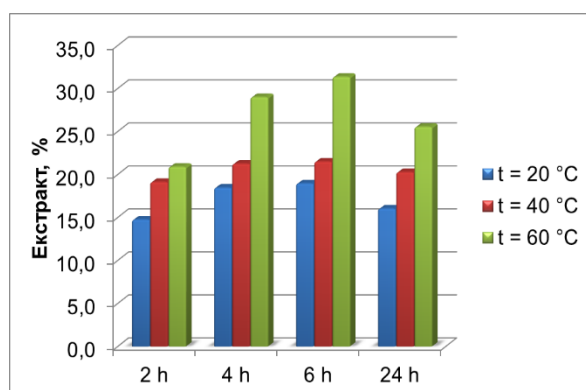
5	40	2	$43,62 \pm 0,17$	$53,68 \pm 0,13$
6	40	4	$48,46 \pm 0,15$	$56,15 \pm 0,03$
7	40	6	$49,03 \pm 0,18$	$59,09 \pm 0,29$
8	40	24	$46,22 \pm 0,23$	$54,83 \pm 0,21$
9	60	2	$47,66 \pm 0,34$	$60,60 \pm 0,37$
10	60	4	$66,14 \pm 0,26$	$71,85 \pm 0,32$
11	60	6	$71,53 \pm 0,24$	$73,56 \pm 0,63$
12	60	24	$58,25 \pm 0,38$	$63,61 \pm 0,13$

Влиянието на температурата и продължителността на екстрахиране е представено на фиг. 1 и фиг. 2. При температура 20 °С, независимо от продължителността на процеса и използвания хидромодул, е отчетен сравнително нисък добив.

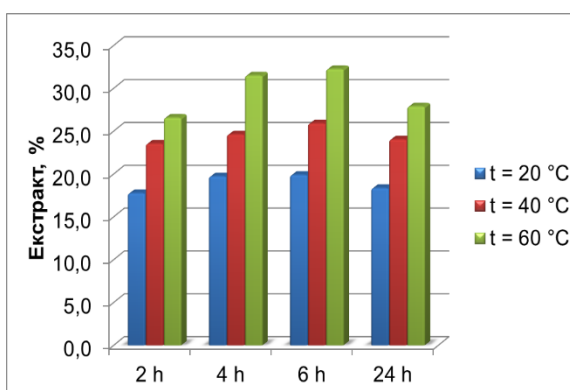
При екстракция за 2 часа се наблюдават най-ниски добиви, като това е установено и за трите температурни режима. При 24-часовата екстракция стойностите са по-ниски от тези, отчетени при 4- и 6-часовата продължителност на процеса. Неефективността на 24-часовата екстракция се дължи на изравняване на концентрационната разлика и протичането на десорбционни процеси от разтворителя към растителната тъкан, като това е установено и при други суровини [2,3,4,8].

При ХМ 1:8 е отчетен по-нисък добив на екстракт в сравнение с добива при ХМ 1:10, което е в сила при трите температурни режима.

Най-високи стойности са отчетени при 6-часова екстракция, ХМ 1:10 и температура 60 °С.



Фиг. 1. Влияние на температурата и продължителността на екстракция при ХМ 1:8 върху добива на екстракт от диворастящ бял риган



Фиг. 2. Влияние на температурата и продължителността на екстракция при ХМ 1:10 върху добива на екстракт от диворастящ бял риган

Количеството на дъбилните вещества в екстрактите от диворастящ бял риган е представено на табл. 3., а степента на тяхното извличане спрямо изходната суровина – на фиг. 3. и фиг. 4. Определено е съдържанието на дъбилни вещества в екстракта, получен при изчерпваща екстракция на диворастящ бял риган (19,07 % \pm 0,11), като то е 92,62 % спрямо това в изходната суровина и е използвано за контрола.

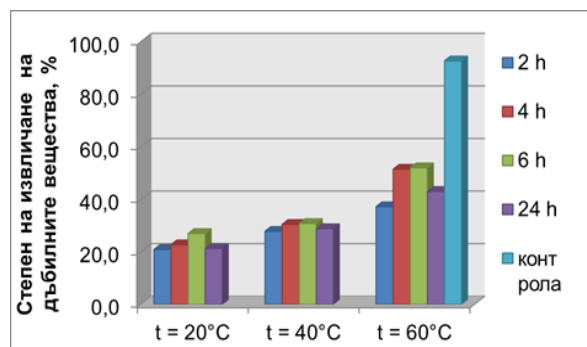
Съдържанието на дъбилни вещества в екстрактите, получени при 20 °С и 40 °С е сравнително ниско, като тази зависимост се наблюдава и при добива на екстракт.

Таблица 3. Съдържание на дъбилни вещества в екстракти от диворастящ бял риган

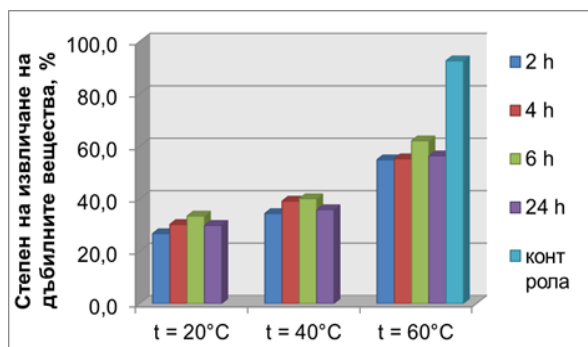
№	Температура, °C	Продължителност, h	Съдържание на дъбилни вещества, %	
			ХМ 1:8	ХМ 1:10
1	20	2	4,29 ± 0,17	5,50 ± 0,12
2	20	4	4,67 ± 0,22	6,22 ± 0,29
3	20	6	5,55 ± 0,09	6,88 ± 0,11
4	20	24	4,38 ± 0,05	6,15 ± 0,19
5	40	2	5,72 ± 0,08	7,08 ± 0,16
6	40	4	6,26 ± 0,24	8,05 ± 0,08
7	40	6	6,34 ± 0,05	8,24 ± 0,06
8	40	24	5,93 ± 0,04	7,38 ± 0,12
9	60	2	7,65 ± 0,08	11,30 ± 0,09
10	60	4	10,59 ± 0,12	11,38 ± 0,15
11	60	6	10,70 ± 0,05	12,79 ± 0,07
12	60	24	8,85 ± 0,14	11,61 ± 0,11

За трите температурни режима, независимо от времетраенето на екстракция, ХМ 1:10 се оказва по-ефективен както за добива на екстракт, така и за съдържание на дъбилни вещества, което съвпада с литературните данни [14].

Влиянието на продължителността на процеса върху съдържанието на дъбилни вещества запазва същата тенденция както при добива на екстракт. Количеството на дъбилни вещества в екстракт, получен за 2 часа е значително по-ниско в сравнение с това при 4- и 6-часовата екстракция.



Фиг. 3. Степен на извличане на дъбилните вещества при екстракция на диворастящ бял риган – ХМ 1:8



Фиг. 4. Степен на извличане на дъбилните вещества при екстракция на диворастящ бял риган – ХМ 1:10

Съдържанието на дъбилни вещества в екстрактите, получени при 24-часовата екстракция е по-ниско, отколкото при 4- и 6-часовата, без значение от температурата на екстракция и използвания хидромодул. Степента на извличане на дъбилните вещества спрямо изходната суровина при 24-часовата екстракция също е по-ниска в сравнение с 4- и 6-часовата, което потвърждава нейната неефективност.

Представените данни показват, че при 20 °C и 40 °C степента на извличане на дъбилните вещества от изходната суровина е сравнително ниска (20,84 – 30,79 % при ХМ 1:8 и 26,71 – 40,02 % при ХМ 1:10). При 60 °C се наблюдава екстрахиране на дъбилни вещества над 50 %, а най-високи стойности са отчетени при ХМ 1:10 и продължителност на процеса 6 часа (62,12 %).

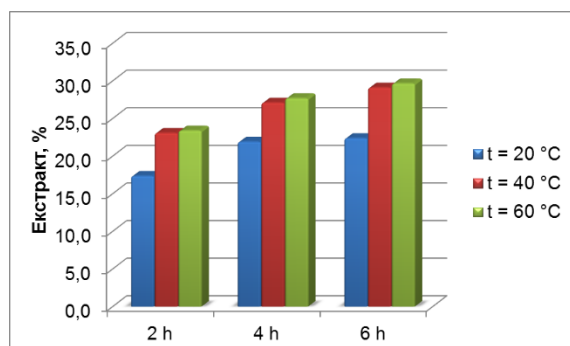
3.2. Екстракция на култивиран бял риган

Схемата на проведените изследвания и получените резултати са представени в табл.4. За сравнение на добивите е проведена изчерпваща екстракция на култивиран бял риган при температура 60 °C (54,04 % \pm 0,12).

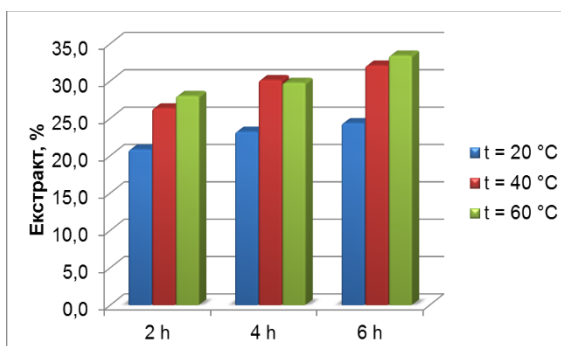
Таблица 4. Добив на екстракт при екстракция на култивиран бял риган

№	Температура, °C	Продължителност, h	Добив към изчерпваща екстракция, %	
			ХМ 1:8	ХМ 1:10
1	20	2	32,12 \pm 0,15	38,53 \pm 0,07
2	20	4	40,54 \pm 0,09	42,93 \pm 0,14
3	20	6	41,41 \pm 0,13	45,04 \pm 0,09
4	40	2	42,71 \pm 0,09	48,72 \pm 0,11
5	40	4	50,15 \pm 0,13	57,38 \pm 0,17
6	40	6	53,87 \pm 0,02	59,31 \pm 0,06
7	60	2	43,28 \pm 0,14	51,79 \pm 0,44
8	60	4	51,24 \pm 0,04	55,72 \pm 0,09
9	60	6	54,89 \pm 0,22	61,81 \pm 0,51

Влиянието на температурата и продължителността на екстрахиране е представено на фиг. 5 и фиг. 6.



Фиг. 5. Влияние на температурата и продължителността на екстракция при ХМ 1:8 върху добива на екстракт от култивиран бял риган



Фиг. 6. Влияние на температурата и продължителността на екстракция при ХМ 1:10 върху добива на екстракт от култивиран бял риган

Както при диворастящия, така и при култивирания бял риган, екстракцията за 2 часа се характеризира с по-ниски добиви в сравнение с 4- и 6-часовата. Поради ниските отчетени добиви при 24-часовата екстракция на диворастящ бял риган, при култивирания такава не е проведена.

Влиянието на използвания хидромодул при екстракцията на култивиран бял риган запазва същата тенденция, както при диворастящия – ХМ 1:10 се оказва по-ефективен в сравнение с ХМ 1:8 за трите температурни режима, установено и при други изследвания [13].

На получените екстракти е определено съдържанието на дъбилни вещества. Количеството на дъбилни вещества в екстрактите от култивиран бял риган е представено на табл. 5., а степента на тяхното извличане спрямо изходната суровина – на фиг. 7 и фиг. 8. При проведената изчерпваща екстракция е определено съдържанието на дъбилни вещества в получения екстракт ($13,02\% \pm 0,09$), което е $94,08\%$ спрямо това в изходната суровина и е използвано за контрола.

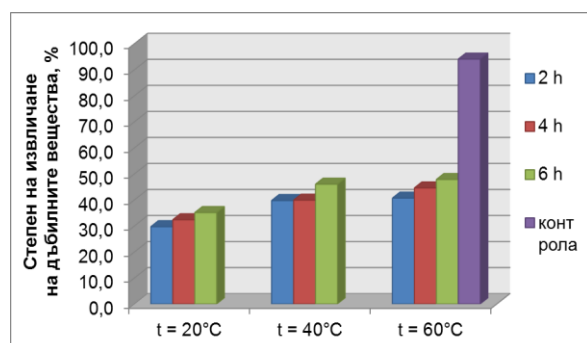
Таблица 5. Съдържание на дъбилни вещества в екстракти от култивиран бял риган

№	Температура, °C	Продължителност, h	Съдържание на дъбилни вещества, %	
			ХМ 1:8	ХМ 1:10
1	20	2	$4,11 \pm 0,22$	$4,98 \pm 0,09$
2	20	4	$4,48 \pm 0,13$	$5,36 \pm 0,22$
3	20	6	$4,86 \pm 0,33$	$6,02 \pm 0,17$
4	40	2	$5,50 \pm 0,12$	$7,33 \pm 0,09$
5	40	4	$5,52 \pm 0,25$	$7,41 \pm 0,21$
6	40	6	$6,37 \pm 0,11$	$7,95 \pm 0,15$
7	60	2	$5,63 \pm 0,09$	$7,14 \pm 0,14$
8	60	4	$6,17 \pm 0,12$	$7,22 \pm 0,26$
9	60	6	$6,62 \pm 0,05$	$8,01 \pm 0,19$

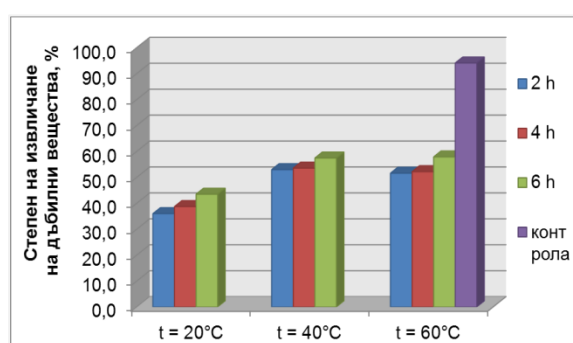
За разлика от диворастящия бял риган, при култивирания са отчетени близки стойности за съдържание на дъбилни вещества в екстрактите, получени при $40\text{ }^{\circ}\text{C}$ и $60\text{ }^{\circ}\text{C}$. По-ниско е количеството на дъбилни вещества в екстрактите, получени при температура $20\text{ }^{\circ}\text{C}$.

За трите температурни режима, независимо от времетраенето на екстракция, ХМ 1:10 се оказва по-ефективен относно съдържанието на дъбилни вещества, както и при диворастящия бял риган.

Продължителността на екстракцията също оказва влияние върху съдържанието на дъбилни вещества. Наблюдава се екстрахиране на дъбилните вещества над 50% при 40 и $60\text{ }^{\circ}\text{C}$, ХМ 1:10 като най-високи стойности са отчетени при $60\text{ }^{\circ}\text{C}$, ХМ 1:10 и продължителност на процеса 6 часа ($57,88\%$).



Фиг. 7. Степен на извличане на дъбилните вещества при екстракция на култивиран бял риган – ХМ 1:8



Фиг. 8. Степен на извличане на дъбилните вещества при екстракция на култивиран бял риган – ХМ 1:10

4. ЗАКЛЮЧЕНИЕ

Българският бял риган съдържа високо количество дъбилни вещества (13,84 – 20,59 %) и е подходяща суровина за получаване на етанолови екстракти.

Най-висок добив при екстракция на диворастящ и култивиран български бял риган със 70 % етилов алкохол се получава при температура на процеса 60 °С, хидромодул 1:10 и продължителност 6 часа. Върху добива на екстракт по-голямо влияние оказва температурата на процеса, отколкото неговата продължителност.

Екстрактите, получени при температура 60 °С, ХМ 1:10 и продължителност на процеса 6 часа са с най-високо съдържание на дъбилни вещества, като при тези параметри те се извличат най-пълно от изходната суровина. Екстрахирането на дъбилните вещества е пропорционално на повишаването на температурата на екстракция и увеличаването на продължителността на процеса.

5. БЛАГОДАРНОСТИ

Настоящите изследвания са резултат от работата по научноизследователски проект (5ФТТ/2016 „Технологични изследвания за получаване на ароматични продукти от подправки“), финансиран от Фонд «Наука» към МОН и Тракийски университет.

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INFLUENCE OF FOOD BY-PRODUCTS ON THE COLOR OF BAKERY PRODUCTS

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Abstract: *The aim of this paper is to analyze the effect of replacing part of wheat flour (4, 8, 16, 24 and 32% for cookies and 4, 6, 8 and 10% for sponge cake) and to measure influence on the color of the cookies and the sponge cake with apple skin powder and grape pomace powder, respectively. The cookies were produced according to the AACC 10-50D method with some modifications, and the sponge cake was produced according to the method presented by Velioglu et al., 2017 with some modifications. Digital image analysis and colorimeter were used to determine the colour change of the samples. Results show that by increasing food by-products (apple skin powder and grape pomace powder), the colour difference between the control sample and other samples was bigger. The colour of the sample measured by digital image analysis covers the entire sample and is more representative and more objective regarding colour measurement.*

Keywords: *cookies, sponge cakes, by-products, colour.*

1. INTRODUCTION

The food industry produces large quantities of waste each year, and their efficient management and use is one of the basic goals of the European Union [4]. This type of waste is a source of: fibers, proteins, carbohydrates, aromatic compounds, etc. [14]. Apple skins is a secondary product that is obtained after the production of canned apples, dried apples, the production of apple puree and apple pie [16,19]. Grape pomace (GP) is the solid residue generated by the wine industry and accounts for about 20-30% of the total weight of the grapes. GP is most frequently used as animal feed or as compost. The chemical composition of GP depends on the type of grapes, the location of the wine plantations, the agricultural mechanical conditions during the growing of the grapes as well as the conditions during the wine production [15].

The group of bakery products includes: bread, cookies, cakes, biscuits (crackers and cakes) and other products containing wheat or other types of flour as the basic raw material. These products are consumed in large quantities on a daily basis and play an important role in human nutrition [9].

The brown color of baked goods and pastries is obtained from melanoids (insoluble dark pigments) and caramel, which are products from the reaction of non-enzymatic browning (*Maillard* reaction and caramelization). When these reactions occur, by-products with potentially mutagenic activity (acrylamide (AA) and hydroxymethylfurfural (HMF)) can also be produced. In addition, there is a loss of part of the nutritional characteristics of the products.

During baking, a crust is formed on the surface of the product. At the beginning of this process the product is light of color (this happens when the temperature on the surface of the baked product is 110°C to 120°C [18]. With the rise in temperature, *Maillard's* reactions and the caramelization process begin to take place (melanoids and caramel are obtained), the crust (surface) of the product is overbaked and eventually a dark-colored product is obtained. The speed at which the color of the surface of products changes depends on the conditions in which the process takes place, the temperature and the duration of baking. Apart from this, the moist content, water activity, pH, etc. also have some influence. It is known that all reactions happen at a certain speed, which depends on the temperature and the concentration of the components included in the reaction. The speed of chemical reactions (chemical kinetics) is related to the change of color in baked goods and pastries during the baking process (kinetic modeling). If the kinetics of non-enzymatic browning reactions are well-known, conditions can be created for improving the quality of food products, maintaining their nutritional values and minimizing unwanted changes which cause the destruction of products. Color sense is a psychological-physical condition that depends on the lighting in the psychological and physical conditions in which the assessor is located. Very often color is a parameter of the food that is first observed and affects directly the choice of the decision whether to purchase a product or not [12].

Color space or Color model is a way to define, create and visualize colors. Depending on the device used, color space is obtained by adding (RGB) and subtracting individual components (CIE $L^*a^*b^*$) [3]. RGB model is defined in three colors: red, green and blue. Each color in this space is created by adding individual components of these three colors. The RGB model is represented in the form of a cube (figure 1) where the red color is represented on the x-axis, the green on the y-axis, and the blue color of the z-axis.

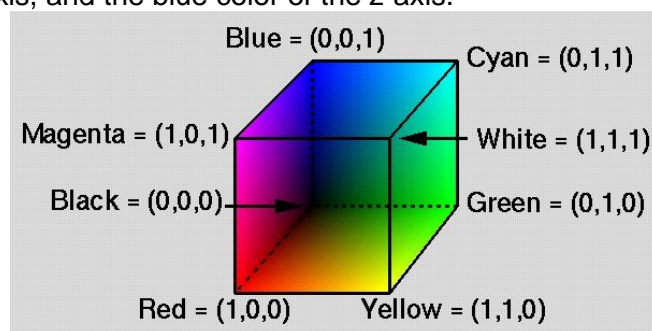


Figure 1. RGB model [6]

The CIE $L^*a^*b^*$ color space determines color by using three components L^* , a^* and b^* (figure 2). The numerical values of these three parameters describe all the colors that can be distinguished by the human eye. CIE $L^*a^*b^*$ is contained in three axes: L^* parameter determines the intensity of the color. According to this parameter it is measured from 0 to 100. The closer the values are to 0 the darker the color of the product is, and the closer the values are to 100, the lighter the color of the tested product is; a^* - shows the relation between the red and green color (negative values show up green, and positive values show up red). b^* shows the relation between yellow and blue color (negative values show up blue, and positive show up yellow) [10].

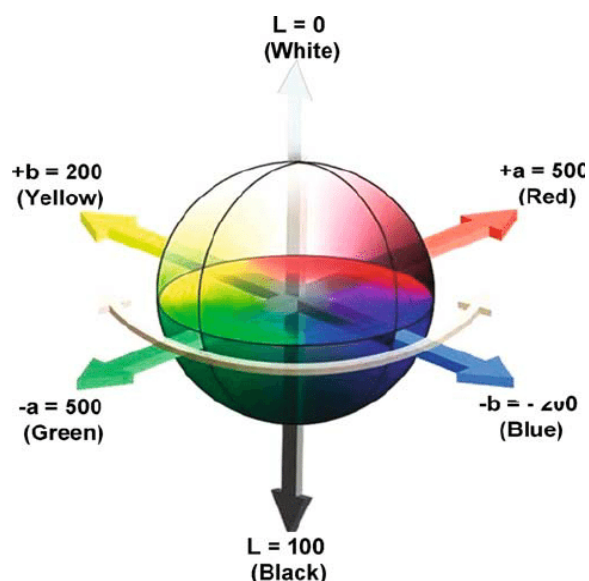


Figure 2 Distribution of the colors in the CIE *Lab* system [13]

The aim of this paper is to determine the impact of the different way of determining the $L^*a^*b^*$ values of baked goods with added by-products (ASP and GPP) in cookies and sponge cakes. The values obtained in the computer processing of the images from the surface of the baking products obtained in RGB will be converted to Lab and compared to the values in the Lab system derived using the color coder Konica Minolta CR-400.

2. MATERIAL AND METHODS

The used raw materials for the production of cookies and sponge cakes are purchased from the local shops in Razgrad, Bulgaria. The cookies were produced according to the AACCC 10-50D method [1] with some modifications, and the sponge cake was produced according to the method presented by Velioğlu et al., 2017 [17] with some modifications.. It was produced six types of cookies (control - 100% wheat white flour and (4%, 8%, 16%, 24% and 32%) of apple skin powder (ASP)) and five types of sponge cakes (control - 100% wheat white flour and sponge cakes with 4%, 6%, 8% and 10% grape pomace powder (GPP)).

2.1. Measuring of color of baked products with computer image processing

The method for determining color by means of computer image processing from samples is presented by Lukinac Čačić J. (2012) [7]. The procedure for determining the color of baked products is in several steps:

1. Digitalization of samples (scanning)
2. Saving of scanned images of baked products in TIFF format
3. Processing and analysis of images using a computer program ImageJ
4. Converting RGB results to CIE $L^*a^*b^*$ model

The samples are digitized using a color scanner EPSON Perfection® V500 Photo. The scanner is set in a dark chamber under controlled conditions (illuminating the sample with different type of light is not permitted). After saving the images from samples in TIFF format, digital image processing commences by using the program ImageJ. The image is segmented by applying the IsoData method. After the segmentation of the image and the removal of the background, the analysis of the color of the baked products follows. By applying amplitude thresholding and a color histogram, the image RGB values results are obtained. These



values are eventually converted to CIE L*a*b* model. The converting of RGB values is first done into CIEXYZ, and then the obtained CIEXYZ values are converted into a CIE L*a*b* model. Converting from one model to another is represented by the following formulas (1-7):

Normalization of sRGB values, whereby $0 \leq R, G, B \leq 1$

$$(1) \quad R = \frac{sR}{255}, \quad G = \frac{sG}{255}, \quad B = \frac{sB}{255}$$

$$(2) \quad \left[\begin{array}{l} R' = \left[\frac{R+0.055}{1.055} \right]^{\frac{2}{4}} \left\{ \begin{array}{l} \text{if } R > 0.04045 \\ \text{otherwise } R' = \frac{R}{12.92} \end{array} \right\} \\ G' = \left[\frac{G+0.055}{1.055} \right]^{\frac{2}{4}} \left\{ \begin{array}{l} \text{if } G > 0.04045 \\ \text{otherwise } G' = \frac{G}{12.92} \end{array} \right\} \\ B' = \left[\frac{B+0.055}{1.055} \right]^{\frac{2}{4}} \left\{ \begin{array}{l} \text{if } B > 0.04045 \\ \text{otherwise } B' = \frac{B}{12.92} \end{array} \right\} \end{array} \right]$$

$$(3) \quad R_s = R' \cdot 100, \quad G_s = G' \cdot 100, \quad B_s = B' \cdot 100$$

With standard values for D65 and 100:

$$(4) \quad \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 0.4124 & 0.3576 & 0.1805 \\ 0.2126 & 0.7152 & 0.0722 \\ 0.0193 & 0.1192 & 0.9505 \end{bmatrix} \cdot \begin{bmatrix} R_s \\ G_s \\ B_s \end{bmatrix}$$

According to formulas 5 and 6 we can calculate L^* , a^* and b^* the coordinates from standard CIEXYZ values

$$(5) \quad X_{ref}=95.811, \quad Y_{ref}=100.00, \quad Z_{ref}=107.304$$

$$X' = \frac{X}{X_{ref}}, \quad Y' = \frac{Y}{Y_{ref}}, \quad Z' = \frac{Z}{Z_{ref}}$$

$$(6) \quad \left[\begin{array}{l} X_s = 7.787 \cdot X' + \left(\frac{16}{116} \right) \left\{ \begin{array}{l} \text{if } X' > 0.008856 \\ \text{otherwise } X_s = (X')^{1/3} \end{array} \right\} \\ Y_s = 7.787 \cdot Y' + \left(\frac{16}{116} \right) \left\{ \begin{array}{l} \text{if } Y' > 0.008856 \\ \text{otherwise } Y_s = (Y')^{1/3} \end{array} \right\} \\ Z_s = 7.787 \cdot Z' + \left(\frac{16}{116} \right) \left\{ \begin{array}{l} \text{if } Z' > 0.008856 \\ \text{otherwise } Z_s = (Z')^{1/3} \end{array} \right\} \end{array} \right]$$

$$(7) \quad \begin{aligned} L^* &= (116 \cdot Y_s) - 16 \\ a^* &= 500 \cdot \left[\frac{X'}{X_s} \right]^{1/3} - \left(\frac{Y'}{Y_s} \right)^{1/3} \\ b^* &= 500 \cdot \left[\frac{Y'}{Y_s} \right]^{1/3} - \left(\frac{Z'}{Z_s} \right)^{1/3} \end{aligned}$$

3. RESULTS AND DISCUSSION

The baking process is one of the most important stages in the production of bakery products. During this process the temperature rises, and physical and chemical changes occur. At a temperature of 50-60°C protein is coagulated, gluten softening, and water releasing occurs; at 60-90°C the leavening agents decompose, and gasses and water turn into vapor, and this increases volume and sponginess of the products; 80°C starch expands to the maximum at a temperature of 160°C sugars caramelize [5].

Table 1 shows the values for $L^*a^*b^*$ determined with the aid of Konica Minolta CR-400 for the color of the surface of cookies with a different content of ASP (4%, 8%, 16%, 24% and 32%) and sponge cakes with different GPP (4%, 6%, 8% and 10%), and Table 2 shows values obtained from computer processing of the surface of the products. First the values are obtained in an RGB model, and then converted into a Lab model.

Table 1: $L^*a^*b^*$ values from the surface of baked products with different quantities ASP and GPP determined with Konica Minolta CR-400

Type of bakery products	% of ASP or GPP	L^*	a^*	b^*
Cookies	0% ASP	76.2±2.42	2.5±0.75	26.3±0.70
	4% ASP	71.1±1.15	3.4±0.42	26.9±1.88
	8% ASP	68.2±1.29	4.6±0.62	27.6±1.64
	16% ASP	68.1±0.94	5.6±1.32	28.4±1.89
	24% ASP	61.8±0.73	6.2±0.48	30.8±3.28
	32% ASP	59.8±1.78	8.0±0.42	33.1±1.06
Sponge cake	0% GPP	56.0±2.53	31.7±0.72	69.7±1.29
	4% GPP	55.0±0.61	33.4±0.47	70.9±1.11
	6% GPP	52.5±1.79	36.0±1.12	71.8±1.60
	8% GPP	52.0±2.07	43.0±1.99	73.7±0.78
	10% GPP	48.7±1.96	74.4±0.34	74.4±1.36

*ASP – Apple Skin Powder, GPP – Grape Pomace Powder; **The means are computed from five repetitions.

Table 2: $L^*a^*b^*$ values obtained in computer processing of baked goods images (by converting the values from RGB to Lab model)

Type of bakery products	% of ASP or GPP	L^*	a^*	b^*
Cookies	0% ASP	60.7±1.28	0.5±0.05	21.5±0.62
	4% ASP	57.8±1.25	1.2±0.43	21.7±0.31
	8% ASP	54.5±1.55	1.8±0.32	22.3±1.09
	16% ASP	53.3±1.01	2.0±0.33	23.1±0.59
	24% ASP	50.9±1.49	4.2±0.23	23.2±0.87
	32% ASP	46.5±0.99	6.0±0.32	26.1±0.65
Sponge cake	0% GPP	45.8±0.12	61.8±0.14	50.0±0.04
	4% GPP	44.2±0.41	62.6±0.09	49.5±0.09
	6% GPP	42.8±0.29	62.4±0.07	49.4±0.07
	8% GPP	42.5±0.05	61.6±0.07	48.8±0.03
	10% GPP	41.6±0.17	61.3±0.05	48.5±0.00

*ASP – Apple Skin Powder, GPP – Grape Pomace Powder; **The means are computed from five repetitions.

Table 1 shows that when a different quantity of ASP (4%, 8%, 16% 24% and 32%) is added to the cookies, the values for the L^* parameter are decreased from 76.2±2.42 for cookies

without added ASP to 59.8 ± 1.78 in cookies with 32% ASP. The decreasing of these values means that the produced cookies become darker when the quantity of ASP increases. On the other hand, the values for parameters a^* and b^* are increased by increasing the amount of ASP in cookies. Lukinac et al., 2015 [8] when adding the apple pomace found that with an increase in the quantity of apple pomace in bread makes it darker, i.e. the values for the L^* parameter decrease, and the values a^* and b^* decrease. Ahmad Mir et al., 2015 [2] used apple pomace, a food industry by-product, for enriching rice crackers. Their results confirm the results obtained from us, i.e. that by adding a larger amount of apple pomace in our case, the new food products are in darker.

Table 1 shows the results from the values obtained for the $L^*a^*b^*$ parameters and for sponge cake with GPP. And when adding this type of food industry secondary product, it was determined that the values for the L^* parameter decrease from 56.0 ± 2.53 for the control sponge cake to 48.7 ± 1.96 for the sponge cake with 10% GPP. The values for parameters a^* and b^* also decrease by increasing the GPP in sponge cakes. If we compare values for parameter b^* for cookies and sponge cakes, we can see that the values for sponge cakes are several times higher. The reason for this is that sponge cakes contain eggs, sunflower oil and margarine, which additionally increase the yellow color of the product.

Adding different types of flours and powder to the wheat flour most frequently used in the production of baked goods causes an increase of the L^* values while a decrease of the values for a^* and b^* . Thus, when adding barley flour to the production of wheat-barley bread Pavlova and Zlatev, 2019 [11] there is an increase of the L^* values and a decrease of the a^* and b^* values. From Table 2 it can be seen that in spite of the different way of color evaluation using a colorimeter or computer image processing, the values for L^* decrease for two types of baked products (cookies and sponge cakes), while the values for parameters a^* and b^* increase.

Figure 1 shows values for L^* , a^* and b^* . The presented values show whether the different way of evaluating the color of the surface of the baked products is statistically significant ($p < 0.05$).

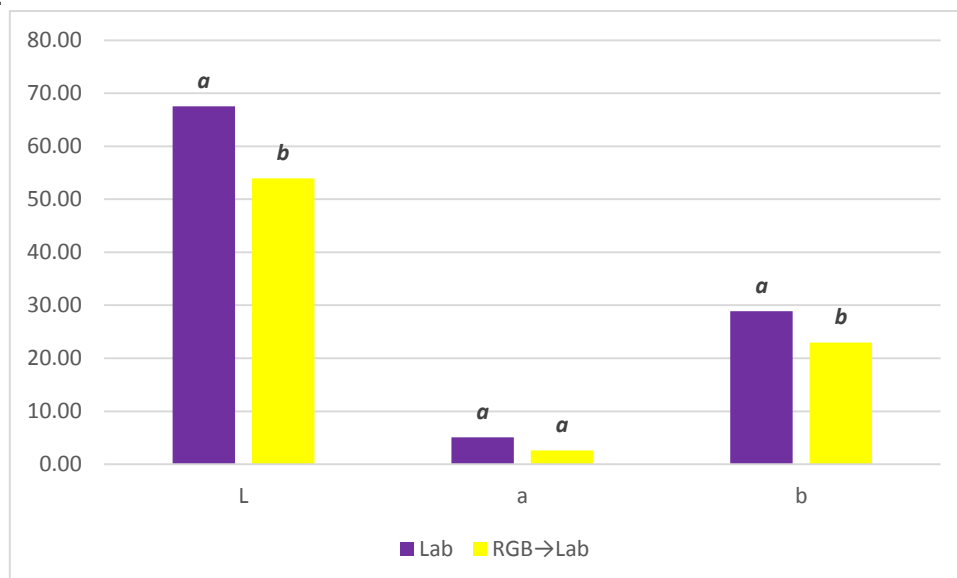


Figure 1. Lab values evaluated with colorimeter and computerized image processing of APS enriched cookies

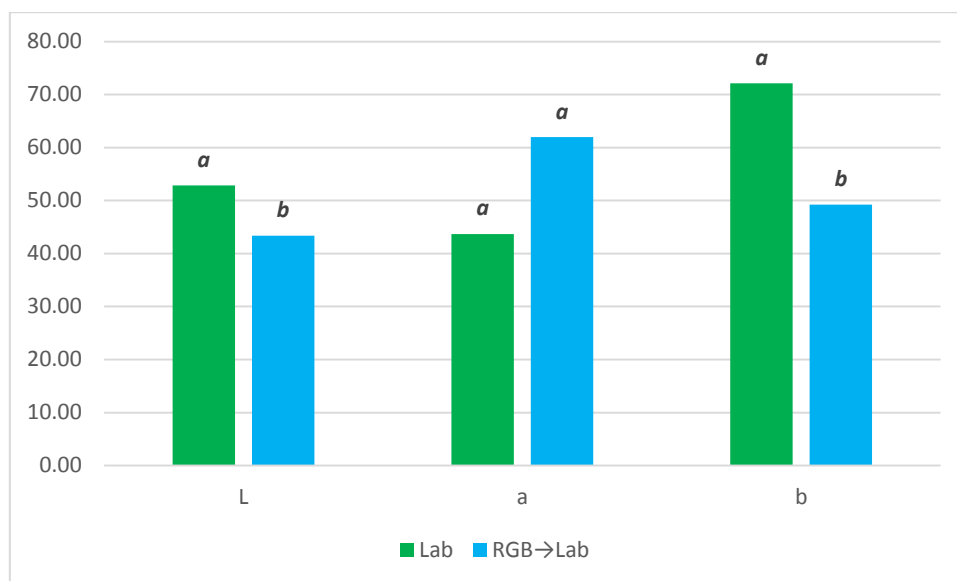


Figure 2 Lab values evaluated with colorimeter and computerized image processing of sponge cakes with GPP

We can see from Figure 1 that parameters L^* and a^* show higher values when evaluating color with colorimeter and are statistically significant ($p < 0.05$) compared with the values for the same parameter obtained by computer image processing. On the other hand, Figure 1 shows that the different manner of evaluating the color does not influence parameter b^* . In Figure 2, we can see the Lab values evaluated with colorimeters and by computer image processing of the produced sponge cakes with GPP. As with cookies and sponge cake with GPP, the different way of evaluating has an impact on the L^* and a^* parameters ($p < 0.05$), and no impact on the parameter b^* .

4. CONCLUSION

Significant differences are observed with the addition of secondary products from the food industry (ASP and GPP), in the color of the surface of the baked products. In addition to the different possibilities for evaluating the color of the baked products, it is determined that the use of the colorimeter gives higher values for the L^* , a^* and b^* parameters, compared to the values obtained by computer analysis of images from the surface of baked products. Nevertheless, the statistical processing of the obtained results shows that there is no statistical difference and significance between the results obtained with the colorimeter and by computer image processing from the surface of the baked products.

5. ACKNOWLEDGMENTS

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EFFICIENCY OF FUNGICIDES IN THE SUPPRESSION OF *Pseudoperonospora cubensis*

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Abstract: *Pseudoperonospora cubensis* is one of the most important cucumber diseases. Its continued appearance in most parts of Europe, Asia and the United States and its persistence represent a significant threat to the production of cucumbers around the world. Although the disease has been successfully suppressed for many years, severe epidemics have been reported since 2004, especially in the United States (Ivanović, M. et al. 2001). Whether this is the result of a change in the pathogen population or changes in the environment, it is currently unknown. The control of the *Pseudoperonospora cubensis* relies on the application of fungicide and the resistance of the host itself to the pathogen. Nonetheless, the resistance of *Ps. Cubensis* is recorded worldwide, and host resistance is no longer sufficient to control the disease as it once was possible. Additional costs on fungicides, along with the potential loss of yield and up to 100% caused by the *Pseudoperonospora cubensis*, endanger the long-term sustainability of cucumber production (Đurovka, 2001).

Knowledge of *Ps. cubensis*, its epidemiology, the process of infection and genetics of the population is currently lacking, which is why it is necessary to encourage future efforts for the development of resistant sorts as well as fungicides in order to successfully combat *Pseudoperonospora cubensis* (Ivanović, et al. 2007). Researching this pathogen can help us understand it, and develop effective measures for diagnosing and suppressing *Ps. cubensis*.

In addition to preventive measures in the protection of cucumbers against plant diseases, the efficiency of fungicides, which suppress *Pseudoperonospora cubensis*, is a limiting factor in cucumber production. Pesticides with the following active substances were used in the study: propineb, metalaxyl + mancozeb, metiram, dimethomorph + mancozeb, azoxystrobin, amethotradine + dimethomorph, azoxystrobin, fluazinam (Vojinović 2014, Vojinović 2015.). The efficiency of the tested fungicides was calculated according to Abbot's formula, and it is 92-97% (Table 1.).

Keywords: *Pseudoperonospora cubensis*, cucumber, efficiency, fungicides

1. INTRODUCTION

Pseudoperonospora cubensis is one of the most important cucumber foliar diseases, causing a significant loss of yield in Europe, USA, China. The pathogen has a wide geographical distribution and has been discovered in more than 70 countries around the world, including environments ranging from semi-arid to tropical (Stojanović, 2004). In addition, *Ps. cubensis* has a wide range of hosts, infecting about 20 different cucurbit species.

Control of *Ps. cubensis* relies on the application of fungicide and the resistance of the host to the pathogen. Nonetheless, the resistance of *Ps. Cubensis* is documented worldwide, and host resistance is no longer sufficient to control the disease as it once was possible. Additional costs on fungicides, along with the potential loss of yield and up to 100% caused by the *Ps. cubensis*, endanger the long-term sustainability of cucumber production (Maksimović, 2011).

Detailed knowledge of *Ps. cubensis*, its epidemiology, the process of infection and genetics of the population is currently lacking, which is why it is necessary to encourage future efforts for the development of resistant sorts as well as fungicides in order to successfully combat

Ps. cubensis (Kostic et al.1965). Researching this pathogen can help us understand it, and develop effective measures for diagnosing and suppressing *Ps. cubensis*.

Symptoms of the disease usually occur on the leaves 5-15 days-old and can be variable, which largely depends on the sensitivity of the sort (Perić, 2012). Symptoms are spotted on the face of the leaf in the form of large polygonal spots. The spots are initially yellow (chlorotic), and later they become necrotic. From the back of the leaf a rare dirty, barely noticeable coat is formed by conidiophores and conidia (zoosporangia) is formed. The tissue in the frame of the pit dries, becomes fragile, it breaks and decays due to the mechanical action of the wind and the rain.

Symptoms of the disease are first detected in the central part of the strains, from where the disease spreads rapidly to the young leaves that dry (Šušić, 2000). Strongly infected plants, due to massive decay of leaves, are completely destroyed. Fruits on such plants are usually not parasitized, but are of poor quality and brittle. Cloves remain green, which is why the diseased leaves do not fall. In greenhouses, due to increased heat and humidity, diseased leaf tissue does not dry, but softens and rots.

2. MATERIAL AND METHODES

For the successful application and selection of pesticides, a good knowledge of certain types of pathogens as well as the basic characteristics of the used pesticides is necessary. The choice of pesticides depends on a lot of things, such as: types and sorts of cultivated plants, age of plantation, spectrum of activity and pesticide efficiency, mechanism of action and persistence, method of exploitation, condition of climatic elements, soil characteristics, plant structure in the crop, the resistance to the pesticides, the availability of machines, proximity to water surfaces, the possibility of mixing with other pesticides, the price of pesticides ...

Protection of cucumber from *Ps. Cubensis* is done from the moment of the seed phase of the plant, until the end of fruiting (Savory et al. 2011). Protecting must be done on time, because this pathogen (*Ps. Cubensis*) can cause enormous damage to the crop. The protection was done on the crops of the household of the Pesic family from Mala Biljanica near Leskovac.

When the cucumber was in the seed phase, it was treated with Propinebum (Antracol WP-70) in order to prevent the development of *Ps. Cubensis* (Photo 1). Propineb is a contact and preventive fungicide from the group of dithiocarbamates. It is used in an amount of 20 grams in 10 liters of water.



Photograph 1: Plantation treated with Probineb

The second cucumber treatment was done when the cucumber was in the development phase of 3 leaves, and on that occasion the application of the "Ridomil Gold MZ 68 WG" containing 2 active substances, mancozeb and metalaxyl-L was performed (Photo 2).

Mancozeb protects the green mass on the surface and has exclusive contact action, while metalaxyl-m very quickly penetrates through the leaf inside the plant. Very soon after application, 30 minutes after application, the plant is completely protected from the outside and from the inside. Due to the pronounced systemicity, metalaxyl-m moves inside the plant tissue in the plant towards the upcoming new green mass. In this way, the plant parts that were grown after treatment with fungicide are protected without additional treatment. Regardless of the pronounced systemic action "Ridomil Gold MZ 68 WG", should be, whenever possible, applied as a preventive, before an established infection. It was used in quantity of 25g in 10l of water per 100m².



Photograph 2: Cucumber in the phase of 3 leaves, treated with „Ridomil Gold“

In the third treatment, when the cucumber was in phase of 4 leaves, a fungicide methram (Polyram DF) was used in an amount of 1.5 to 2.0 kg per hectare (Photo 3). Meteram is a fungicide with selective and curative action, it is completely selective for all grown plants and does not harm bees.



Photograph 3: Completely healthy plant in the phase of 4 leaves

Prior to the fourth treatment of cucumber, there were no symptoms of *Ps. Cubensis*. During this period, it was treated with "Acrobat MZ WG" which contains 2 active substances, mancozeb and dimethomorph. Mancozeb acts preventively and prevents germination of spores on the surface of the leaf, while dimetomorph is local-systemic, it penetrates the plant quickly and prevents the penetration of the fungus through the stomas openings. It is used in the amount of 2.5 kg per hectare.

At the bloom stage, crop treatment was done for the fifth time (Photo 4). This time, the fungicide Fluazine (Nival) was used. It is a contact fungicide with preventive action to suppress the trigger of *Ps. Cubensis*. It is used in the amount of 0.4 liters per hectare. It is also important that he has a 7-day withdrawal period.



Photograph 4: Cucumber crop in the blooming phase

At the stage when the cucumber was greatly fruiting, several treatments were carried out, after each harvest. Fungicides used are azoxystrobin (Quadris) and a combination of dimetomorph and intium (Orvego). Azoxystrobin is a local-systemic fungicide used in the cucumber crop to prevent *Ps. Cubensis*, in an amount of 7.5ml in 2-4l of water (Photo 5). The withdrawal period for this fungicide in cucumber is 7 days.

Azoxystrobin has unique characteristics. A part of the substance gradually penetrates into the leaf, protecting the plant tissue, while the remains stay at the surface of the leaf preventing the emergence of new infections. Azoxystrobin has high fungicidal activity and excellent selectivity for cultivated plants, and is also low toxic for the environment. Azoxystrobin easily penetrates through the cell walls of phytopathogenic fungi and exhibits its activity in mitochondria (cellular organelles) in which all the energy required for fungi is produced. Left without energy, the fungus is dying and the plant re-establishes its normal activity. Azoxystrobin is used exclusively preventively in all crops and plantations, before the onset of infection, and at the latest in the onset of the first symptoms of the disease.

"Orvego" was used to suppress the *Ps. Cubensis*, because it has a very short withdrawal. The withdrawal period for cucumber is only one day.



Photograph 5: Cucumber in the fruiting phase, after treating with Azoxystrobin

3. RESULTS OF WORK

From the very beginning, that is, from planting, until the end of the crop fruiting, great care was taken to avoid infection with the pathogen *Pseudoperonospora cubensis*. All agrotechnical measures were carried out, in time, as well as treatment with chemical preparations, that is, fungicides for suppression of *Ps. Cubensis*. Timely and quality treatment of fungicidal crops has led to very effective suppression of *Ps. Cubensis*, so the pathogen did not endanger cucumber production.

The efficiency of the tested fungicides was calculated according to Abbot's formula and is 92-97% (Table 1.).

$$E = (C - T) / C \times 100$$

E - The efficiency of the tested fungicide

C – number of diseased plants on untreated variant

T - number of diseased plants on treated variant

Table 1: Efficiency of fungicide in suppressing *Pseudoperonospora cubensis*

Number	Fungicide	Active substance	Dose	Efficiency (%)
1.	Antracol WP-70	Propineb	2,5kg/ha	92
2.	Ridomil gold MZ 68 WG	Metalaksil + mankozeb	2,5 kg/ha	94
3.	Polyram DF	Metiram	2 kg/ha	92
4.	Acrobat MZ	Dimetomorf + mankozeb	0,2%	92
5.	Nivaler	Fluazinam	0,4 l/h	94
6.	Quadris	Azoksistrobin	0,75 l/ha	95
7.	Orvego	Ametoktradin + dimetomorf	0,8 l/h	97
8.	Control	/	/	0

4. CONCLUSION

The constant appearance of *Pseudoperonospora cubensis* in much of Europe, Asia and the United States and its persistence present a significant threat to the production of cucumbers around the world. Although the disease has been successfully suppressed for many years, severe epidemics have been reported since 2004, especially in the United States. Whether this is the result of a change in the pathogen population or changes in the environment, is currently unknown. Therefore, we must examine the changes that have taken place in the pathogen population, environmental factors, and how the relationship between the pathogen and the environment influences the relationship between the host plant and pathogen and the development of the disease itself. Although many studies have been done on *Ps. cubensis*, this is not enough and additional research is needed to provide information on the possible evolutionary changes in the pathogen, which may be the cause of greater virulence.

An integrated, sustainable approach is needed, which includes all the factors that influence the development of the disease (pathogen, host and environment) and, as such, would be essential to suppress, control and predict possible *Pseudoperonospora cubensis* epidemics in the future. From this, manufacturers would greatly benefit because more effective fungicides for suppression of *Ps. cubensis* would be invented, as well as the development of effective systems for the prognosis of the disease. In short, research efforts that contribute to the development of sustainable management strategies should be a priority in order to ensure long-term and sustainable crop production as well as other agricultural crops.



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DIGITAL TRANSFORMATION IN COMPANIES OF FOOD INDUSTRY IN BULGARIA: CHALLENGES AND TRENDS

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Abstract: *The purpose of this study is to investigate how companies from food industry in Bulgaria cope with the challenges and trends of the digital transformation. The analysis is based on data from specialized literature and statistics of NSI, EUROSTAT, Siemens and GBCIC, McKinsey Global Institute, IFAC, etc. to draw a comprehensive picture of the degree of digitization penetration in the enterprises of the food industry in Bulgaria. The results illustrate the complexity of the digital transformation of enterprises of food industry in Bulgaria and the challenges they are facing in their digital transition. This study can be a reliable reference for the industry to understand the current situation and the challenges of digitization.*

Keywords: *food industry, digitization, Industry 4.0, Internet of Things.*

1. INTRODUCTION

Encountering significant challenges referring fluctuations in demand and dynamically changing culture of the modern consumer, food processing companies are now facing the need for a comprehensive review of their current strategies. Along with these market factors, there are new technological paradigms that require re-thinking of production systems and their ability to interact with other elements in the value chains of the companies.

The purpose of this study is to investigate how Bulgarian food companies are coping with the challenges and trends of digital transformation.

2. EXPOSURE

Food industry is traditionally a highly developed industry with a significant place in the country's economy and exports. [10] According to the NSI [13], about 73 404 people now work in the enterprises of the food industry. According to EUROSTAT [14], the value of production is EUR 4 110 million, the number of officially registered enterprises is 5 383, the turnover of enterprises is EUR 4 661.5 million.

The significant share of food industry in the country's economy (in terms of value added, employees, exports), its better adaptability and more stable and dynamic development than other industries in the context of European membership place the industry in the group of priority sectors of the national economy.[7] The industry is a priority for the country in terms of attracting foreign investment and innovation. [11]

Digitization plays a key role in the massive transformation of the food industry. Along with traditional trends in this industry, including product safety and quality control, sustainability, water, resource and energy efficiency, other features are also being overseen such as an increasing level of automation and robotics, implementation of connected and intelligent production systems, cloud platforms, collecting and processing massive amounts of data, etc. Digital technologies and the opportunities they create will be the driving force for success in an increasingly digital future.



By implementing a wide range of IT and communication innovations in their productions, food processing companies are seeking to increase their economic potential and meet the requirements of new global concepts such as Industry 4.0 and Internet of Things.

The McKinsey Global Institute identifies Industry 4.0 (the Fourth Industrial Revolution) as the age of “cyber-physical systems” - systems that integrate computation, networking, and physical processes and include a myriad of technologies that span mobile devices, the Internet of Things (IoT), artificial intelligence (AI), robotics, cyber security, and 3D printing. [3] It is associated with many opportunities and challenges for enterprises of food industry, and the integration of new technologies aims to significantly improve their quality, efficiency and competitiveness.

Any company that finds it difficult to meet the requirements of this new production order encounters additional difficulties in bringing new products, services and other innovations to the market. [6] This phenomenon is becoming even more pronounced in the food industry, which is one of the pillars of the modern economy and is fully subordinated to the increasingly demanding consumer tastes.

According to a study by Siemens Bulgaria and the German-Bulgarian Chamber of Industry and Commerce (GBCIC), managers from 76 companies in Bulgaria believe that digitization can bring significant benefits if only it is based on a long-term digital strategy as a part of a common business strategy, rather than as a series of uncoordinated experiments. According to the survey, nearly 2/3 of the companies surveyed stated that they had a complete (11.8%) or at least partial (53.9%) digital strategy. At the same time, one third of the respondents admit that they do not have such a strategy. [12]

The increasing rate of digitization [9] and the almost endless diversification of assortments in the various subsectors of the industry in terms of modifications, search opportunities, supply modes, variations in production volumes and even customization of mass production products require the need for high flexibility, efficiency and productivity of technological equipment.

Companies in Bulgaria are at different stages of implementing digital technology in their business operations. In general, companies in Bulgaria have taken or are taking steps in this direction, most of them still in the initial or intermediate phase. In terms of investments in digitization, a significant proportion of the companies surveyed (40%) in the survey of Siemens and GBCIC plan to invest on average between 2 and 3 percent of their turnover in such technologies. Just over 15 percent are companies planning to invest in digital technology at 7-10 percent of turnover, and below 5 percent are companies that plan to exceed this percentage. [12]

A study [4] by the International Federation of Automatic Control (IFAC) highlights some of the major trends in the transformation of the food sector in recent years. The most important areas in which manufacturing companies in this industry are focusing their efforts are identified. These are: water resource management; traceability; sustainability; robotics; risk management; increase in productivity; optimization of product design; Internet of Things; introduction of “green” technologies and transition to “green” factories; environmental protection; stimulating the use of emerging technologies; overall efficiency; biotechnology; managing large data sets.

The trend in the market demand for food products in recent years, which also determines the technological development of manufacturing enterprises in the industry, is the direction of the demand-driven supply chain [1]. It has changed so that today consumers directly tell manufacturers what they want to consume.

At the heart of this “chain reversal” is the pursuit of satisfying increasingly individual tastes rather than the supply of standard products to the general public.

To make this vision a reality, the individual elements of the production networks must be able to exchange information and interact autonomously. The result is a connected system in which all processes are fully integrated with the equipment and decision-making units.

A clear indicator that speaks about the impact of digitization on food industry is the globalization of the industry [5] in contrast to the local focus of the manufacturing and distribution in the past. Today, globalization has completely changed the way products reach consumers, which has a direct impact on production networks and supply chains. One of the trends in the digitization of the industry is the continued pursuit of survival and competitiveness in a dynamic and highly oversaturated global market.

Factors that influence the efficiency and productivity of enterprises in this sector are the price pressure of raw materials, as well as the commitment to the consumer to continuously diversify the product range.

In general, Bulgarian companies do not expect a significant impact on the number of employees due to the introduction of digital technologies. Regarding the demand for new staff and skills, the analysis of the answers in the survey of Siemens and GBCIC shows that companies in Bulgaria are looking for or will be looking for specialists in technological fields such as Industry 4.0/production automation (43.4%), development of mobile applications (32.9%) and analysis of large amounts of data (32.9%). At the same time, it is noticeable that no less a focus is placed on strategic competencies related to the development and implementation of new business strategies, including the development of digital business models (40.8%) and digital marketing (46.1%).

Employee qualification and the amount of investment are a major obstacle for the Bulgarian business in terms of further implementation of digital technologies and processes. Insufficient technology maturity and unclear economic benefits are also hindering companies in Bulgaria in their digital transformation. In addition, business believes that a larger integration of digitization is needed in the corporate strategy, and an assessment and analysis is required regarding the economic effects and processes of digitization. [12]

For many global companies part of the actions needed to implement concept like Industry 4.0 is adopting unified technology solutions across all local manufactories, as well as homogeneous KPIs, to easily and transparently measure results from the investments made. When manufacturing is connected and intelligent it opens up opportunities for improving staff safety and employee well-being, including enhancing the security of various devices, machines and equipment and providing the necessary systems for equipment monitoring. Achieving greater environmental sustainability is associated with minimizing waste and harmful emissions from production, optimizing production capacity through more efficient utilization of available resources, etc. Achieving all these goals also allows for further reduction of operating costs.

A key task in terms of product safety and quality is the provision of impeccable material, product and process traceability [8]. In this direction comes the assistance of the most advanced means of industrial automation, marking, labeling, barcode reading, visual inspection, machine vision, etc.

The ultimate goal of digitization is the implementation of the concept of completely paperless factories [2], in which all information flows and data sets are digital and are generated, processed and managed in virtual platforms that interconnect the individual elements of production systems and facilitate multidirectional communication among them. Not only does automated data collection and processing reduce human labor, but it also reduces the risk of errors.

3. CONCLUSION

In summary of the analysis of the specialized literature and statistics surveyed, it can be stated that most of the enterprises in the food industry in Bulgaria see the digitization as a way to optimize the use of resources, to automate their production, to improve their interaction with customers and suppliers, and integrate their processes. In the coming years, the enterprises will need besides technology and engineering professionals, also experts

with strategic competencies, specialists who can develop digital business models and digital marketing.

And although most enterprises are aware that digitization is becoming a mandatory part of business in Bulgaria, most of them do not have an overall digital strategy.

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EFFECTS OF DIFFERENT IRRIGATION TECHNOLOGIES ON IRRIGATION SCHEDULING AND PRODUCTION OF ONION

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Abstract: *Fields studies were conducted in 2014-2015 on the territory of the experimental field Chelopechene to IPAZR "N. Poushkarov" on leached cinnamon forest soil. They were examined variants with different irrigation technologies in an optimal and reduced irrigation regime of onion: V_1 - mikrosprinkler irrigation equipment - 100% irrigation rate; V_2 - subsurface drip irrigation - 100% irrigation rate, V_3 - subsurface drip irrigation - 50% irrigation rate; V_4 - surface drip irrigation - 100% irrigation rate; V_5 - surface drip irrigation - 50% irrigation rate; V_6 - non-irrigated option. Reduction the irrigation rates by 50% at surface and subsurface irrigated results in a reduction in yield by 23 and 7%, and can be used when have water deficit.*

Keywords: *technologies for irrigation, onions, irrigation regime.*

1. INTRODUCTION

The interest of onion grew production in Bulgaria and abroad has increased during the last ten years. Conducted studies and experimental results from various independent research (Bekele et al, 2007, CC Shoke et al 2000, A. Kadayifci, et al, 2005, Mitova, Iv, all 2016, A. Mermoud, et al., 2005) show that this culture is sensitive to water shortage and mineral fertilization in the soil during the formation of the bulb and less sensitive during the maturation phase. Many studies have been conducted on the "water-yield" link, one of them Kumar et. al., 2007; have found that the application of an irregular irrigation regime with a reduction of the irrigation rate by 20 and 40% of the optimal results in a yield decrease with 14% and 38% and irrigation water shortages, respectively, can be successfully implemented. In the case of drip irrigation, in order to have an even distribution of the water supplied to the plants, it is necessary to correctly select the characteristics of the irrigation wings. The purpose of the hydraulic dimensioning of the PT is to determine their L_{PT} length so that the allowable pressure difference PT is within the adjustable range of the droplets and the speeds are initially lower than the maximum allowable according to the design rules. (Georgiev, D. 2015)

Preliminary studies of onion irrigation technology of IPAZR "N. Pushkarov" experimental field in Chelopechene have not been carried out yet.

The aim of the present study is to investigate the effect of various micro-irrigation technologies (drip irrigation and micro-stream) at onion production on cinnamon forest soil.

2. METHOD

Field experiments were conducted on the territory of IPAZR "N. Pushkarov " experimental field in Chelopechene, near to Sofia. The soil was Chromic Luvisols typical of the Sofia area (42.6°, 550m above sea level), is situated of temperate continental climate zone in Europe. It was found that mechanical compositions of these soils were medium to heavy. The water-physical properties of this subtype soil are average for the layer 0 – 0,50 m depth are the following: field capacity (PPV) - 22.0% relative to the weight of the absolutely dry soil; soil volumetric weight at PPV - 1,47g/cm³

The subject of the study: The micro-irrigation technique

Experiment betting method: Non-standard two-factor block method in four iterations.

Irrigation: Drip irrigation (surface and subsurface) and micro-sprinkler.

Meteorological factors

Crucial for crop cultivation meteorological factors:

- air temperature and rainfall

Outdoor air temperature is measured yearly at 7, 14 and 21 hours. Daily average values of the indicators were calculated on the basis of measured values. Rainfall was reported on the meteorological landing territory yearly.

Fenological research begins from the beginning of the bulbs planting and takes place during the growing season: The onion development main stages are germination, increased growth, ripening of the heads.

The following options are set (Figure 1)

Variants

V₁ - mikrosprinkler irrigation equipment - 100% irrigation rate

V₂ - subsurface drip irrigation - 100% irrigation rate,

V₃ - subsurface drip irrigation - 50% irrigation rate

V₄ - surface drip irrigation - 100% irrigation rate,

V₅ - surface drip irrigation - 50% irrigation rate

V₆ - non-irrigated option.

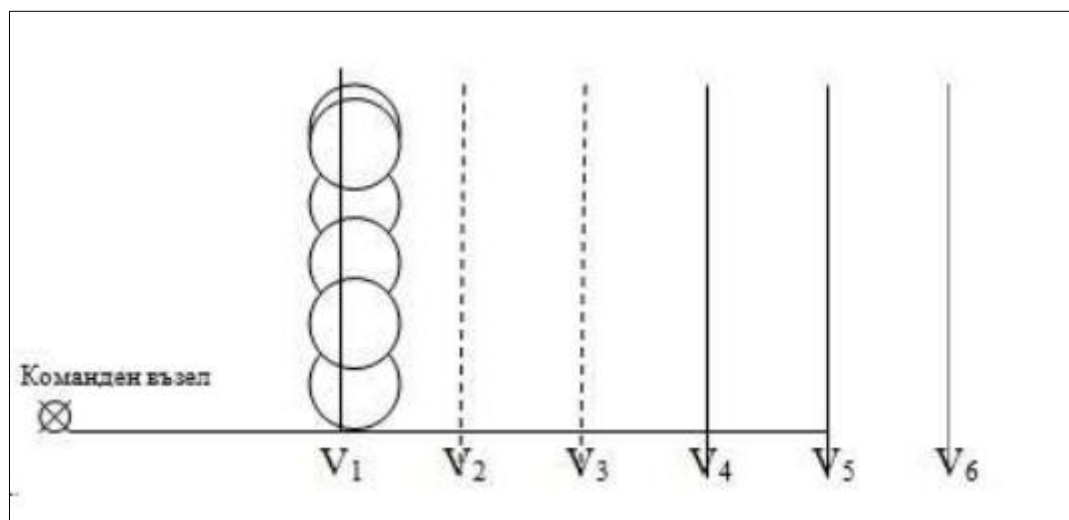


Figure 1. Experiment placement scheme.

Determination of irrigation rates. Monitoring of the soil moisture dynamics - soil samples are taken over 7 to 10 days at a depth of 50 cm through 10 cm in three replicates and processed using the classic thermostatic weight method. Obtained results on the basis of the soil humidity, the required irrigation norms are filed using the Formula (1).

Irrigation scheduling

The irrigation norm was being calculated using the formula Kostiakov:

$$m = [10H \cdot a \cdot (\delta^{FC} - \delta^{80\%FC})] \cdot K.$$

where,

m - irrigation norm in mm; a - soil density in gr/cm³; H - depth of the active soil layer in m (H = 0,30 m); δ of PPV - marginal land moisture in% relative to absolute dry weight of soil, % of

soil moisture content in % relative to absolute dry weight of soil; K -reduction coefficient of irrigation rate by plants occupied area in 1da.

The yield was determined in four replicates for each variant in kg/dka. The statistical processing of the yields was performed on the ANOVA (Analysis of variance) dispersion analysis for each experimental year.

3. MATERIALS AND METHODS

Climatic characteristics of the experimental years 2014 - 2015

The crucial main factors of optimal yield formation are the average daily air temperature and rainfall. Rainfall is one of the limiting factors for sustainable yields. Because of their unevenness during the vegetation period of onion, the application of irrigation was necessity. Regarding the climatic factors for the study period, the two experimental years differ significantly. Provision rain fall determination and average daily temperatures was done over a period of 60 years (1955 - 2015). Regarding to the amount of fallen rainfall during 2014 (Fig. 2) characterized as very humid with $p = 2.82\%$ and rainfall amount 629.5mm and medium wet 2015 year with $p = 62.42\%$ and rainfall 321mm. On (Fig. 3) are presented the amount of rainfall for ten days for 2014/2015 years. The annual average daily air temperature is proportional to soil temperature and influences the rate of flow of plant life, on the intensity of photosynthesis.

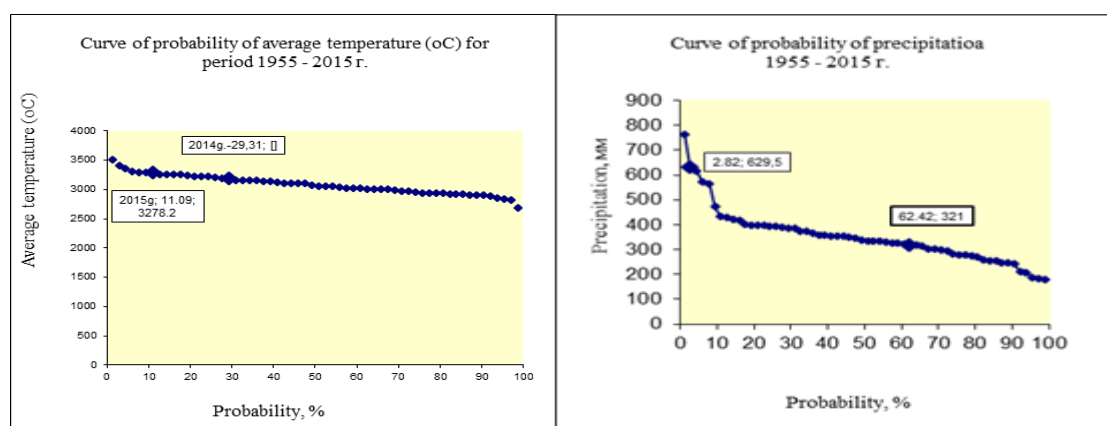


Figure 2. Provided curves for average daily air temperatures and rainfall for the period 1955 - 2015.

Regarding air temperature, the years 2014 and 2015 are very warm with $p = 29,31\%$ (2014) and $p = 11,09\%$ (2015) with temperature sums of $3183,2^{\circ}\text{C}$ and $3278,2^{\circ}\text{C}$. (Fig.2) These norms are above the average for the Sofia region with positive deviations of 3.40% and 6.40%. The hottest are the months of July and August, which coincides with the position of the laid down of the lying stems and has a favorable effect on the ripening of the bulbs.

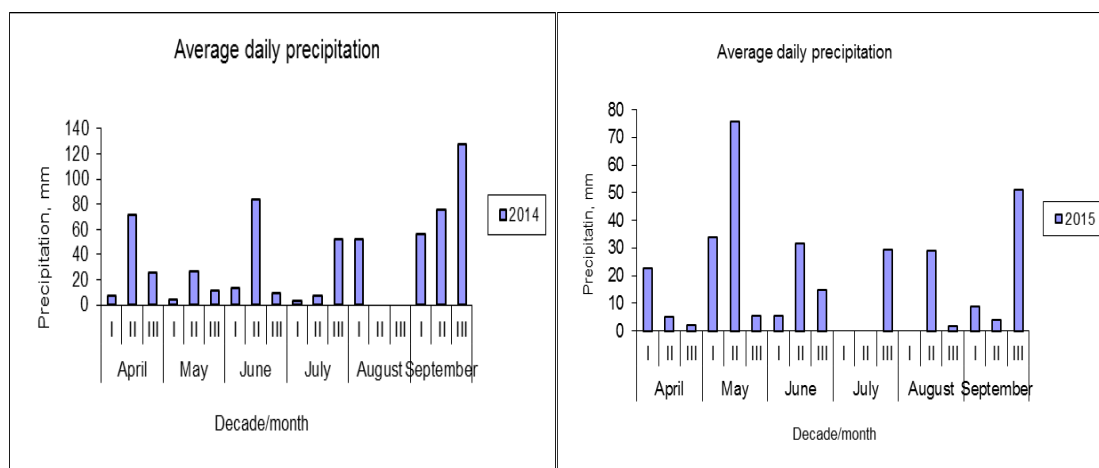


Figure 3. Distribution of rainfalls for the period April - September 2014 – 2015

4. PHENOLOGICAL RESEARCH

The 2014 onion set was planted on March 26 and in 24.042015 was planted onion sort “Stuttgartrizen”. After about two months the onion was ready for green sale. The beginning of bulb growth was about 10.06 (2014) and 25.06 (2015). The yield harvesting during the two experimental years occurred in the first ten days of August 01 - 06 .08. 2014/2015. On (Table 1) are shown the main phases of cultural development. The seed onions planting later in 2015. had no effect on harvesting. Higher soil and air temperatures in May helped to grow faster than in 2014.

Table 1. Characterization of onion phenophase - mature period 2014-2015 year

Year	Planting	Sprouting	Intense grow	Ripening the bulb		
				Beginning	Start of Head Chapters/ Mass position of the lying stem	Yield collecting
2014	26.03	30.03	20.04	26.05	10.06/15.05	1.08
2015	24.04	29.04.	1.05.	15.06	25.06/20.07	06.08.
FAO56	85/114	89/119	110/121	146/135	161/135//176/201	213/218

The vegetation period of onion “Stuttgartrizen” variety is 130 (2014) and 110 (2015), on average 120 days.

5. IRRIGATION SCHEDULING

In order to ensure normal development of the seed onions to the onion- mature, it is necessary to maintain an optimal soil moisture. Pre-humidity outdoor cultivation during different stages of development is different. Soil moisture and air content during germination and intense growth of onion is particularly demanding and it is necessary to maintain over 80-90% of PPV. During May-June, when the soil is drought, the growth of onions slows down and this leads to loss of yield. For better development of the bulb after plantings applied irrigation with irrigation rate 10m³/da. Upon drying of the top layer 0-5 cm 3-5 days after planting, a second watering is made regardless of the soil moisture in the lower layers. Better technique for watering is micro-irrigation, it causes a more uniform wetting of the soil surface.

Depending on the weather conditions in 2014/2015 1/2 irrigation and 6/6 irrigation were carried out with the three irrigation techniques. In the 100% irrigation option averages over the 2014-2015 period for the vegetation period 6 count with inter-irrigation periods of 10-15 days with irrigation rate for surface drip, subsurface drip and micro-sprinkler were realized respectively 15/13 and 20 m³/da. At subsurface drip irrigation, decrease in evaporation from the soil surface and a reduction of the irrigation rate by 15% was found compared to the surface position of the irrigation wings. Irrigation decrease variants with 50% of irrigation rate are respectively 7.4 (45) / 6.5 (39) and 20.8 (125) m³ / da. (Table 2). Bulb shaping, when the licking stem begins to soften, the irrigations stop and wait 15-20 days to grow the bulb. At 3-4 sheet phase, an ammonium nitrate feed is required, at a rate of 15-20 kg / da. (depending on soil chemical characteristics). When manna is observed, preparations are used, e.g. Ridomil Gold 0,25%.

Table 2. Irrigation scheduling elements for 2014 and 2015.

Years	2014			2015			Average for the period 2014/2015.		
	Number of irrigation	Irrigate. norm m ³ /da	Irrigation rate m ³ /da	Number of irrigation	Irrigat.norm m ³ /da	Irrigation rate m ³ /da	Number of irrigation	Irrigat. norm m ³ /da	Irrigation rate m ³ /da
Subsurface drip Irrigation									
100% irrig. Norm	6	15,0	90	6	10,8	65	6	13	78
50% Irrigate. norm	6	7,5	45	6	5,4	32,4	6	6,5	39
non-irrigation	0	0	0	0	0	0	0	0	0
Surface drip irrigation									
100 % irrigate. Norm	6	17,0	100	6	12,5	75	6	14,8	90
50 % Irrig. Norm	6	8,5	50	6	6,3	37,5	6	7,4	45
non-irrigation	0	0	0	0	0	0	0	0	0
Micro-sprinkler									
micro-irrigation	6	24,0	140	6	17,5	105	6	20,8	125

6. YIELD

The magnitude of the yields of the tested variants irrigated by drip irrigation and micro-sprinkler different. On average for the experimental period 2014/2015 micro-sprinkler irrigation with in the 3-meter planting scheme and a distance between and in the lines of 0.30/0.10, the highest average yield was 3100 kg/da. Irrigated variants with subsurface drip irrigation at a planting scheme of 0.20/0.10m and traces of 0.50m 3000kg/da, in the case of surface drip irrigation 2820kg/da. (Table 4). The irrigation rate decrease with 50% affected the yield in both years. The following average yields were 2680kg/da in subsurface drip

irrigation and 2318kg/da in surface irrigation. When naturally wetted, a yield of 2170 kg/da was obtained.

7. RESULTS OF THE DISPERSION ANALYSIS

The betting method in 2014/2015 in Chelopechene experimental field with different irrigation technologies on onion growing is an unconventional two-factor block method with four reps. To demonstrate the impact of the different irrigation standards on yield, the results obtained from the four iterations of the variant were subjected to a dispersion analysis. The significance of the differences obtained and the interaction of the factors was proven. The interaction between the factors of the experiment in terms of the indicators tested is demonstrated by the Fisher criterion in (Table 3).

Table 3. Dispersion analysis for onion extraction of onion on different irrigation technologies in 2014-2015.

Options	Yield	Differences		Proof
2014	kg/da	kg/da	%	
V2 - subs. 100%	3330	919	38	+++
V3 –subs. 50%	3017	606	25	+++
V4 - surface area 100%	3140	729	30	+++
V5 - surface area 50%	2671	260	11	++
V6 - non-irrigated	2410	St.	-	/
GD _{5%} =132,40 kg/da		GD _{1%} =185,63 kg/da		GD _{0,1%} =226,36 kg/da
Options	Yield	Differences		Proof
2014	kg/da	kg/da	%	
V2 -100% subs. Irrig.	2 855	924	48	+++
V3 - 50% subs. irrig.	2 342	411	21	+++
V4 - surface area 100%	2 504	573	30	+++
V5 - surface area 50%	1 964	33	2	+
V6 - non-irrigated	1 931	St.	-	/
GD _{5%} =114,60 kg/da		GD _{1%} =160,68 kg/da		GD _{0,1%} =227,10 kg/da

From the statistical estimations set out in the experiment with different irrigation technologies and different water supply, it can be seen that:

Variants V₂, V₃, V₄ - are significantly different from non-polluting version V₆ - with a confidence level P = 0.1% and are marked with three plus, the difference is very well proven. Option V₅ - 50% has a simple proof (+) with confidence index P = 5%.

In all four irrigation modes, yields are higher than the non-irrigated option. The yield of 100% water supply in both the irrigation wings is high and differs from the non-irrigated variant by 43% and 30%, respectively, which proves that the onion is a moisture-loving crop and in our climatic conditions for better quality and quantity needs irrigation. Reducing irrigation rates by 50% leads to a decrease in yield by 23% (V₃ - 50%) and 7% (V₅ - 50% area).

8. CONCLUSIONS

1. Subsurface drip irrigation SDI has a better effect on the development of green onions, but in the case of micro-sprinkling irrigation in both years the productivity is higher. Its yield is 3100 kg/da, followed by 100% irrigation subsurface drip irrigation 3000 kg/da and surface drip irrigation – 2820 kg/da, in non-irrigated variant 2170 kg/da.
2. Lowering the irrigation rate by 50% resulted in decreased yields of 23% and 7%. In case of a water deficit, this mode can be applied.
3. The yield of 100% water supply in both ways of laying the irrigation wings is high and differs from the non-irrigated version by 43% and 30% respectively, which proves that the onion is a moisture-loving crop and under our climatic conditions for better quality and quantity needs irrigation.
4. The difference in soil moisture in the layer 0 - 30 cm in subsurface drip irrigation compared to the surface drip irrigation is in the order of 20-30%.

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DETERMINING THE NATURE OF COMPETITION IN BULGARIAN FOOD INDUSTRY

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Abstract: *The highly competitive environment for the food industry after the accession of Bulgaria to the European Union puts companies under conditions where the focus is on the quality and products safety. Both the competitiveness theory and the topic of food safety have been widely discussed in recent years, and research in this area is growing, but there is a lack of in-depth information in the Bulgarian literature on the relationship between competitiveness ↔ food safety systems and the open question of how strategies food safety would increase corporate competitiveness. Examining this relationship, it is possible to uncover those factors stemming from the requirements of food safety systems, the improvement of which can help the food industry companies to increase their competitiveness. The subject of the study is the different approaches and methods of assessment and analysis outlining the opportunities for increasing the competitiveness of enterprises from the food industry through the implementation of food safety systems. The report aims to reveal the interrelationship between competitiveness and food safety systems and the implementation of methodologies to increase their competitiveness. The study and assessment of factors to improve the competitiveness of food business enterprises through the implementation of food safety systems is based primarily on expert judgment as well as on marketing and diagnostic analysis. Emphasis is placed on factors that arise from the requirements of food safety systems and a few extras that are important for the formation of strong competitive advantages.*

Keywords: *competitiveness; products safety; food industry; competitive advantages*

1. INTRODUCTION

Competition is a driving force and an incentive to increase the efficiency of business operations. It is an integral part of the market economy and should be considered in relation to the market as a whole system [1]. Since competition is a competition between different business entities, it allows for the most efficient use of resources and the most successful organization of business to achieve the ultimate goal of making more profits [2]. Competition can be defined as a driving force for the development of society. It provokes the use of the best of abilities and knowledge, leads to increased human wealth and diversity, leads to rational behavior on the part of sellers and buyers, and rational use of resources [3],[4]. According to Joseph Schumpeter, in the economic system, the new combinations make their way, defeating the old ones, and for him this process is the basis of competition. Enhancing the ability of enterprises to meet standards more stringently is likely to create new forms of competitive advantage [5]. In this regard, research has been carried out on some sectors - Spring and Isaac emphasize the fundamental importance of food safety to the competitiveness of the meat industry in Australia, Canada, the UK and the United States. Issues related to increasing business competitiveness are particularly relevant as they affect in particular the food industry and, more generally, they are also linked to national competitiveness [6], [7].

Under increasingly sophisticated market relationships, the success of the food industry is driven by their flexibility and adaptability to the demands of their environment, as well as the

prudent management of intra-company processes focused on the quality and safety of production.

The **research is focused on** the food industry - a sector with long traditions, occupying a major share of the Bulgarian industry. In addition, food productions fall into a risk group from a safety perspective and it is appropriate to target food companies and their food safety systems as an area that can be developed and used as a source of competitive advantage;

The main purpose of the study is to reveal the interrelationship between the competitiveness of the food safety systems and to implement a methodology for increasing the competitiveness of the enterprises in the food industry.

The objective is decomposed into the following research tasks:

First, to review the current state of the food industry and to develop a methodology algorithm for increasing the competitiveness of enterprises in the food industry through food safety systems.

Second, to approve the established methodology in Bulgarian food industries selected on the basis of relevant criteria and to provide recommendations for increasing the competitiveness of the sector through the implementation of food safety systems.

The object of research is 198 enterprises, representing food sector of the Bulgarian economy.

The subject of the study is the different approaches and methods of assessment and analysis outlining the possibilities for increasing the competitiveness of the food enterprises by applying the food safety systems.

The research supports **the main research hypotheses**, namely that the food safety management systems are tied to company competitiveness and competitive advantages and a methodology can be applied to reveal opportunities for increasing the competitiveness of food business companies by systems of food safety.

In the present study, the following **methods were used**: methods for collecting primary empirical information, questionnaire, deep interview method, expert assessment were applied. Methods of analysis and synthesis, comparison and analogies are also used; dialectical, logical, causal, economic-statistical and comparative analysis.

Studies, strategies, outcomes and guidelines of work from national and regional programs have been used. In the development of the analysis, results of the Association of Meat Processors in Bulgaria and the Association of Industrial Capital in Bulgaria surveys, as well as similar surveys and relevant information sources on the subject of analysis were used.

2. LITERATURE REVIEW

The term competition "concurrentia" derives from the Latin word "co cure", which means I run to the goal [. In daily vocabulary, it is used in the sense of rivalry, competition, and race between people, companies, countries and regions to achieve a particular goal. There are different definitions of competition in economic literature. Porter describes it as a "competition between companies in which they use national, regional, and global strategies" [1]. According to Ribov, "competition is an interaction between business entities, each of which strives to realize its interests, regardless of the other subjects." According to Ganchev, [3] "competition, each pursues one's own interest, but at the same time the interests of society are realized". Vladimirova defines it as "a rivalry between economic agents to achieve the goals set (the most efficient use of resources, maximizing profits, achieving a high market share, etc.), which takes place in the conditions of interaction between them [2].

The diversity of competitive relations in the economy is divided into **three levels**:

- *Micro level* - for individual types of products, productions or companies;
- *Meter level* - for a given industry, corporate unions and conglomerate type companies;
- *Macro level* - for a country.

The study of competition takes place through the so-called competition mechanism, which consists of the following elements:

- *Sources of competitive advantage.* There are two types - lower costs and differentiation of goods and services.
- *Subject to competition* - these are: consumer demand (domestic and international), factors of production (labor, land, capital and information) and power.
- *Subject of competition* - here are individuals (physical or legal) leading to competition for the objects of competition, ie. competing companies that produce or sell similar products and services.
- *The subject of competition* is goods, services or products.
- *Competitive struggle methods* - applied by subjects to the competition process for sites.

To survive on a highly competitive market, subjects can apply different methods of competitive struggle - to reduce prices, improve quality, expand service, and more [7]. Unlike competition, which is characteristic of the market, competitiveness is a characteristic of the particular economic entity / system. In other words, competitiveness can be defined as the ability to compete [8].

There is no complete and accurate definition of competitiveness. It is so comprehensive that different definitions are not contradictory but rather complementary. The existing definitions of competitiveness differ depending on the level they are relevant to. According to some of them, competitiveness is linked to the production and distribution of manufactured products [9]. Other definitions are based on the understanding of the efficiency of the production process and the potential for innovation and technological excellence. According to Michael Porter, competitiveness refers to the way in which the available resources are used [1]. The link between the notions of competition and competitiveness can be explained in the following way: competition and competitive relations predetermine the competitive advantages that are a factor of competitiveness. enterprises, corporations, economic systems, the national economy of the country or the world as a whole" [10].

2.1. Form the model of perfect and imperfect competition

The neo-classical theory of perfect competition is based on unrestricted competition between business entities. The main moments in it were developed by Adam Smith, and A.Marshall, L.Walras, E.Djevins and Pareto are involved in the development of the model [1],[2]. The main points in A.Smit's theory of perfect competition are:

- Defines the notion of competition as rivalry, rising prices when supply is reduced and prices fall in surplus supply.
- Defines the main principle of competition - "The principle of the invisible hand". Competition forces market players to follow the instructions of the "invisible hand" and is a mechanism to automatically achieve market equilibrium.
- Develops the theoretical foundations of a flexible competition mechanism that balances the industry's profit rate, leading to an optimal allocation of resources across the various sectors of the economy.
- Defines the basic conditions for effective competition, including the availability of a large number of sellers and buyers, the mobility of the resources used, the availability and availability of information on the level of demand, supply and prices, which makes it possible to make optimal choices.
- Defines competition as a means of solving contradictions between private and public interests.

Perfect competition - characterized by a large number of players (sellers and buyers) on the market. Each of them has enough full market information and none of them can control market demand, delivery of goods and their price.

Perfect competition is growing into its antipode - the monopoly, that is, in imperfect competition. It appears in a market where individual producers (sellers) can have some impact on the price.

In the monopoly theoretical model there is only one producer or consumer who has no competitors on the market, there are no substitutable goods or services [8]. There are different circumstances in which a firm may become a monopolist. In this sense, it is a closed, natural or open monopoly.

- *Closed monopoly* - is typical for cases where the company is protected by competition by means of legal restrictions (by the Copyright Agency).
- *Natural monopoly* - exists when there is a company producing a unique product on the market and there are some limitations on the factors of production (unique natural resources).
- *Open monopoly* - for a while, a company is the only supplier of a particular product without any specific protection from competition, as in the closed and natural monopoly, but in the future a competitor may appear.

When examining market conditions, the authors of the theory of *imperfect competition* focus their attention on the situations of *polypole, oligopoly and monopoly*

- ✓ *Polypol* is a market with many participants, but they are mostly small companies;
- ✓ The *oligopoly* is a market with a small number of participants, but medium-sized companies;
- ✓ The *monopoly* is a market with only one bidder on the demand or supply side, but it is a big company.

In order to regulate competition, Bulgaria adopt and enforce anti-monopoly legislation.

There are quantitative methods defining market conditions for determining the nature of competition. Widespread indicators are two: the concentration ratio of leading (usually four) firms and a Herfindal-Hirschman index.

Concentration ratio of the four largest companies - represents the sum of the relative shares of the sales value of the four largest companies. Determined by the formula:

$$CR4 = MS1 + MS2 + MS3 + MS4 \quad (1)$$

where:

CR4 is the concentration factor (concentration ratio);

MS1, 2, 3, 4 – market share (as a percentage) of the four largest companies.

The index may range from zero in pure competition to 100% in monopoly. An indicator value above 40% is indicative of oligopolistic competition, and below 40% for monopolistic competition.

Herfindahl-Hirschmann Index - represents the sum of squares of market shares of major competitors. Determined by the formula:

$$HHI = \sum_{i=1}^N (MS)_i^2 \quad (2)$$

where:

HHI is the Herfindal-Hirschman index;

MS - market share in percent;

N - the number of competitors.

The higher the index, the more monopolized the relevant market and:

HHI ≤ 1000 means a competitive market;

1000 ≤ HHI ≤ 1500 - Slightly monopolized market;

1500 ≤ HHI ≤ 2500 - moderately monopolized market;

HHI ≥ 2500 - high concentration of monopoly power;

HHI = 10,000 - full monopoly of 1 company.

2.2. Functions and importance of competition

The **first function** is a counterpart. It finds expression in the impact of competition in two directions:

- Competition is a universal tool for comparing the effectiveness of different companies to discover and stimulate the most economically active [5], [7].
- Such a match meets the interests of the consumer, who chooses the trader giving him the most advantageous terms.

The **second function** is selective. It involves removing market participants who work economically ineffective. As a result, overall efficiency of production and trade is increasing.

The **third function** is related to its disciplining power in the market economy. The availability of alternative sellers and buyers in the market to some extent forces companies to comply with consumer wishes and to seek more efficient ways to carry out their business. Companies that fail to provide consumers with quality goods and services at competitive prices will suffer losses and will eventually go bankrupt.

The **fourth feature** focuses on the dynamics. Firms operating under strong competition find new ideas, develop new offers on the market, new channels for realization, new forms of service, and make profits as innovators. At the same time, they take the risk that new ideas and developments will not be accepted by the market, which would bring them losses. This is how dynamic changes are made, in which the old methods and methods give way to the new ones.

2.3. Competition and efficiency

Competition is a driving force and an incentive to increase the efficiency of business operations. It is an integral part of the market economy and should be considered in relation to the market as a whole system [3], [9].

Since competition involves a struggle between different business entities, it enables the most efficient use of resources and the most successful organization of the business to achieve the ultimate goal of gaining more profits [6], [10].

Competition is closely related to efficiency as:

- Involves actions whereby the business seeks to offer higher quality and more efficient products and services to achieve higher turnover and hence greater profit than other manufacturers and traders.
- Competition stimulates efficiency by introducing innovation. Scarce public resources and limited demand necessitate the introduction of new ideas, methods, tools, knowledge and experience that, under the influence of competition, provide businesses with high performance and success in competitive struggle.
- The market raises the drive for greater profit and maximizing profits. It forces manufacturers to implement the latest advances in science and technology, creating conditions for increasing production efficiency. Universal competition is a prerequisite for thriving the one who is quicker and best adapted to changes in consumer demand and most effectively introduces the latest advances in scientific and technological progress by reducing production and labor costs.

2.4. Analysis of the company's competitiveness

The research and analysis of the competitiveness of a company is carried out at three levels - national (macro level), sectoral and company level. It can take place both in the order and in the opposite direction: company, industry, national level. The relationship of the analysis levels with the analysis tools is presented in Fig. 1.

At national level, the Porter Diamond tool is most commonly used to analyze competitiveness. The four main tips in the "diamond" are: *Factors of production; Demand conditions; Connected and supporting industries. Company strategy, Structure and competition.*

The elements are: **Competition between existing companies; The threat of new firms entering; The emergence of substitute products; Contractual power of suppliers; The contractual strength of customers** is directly reflected not only on the particular firm, but also on the competition in the industry, which may cause a direct clash between different companies. As a result of the sectoral level analysis, we need to get an evaluation of the competitive advantage over the rivals.

At company level, the competitive advantage can be determined by the following methods: **Competitive triangle** - is a comparison with the leading competitor. It is often used also the abbreviation three K (client, company, competitor). The competitive triangle reflects the fact that the consumer perceives the value offered by a particular company and its main competitor.

Value chain. It uses the system approach to form the market advantage of the company. It divides company activities into two types: primary and secondary.

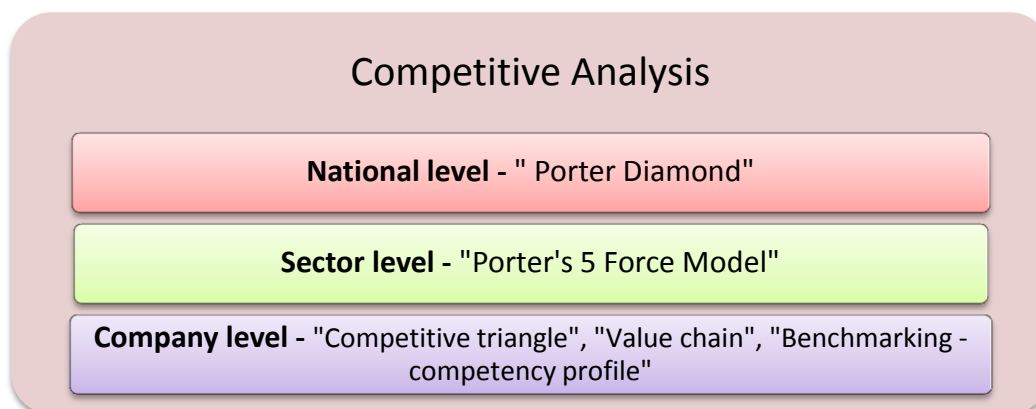


Fig 1. Relationship between Analysis Levels and Competitive Analysis Methods

At the industry level, the "Porter's Five Force Model" is the most widespread [2]. The competitive advantage can be determined by the following methods:

- **Benchmarking method - drawing up a profile of competence.** The method allows for ongoing monitoring of the main rivalries and comparison with customer requirements, not the establishment of the results after the occurrence of the unfavorable events or at the end of a certain period [3],[9].

In the current conditions of increasing competition between rivals, the idea of the dynamic nature of competitive advantage and hyper-competition is becoming more and more popular [4],[10]. These models emphasize the speed and aggressiveness of the action taken and the countermeasures in the particular market, resulting in competitive advantages quickly becoming eroded.

- **Hyper-competition.** The model is based on the following prerequisites. Any competitive advantage may be copied or undermined by other market participants. Once overcome, it becomes a burden. Blindly following the idea of maintaining the market advantage can be a fatal delusion because the pursuit of perfecting the advantage diverts attention from the formation of a new competitive advantage. Overtaking of the immediate competitors is not once established forever. It represents a number of small steps, each of which allows to undermine, destroy the advantage of the opponent or build the next

competitive advantage before eroding the present. In this direction, the following strategies can be implemented:

1. The strategy of undermining the market advantage includes two elements: *consumer satisfaction* and *strategic prediction (prediction)*. They help to explore in more detail the requirements of current users or to open new customers whose needs are not satisfied. This strategy can also be used by the market leader, and in this case, it will be possible for him to preserve his position [.

2. The tactic of erosion of the market advantage includes three types of possible actions: *changing the game's rules* - the conditions of competition by opening new ways of servicing consumers; *disclosure of strategic intentions* - to drive action and track competitors' responses; *simultaneous and consistent attacks* on rivals to confuse and block their efforts to maintain the market advantage. These actions shape the direction or nature of the response of competitors.

3. The possibilities of undermining the competitor's market advantage are two: *speed and surprise*. Positioning the product and brand with the ability to reposition it as quickly and in a way that will surprise the competition.

3. EXPLORATION

The survey of was conducted between September of 2018 and February of 2019 among companies of various food' industry subsectors and sizes. The survey is based on open and closed questionnaire distributed by email. A questionnaire was used to collect data from a sample of 198 enterprises which were selected through stratified random sampling method from all subsectors of Bulgarian food industry.

Respondents are representatives of all major subsectors of the food industry in Bulgaria and their relative shares are shown in Fig. 2.

It appears that the largest share is the respondents representing the subsector - production of other food products - 35%; followed by representatives of the meat processing industry - 19%, the dairy sector - 15%, followed by preserved plums and vegetables - 11%, canned fish - 8%; the production of vegetable oil and animal oil - 6%, manufacturer of beverages are 4%, and with the smallest share being the respondents-bakers and producers of starch products - 2%.

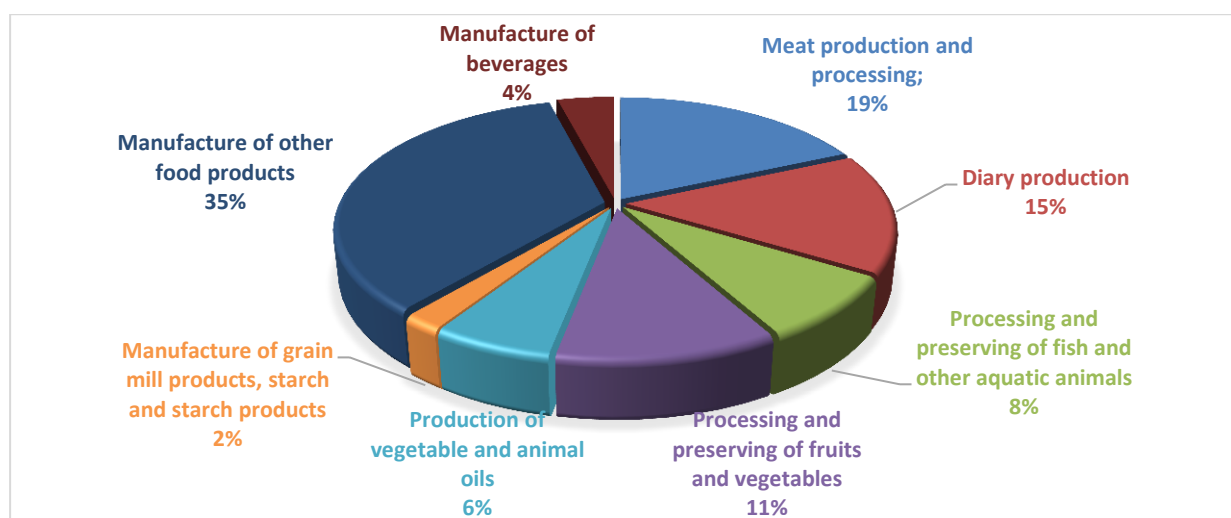


Fig.2 Share of respondents from food subsectors in Bulgaria

Table 1. Determining the nature of competition in Bulgarian food industry

Manufacture of food products	Widespread indicators		The nature of competition
	<i>the concentration ratio of leading firms</i>	<i>Herfindal-Hirschman index</i>	
1. Meat production and processing	48 %	HHI < 1 000	Competitive market
2. Dairy production	62 %	1 000 < HHI < 1 500	Slightly monopolized market
3. Processing and preserving of fruits and vegetables	79%	1500 < HHI < 2 500	Moderately monopolized market
4. Production of vegetable and animal oils	82%	1 500 < HHI < 2 500	Moderately monopolized market
5. Processing and preserving of fish and other aquatic animals	99%	HHI = 10 000	Full monopoly
6. Manufacture of other food production	45 %	HHI < 1 000	Competitive market
7. Manufacture of grain mill products and starch products	%	HHI > 2 500	High concentration of monopoly power
8. Manufacture of beverages	52%	HHI < 1 000	Competitive market

We applied the quantitative method to measure market conditions for determining the nature of competition in Bulgarian food industry (see Table 1).

The analysis of the survey results shows that the meat industry companies in Bulgaria are operating under conditions of monopolistic competition. Dairy firms are operating under a slightly monopolized market, with the concentration ratio of leading firms $CP > 40\%$, which is indicative of working in oligopolistic competition. Companies in the beverage sector in Bulgaria, as well as those from the sub-sector of other food products, operate under conditions of monopolistic competition. Companies in the canned fruits and vegetables sector and the production of vegetable and animal oil work in a moderately monopolized market. The companies from the subsector of grain mill manufacturing and starch products works in the condition of high concentration of monopoly power.

4. CONCLUSION

The most important sectors (meat processing, production of other food products and beverage production) are identified as well as those with the best prospects from an economic point of view (canned fruits and vegetables, vegetable and animal oil, dairy products). An analysis of the industrial structure and the market conditions in which they work is carried out. As a result of the survey, it has been established that the food industry in Bulgaria is experiencing difficulties in marketing and innovation activity, offering products that meet specific consumer needs, using modern methods of analysis, applying management practices, building on voluntary standards. The conclusion is that the main subsectors of the food industry in Bulgaria are operating in the conditions of monopolistic competition, which requires the adoption of concrete strategic decisions for affirming their competitive advantages and expanding the market positions.

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IMPACT OF INNOVATION - SUPPORTIVE CULTURE FOR AN EFFECTIVE BIO-ECONOMY IN BULGARIA

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Abstract: *Bio-based economy as a part of circular economy covers all sectors and systems that use biological resources. It is one of the largest and most important sectors of the EU and includes agriculture and forestry, fisheries, agro-food, biomass and bio-based products. Its annual turnover is about 2 trillion euros, and it employs about 18 million people. Bio-economy is also a key area for stimulating growth in rural and coastal areas. In Bulgaria there is still a limited understanding of the added value of eco-innovation, the effects of defragmentation of the value chain, the consequences of the limited application of environmental investments, as well as the lack of appropriate financial instruments stimulating technological progress. The focus of the research was to measure the innovation-supportive culture exhibited through innovativeness, creativity, business alertness and risk taking and how and how they influence the effectiveness of bio-enterprises. The research focused on a population of 285 enterprises for the production of organic food from all Bulgarian regions. Collected data were analyzed using descriptive and inferential statistics with the aid of Statistical Package for Social Sciences (SPSS). Correlation and multiple regression were employed to analyse the data and test the hypotheses. The study revealed that innovativeness, creativity, business alertness and risk taking were significant for the formation of an innovations-supportive culture and affecting performance of Bulgarian bio-economy. The study concluded that innovation-supportive culture or lack of it has a major effect on business performance and if any organization is bended towards development and growth, it would have to embrace this concept.*

Keywords: *innovation - supportive culture; bio-based economy; entrepreneurial innovativeness*

1. INTRODUCTION

In developing economies like Bulgaria one of the biggest problems is to create an entrepreneurial culture of people and attitudes to innovate in their business efforts in order to avoid the bad practice of duplicating products found among many traders. The innovative-supporting culture of the entrepreneur determines the business success in today's competitive market. Entrepreneurship refers to the ability to recognize or create an opportunity and take action aimed at realizing the innovative knowledge practice or product. It does not aim at the realization of monetary profit, but focuses on opportunities with the goal to improve the production. McGrath & MacMillan explain that entrepreneurial innovations-supporting culture manifests through innovation, creativity, business alertness and risk taking. Entrepreneurial innovativeness portrays organizational willingness and a tendency to achieve the desired innovation demonstrated in terms of behaviors, strategies, activities and processes. Empirical research and surveys of business activities show that innovation leads to new products and services, better quality, and lower prices. Businesses that have a strong track record of successful innovation also tend to enjoy significant competitive advantages and increased enterprise value. Creativity in an entrepreneur is critical for it result in three exhibits. These are: knowledge, which refers to having relevant understanding an individual brings to bear on a creative effort, creative thinking which shows how people approach

problems and depends on personality and thinking style, and finally motivation acting on an intrinsic passion that drives one to perform better. Business alertness is the capability to respond at the right time to the dynamics of the environment [1]. This is critical in creating a competitive edge in a very fast changing market. The extent to which an entrepreneur exhibits these three attributes determines whether a manager has entrepreneurial mindset or not and that is what makes a difference in business performance [2]. According to Dhliwayo and Vuuren, risk taking is an important element of the strategic entrepreneurial innovation-supportive culture. This is because risk taking is essential for the success and growth of a business, which is based on how managers perceive and manage the risks in their environment. Observations have also shown that many businesses stagnate while others show remarkable performance in terms productivity, profitability, or expanded market size. These variations in performance of bio-based enterprises in Bulgaria triggers the need to investigate the role of entrepreneurial mindset of managers manifested through innovativeness, creativity, ability to recognize business opportunity (business alertness) and risk taking. This is why this study is carried out in order to examine the influence of the innovation culture and the management mentality to increase the efficiency of the organic food production companies in Bulgaria.

The aim of this paper is to measure the impact of innovation-supportive culture exhibited through innovativeness, creativity, business alertness and risk taking and how these attributes contributed to the organizational performance. The focus of the research was to measure the innovation-supportive culture exhibited through innovativeness, creativity, business alertness and risk taking and how and how they influence the effectiveness of bio-enterprises. The research focused on a population of 285 enterprises for the production of organic food from all Bulgarian regions. Collected data were analyzed using descriptive and inferential statistics with the aid of Statistical Package for Social Sciences (SPSS). Correlation and multiple regression were employed to analyse the data and test the hypotheses. The study revealed that innovativeness, creativity, business alertness and risk taking were significant for the formation of an innovations-supportive culture and affecting performance of Bulgarian bio-economy. The study concluded that innovation-supportive culture or lack of it has a major effect on business performance and if any organization is bended towards development and growth, it would have to embrace this concept.

2. LITERATURE REVIEW

1.1. The Concept of “Bio-based economy”

The theme significance takes a central position in discussions, researches and organisational activities connected with bio-economy and entrepreneurship. This takes an essential role in the Bulgarian economic environment as well as the national strategies for economic growth. All statements lead to the necessity of investigating the opportunities for transformation of bio-based organizations in different way of doing business in digital era. The bio- economy in the European Union is growing much faster than the rest of the economy, which will lead to the creation of more jobs and the continuation of the digital transformation of the European economy. Bio-economy covers all sectors and systems that use biological resources [4]. It is one of the largest and most important sectors of the EU and includes agriculture and forestry, fisheries, agro-food, biomass and bio-based products. Its annual turnover is about 2 trillion euros, and it employs about 18 million people. Bio-economy is also a key area for stimulating growth in rural and coastal areas. The new bio-economy strategy fits in with the Commission's efforts to further boost jobs, growth and investment [5]. It aims to improve and expand the sustainable use of renewable sources to overcome global challenges such as climate change and sustainable development [6].



Biological resources and ecosystems in the world are limited, so efforts and an innovative approach are needed to feed the population and provide clean water and energy. Bio-economy can turn algae into fuel, recycle plastics, produce furniture or garbage from waste, and create organic fertilizers from industrial waste products. It has the potential to create 1 million new green jobs by 2030.

There is a need for a change in the system, the way we produce, consume and dispose of goods. By developing its bio-economy - the renewable segment of the circular economy – EU countries can find new ways of providing food, goods and energy without depleting the limited biological resources of the planet. Moreover, not only environmental protection and climate change make them reconsider their economic paradigm and modernize their production patterns: there is also a significant potential for new green jobs, especially in rural and coastal areas [7]. The EU has to pave the way for the transformation of waste, residues and unnecessary items into high value products, environmentally friendly chemicals, feed and textiles. Research and innovation play a key role in accelerating the building of a green European economy and achieving the goals of the United Nations for sustainable development. This strengthening of the bio-economy can make a significant contribution to achieving a wide range of EU objectives, including mitigation of climate change, circular economy and resource efficiency, environmental protection, job creation, growth and revenue. Achieving a sustainable circular bio-economy requires concerted work by the public and private sectors. Major sectors of the bio-economy are agriculture and forestry, fish and aquaculture, bio-energy and biofuels, food industry, bio-based products and processes.

1.2. The Concept of “Innovation-supportive culture”

In view of the multidisciplinary nature of prior research, there are varying definitions of innovation-supportive culture and it is problematic to determine an exact meaning of it. Entrepreneurial innovation-supportive culture is simply defined as the feelings and the belief of a particular ability to think out of the box. Scholars have described the innovation-supportive culture as that ability to repeatedly initiate new product or service ideas, reconverting all resources into new uses, bringing new ideas from many sources. Ideas must be generated, resources assembled, the new product or services produced and delivered to users (Lackéus & Williams, 2015, Lackéus, 2016) [8]. In this study, innovation-supportive culture is considered a holistic perception of generating novel ideas, evaluating opportunities and risks, or starting and running a business, whereby an individual internally assesses his or her perceptions based on holistic rather than functional attributes. An innovation-supportive culture indicates a way of thinking about business and its opportunities that capture the benefits of uncertainty (Dhliwayo and Vuuren, 2007). According to Senge (2007), it portrays the innovative and energetic search for opportunities and facilitates actions aimed at exploiting opportunities [9]. Establishing an innovation-supportive culture is important to sustain the competitiveness of economic organizations and the socioeconomic lifestyle of the population through value and job creation. This importance is portrayed in the sense it enables supporters of new ideas to establish organizations with new valuable ideas, which are resourced and developed in an encouraging and enabling culture (Thompson, 2004). An enterprising mindset is about having a way of thinking, which sees opportunities, rather than barrier, that sees possibilities rather than failure and wants to do something to make a difference rather than sit and complain about the problems (Rouse, 2015). McGrath and MacMillan (2000), further assert that individuals/enterprise owners and managers capture these benefits in their search and attempts to exploit high potential opportunities commonly associated with uncertain business environments. The inability of enterprises to either create more job opportunities or grow is because of the perceived “mindset” of its owners/managers-identified as one of the major causes of enterprises failure rates. Managers/individuals with an innovation-supportive culture see needs, problems and



challenges as opportunities and develop innovative ways to deal with the challenges, exploit and merge opportunities. McGrath and MacMillan (2000) argue that, possession of an entrepreneurial mindset is a primary way managers can successfully move forward in an entrepreneurial process [12]. Dhliwayo and Vuuren (2007), emphasize that an innovation-supportive culture is an important success factor for companies without which a business will fail [3]. Morris and Kuratko (2002), also argue that the current business environment needs an entrepreneurial mindset that must unlearn traditional management principles in order to minimize the high failure rates of companies. This particular argument opens managers/enterprises to modern styles of consciousness and securing them a place in modern business world. Also important is the fact that owners/managers need to develop "creative mindsets" that will help them create new ideas and bring them to the market in an appropriate way that can create value for an external audience. McGrath and MacMillan (2000) identify some characteristics of the innovation-supportive culture to include: passionately seeking new opportunities; pursuing opportunities with enormous discipline; pursuing only the very best opportunities; focusing on execution; and engaging everyone's energy in their domain.

Business performance is of key interest for the top management of a company. If business performance is weak, managers need to intervene in order to return to the path of growth. Especially in a market in which competition is increasing and globalization demands for better competitiveness, business leaders need to pay close attention to business performance. All business processes eventually revolve around the target of contributing to the success of the company in one way or another. Business success indicates the level of achievement and how much the small business is near or far from its target. Business success can be measured based on many different dimensions such sales growth, capital, increase in employment, increase in production line and others. According to Barney (1991) performance is a continuous process to controversial issue between organizational researchers.

Organizational performance does not only mean to define problem but it also for solution of problem. Daft (2000), said that organizational performance is the organization's capability to accomplish its goals effectively and efficiently using resources. Tanveer et al. (2013) defined the dimensions of performance measurement as: growth, profit, size, liquidity, success/failure and others. Rouse (2015) defines organizational performance as a systematic process for improving functioning of organizations by developing the performance of individuals and teams. Organizational performance comprises the actual output or results of an organization measured against its intended outputs (organizational goals and objectives).

Innovation is defined as the introduction of new things, ideas, or ways of doing things/something, which is yet to be carried out by anyone or that is unique. Innovation is described as the introduction of new or improved processes, products or services based on new scientific or technology knowledge and/or organizational know-how (Rebound, 2008).

Innovation is the successful implementation of novel ideas within an organization. Innovation can be viewed as a novel idea that has been implemented and generally accepted which makes an organization unique or produce a unique product or services. In its original sense, innovativeness can be defined as the degree to which an individual or other entity is relatively earlier in adopting new ideas than the other members of a system (Wetzstein, 2014) . Similarly it is the tendency to support new ideas, experimentation and creative processes (Lumpkin & Dess, 2001).

Creativity means the production of novel and useful ideas in any domain. Creativity refers to the generation of novel, useful idea, and employees' ability to create new practical ideas. It is the start point of innovation. Creativity can be defined as the creation of something new which is in turn manifested in the act of starting up and running an enterprise (Lackéus et al. 2015). Creativity is therefore central to entrepreneurial process. It is that capability of an entrepreneur to venture into new business, to bring new products into the market, open new

offices, branches, test new technology and venture into new markets. Creativity has been viewed as the construction of ideas or products which are new and potentially useful.

Kirzner was the first to use the term “alertness” in explaining the entrepreneurial process of opportunity recognition. Alertness is defined as a process and perspective that helps some individuals to be more aware of changes, shifts, opportunities and overlooked possibilities (Kirzner, 1997). In taking the economics perspective, Kirzner (1999) further elaborated alertness as the ability to notice, without search, opportunities that have been overlooked

The concept of risk-taking has been long associated with entrepreneurship. Early definition of entrepreneurship centered on the willingness of entrepreneurs to engage in calculated business risks. Lumpkin and Dess (1996), Oscar, et al, 2013 identified venturing into the unknown as a generally accepted definition for risk taking, though may be difficult to quantify. This is because, in addition to monetary risk, it typically entails psychological and social risks (Lumpkin & Dess, 1996, Oscar et al. 2013). Meta-analysis investigating the relationship between risk-taking and performance found positive correlation between the two elements. To create a better method for gathering the investigation aims and realizing the tasks are preliminary formulated the next basic hypothesis:

Ho1: Innovativeness has no significant effect on the performance of bio-based enterprises in Bulgaria.

Ho2: Creativity has no significant effect on the performance of bio-based enterprises in Bulgaria.

Ho3: Business Alertness has no significant effect on the performance of bio-based enterprises in Bulgaria.

Ho4: Risk taking has no significant effect on the performance of bio-based enterprises in Bulgaria.

3. RESEARCH METHODOLOGY

A survey research design was used in this study. This gave the opportunity to gather answers of the owners/managers of bio-production companies from all regions of Bulgaria, regarding the variables of the study. The population statistics was obtained from Bulgarian Chamber of Commerce and Confederation of the Employers and Industrialists in Bulgaria – CEIBG. Stratified sampling was used to select 285 companies from bio-production industry. A stratified random sample was a useful blend of randomization and categorization, which enabled both a quantitative and qualitative process of study to be undertaken.

The study used a structured questionnaire in data collection. The questionnaire was carefully designed and administered to the respondents. The questionnaire was designed on a four point Likert-Scale which ranged from strongly agree (4 points), agree (3 points), disagree (2 points) and strongly disagree (1 point). The items were structured to capture information on the dependent variable (organizational performance) and the independent variables (innovativeness, creativity, business alertness and risk taking).

Factor analysis were used in this study to measure the validity of the instrument. *Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)* were used to assess the construct validity of each variable in the study. At 1% level of significance, the result shows that the data is highly significant ($p < 0.001$). The result shows that the Kaiser- Meyer- Olkin (KMO) which measures the sample adequacy was 0,598 while the Bartlett's Test of Sphericity was significant (App. chi-square= 267.889, sig. = .000) which indicates the sufficient inter correlations of the factor analysis. Also, before the questionnaire was administered to the management of the selected companies, the researcher tested its reliability by conducting a pilot research on ninety five ($1/3 * 285 = 95$) managers of bio-production enterprises of all regions of Bulgaria. The Cronbach's coefficient alpha was applied on the results obtained to determine how items correlate among them in the same

instrument. Cronbach's coefficient Alpha of more than 0.7 was taken as the cut off value for being acceptable which enhanced the identification of the dispensable variables and deleted variables. It is evident through the Cronbach's Alpha values that the reliability coefficients of all the study variables are high and suitable for the current study objectives.

Table 1. Reliability coefficients of the study variables (Source: Own field survey, 2019)

Variables	No of items	Reliability coefficients
<i>Innovativeness</i>	5	0,877
<i>Creativity</i>	3	0.743
<i>Alertness</i>	3	0,809
<i>Risk-taking</i>	4	0,721
<i>Organizational performance</i>	6	0,808
<i>Overall Reliability</i>		0,766

The study conducted initial data analysis using simple descriptive statistical measures such as mean, standard deviation and variance to give glimpse of the general trend. However, correlation analysis was used to determine the nature of the relationship between variables at a generally accepted conventional significant level of $P=0.05$. In addition, multiple regression analysis was employed to test the hypotheses. Multiple regression analysis is applied to analyze the relationship between a single dependent variable and several independent variables. The study also utilize variable inflation factor (VIF) to handle the issue of Multicollinearity.

This study is anchored on two major variables namely: the independent variable (innovation-supportive culture) and the dependent variable (organizational performance). The beta (β) coefficients for each independent variable generated from the model, was subjected to a t – test, in order to test each of the hypotheses under study. The regression model used to test is shown below:

$$OP = f(MM) \quad y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon \quad (1)$$

where; y = Organizational Performance; α – Constant; β_1 , β_2 , β_3 and β_4 - Coefficient estimates; X_1 – Innovativeness; X_2 – Creativity; X_3 - Business Alertness; X_4 - Risk-taking and ε - Error term.

All the above statistical tests were analyzed using the Statistical Package for Social Sciences (SPSS). All tests were two-tailed. Significant levels were measured at 95% confidence level with significant differences recorded at $p < 0.05$.

4. ANALYSIS AND RESULTS

The distribution of respondents by gender revealed that 171 sampled respondents (representing 60 %) were males while 114 (representing 40 %) were females. This implies that most of the respondents were males. The result also shows that, 111 respondents (representing 39 %) were 18-27 years old, 86 respondents (representing 32 %) were between 28 and 37 years while 57 respondents (representing 20 %) were within the age range of 38-47 years and 26 respondents (representing 9 %) were 48 years and above. *This age distribution showed that the respondents were mature enough to understand the subject matter of the research.* The distribution of the respondents by educational qualification revealed that 54 respondents (representing 18.9 %) had secondary school qualification, 133 respondents (representing 47%) respondents had tertiary level qualification while 97 respondents (representing 34.1 %) had professional qualifications. This distribution of the

respondents' educational qualification represents **a very literate sample that can provide valid information on the subject matter under study**. Finally, the result showed that 66 respondents (representing 23 %) had 15 years' experience, 100 (representing 35 %) respondents had experience between 6 and 10 years. Also, 57 respondents (representing 20 %) have 11-15 years business experience while 34 respondents (representing 12 %) had experience from 16–20 years and 29 respondents (representing 10 %) had experience doing business from 21 years and above. **This gives a representation of people who had better understanding of the subject under study.**

Table 2. Correlations statistic for relationship between variables (* Correlation is significant at the 0.01 level (2-tailed).

Variable	Organizational performance	Innovativeness	Creativity	Business Alertness	Risk-taking
Organizational performance	1				
Innovativeness	0,601	1			
Creativity	0,421	0,532	1		
Business Alertness	0,447	0,376	0,456	1	
Risk-taking	0,468	0,302	0,333	0,425	1

Pearson's measures the strength and direction of the linear relationship between variables. From the results, a significant relationship exists between the variables (table 2). *Innovativeness* was shown to contribute 60.1% of the change in organizational performance as indicated by the correlation coefficient value of 0.601 which is significant at $\alpha = 0.01$. *Creativity* was positively correlated to organizational performance as indicated by correlation coefficient value of 0.421 indicating that the creativity was a significant factor and contributed up to 42.1% of the change in organizational performance. *Business alertness* was also shown to contribute 44.7% of the change in organizational performance as indicated by the correlation coefficient value of 0.447 which is significant at $\alpha = 0.01$. The correlation for *risk taking* showed that 46.8% of the change in organizational performance was significantly accounted for by risk taking as shown by correlation coefficient value of 0.468 (significant at $\alpha = 0.01$). This paves way for multiple regression analysis (table 3).

Table 3. Multiple regression model

Variable	Coefficient	Std. error	Beta	t-statistics	Sig.	Tolerance	VIF
Constant	3,201	0,499		4,211	0,198		
Innovativeness	0,433	0,001	0,398	3,280	0,006	0,856	1,512
Creativity	0,354	0,087	0,302	3,239	0,003	0,899	1,102
Alertness	0,262	0,122	0,331	2,367	0,032	0,732	1,459
Risk taking	0,284	0,158	0,273	2,876	0,029	0,458	1,701

* Dependent variable: organizational performance

Hypothesis one (**H01**) estimated that innovativeness has no significant effect on organizational performance. However, research findings showed that innovativeness had coefficients of estimate which was significant based on $\beta_1 = 0.398$ (p-value = 0.001 which is less than $\alpha 0.05$) implying that we reject the null hypothesis stating that there is no significant effect of innovativeness on organizational performance in the companies from food industry in Plovdiv and Plovdiv region. This indicates that for each unit increase in the positive effect

of innovativeness, there is 0.398 units increase in organizational performance. Furthermore, the effect of innovativeness was stated by the t-test value =3.280 which implies that the standard error associated with the parameter is less than effect of the parameter.

Hypothesis two (**H02**) stated that creativity has no significant effect on organizational performance. Findings showed that creativity had coefficients of estimate which was significant based on $\beta_2 = 0.302$ (p-value = 0.003 which is less than $\alpha 0.05$) hence we reject the null hypothesis and conclude that creativity has significant effect on organizational performance in Plovdiv region. This indicates that for each unit increase in the positive effect of creativity, there is 0.302 units increase in organizational performance. Furthermore, the effect of creativity was stated by the t-test value =3.239 which implies that the standard error associated with the parameter is less than effect of the parameter.

Hypothesis three (**H03**) stated that business alertness has no significant effect on organizational performance. Research findings indicated that business alertness had coefficients of estimate which was significant based on $\beta_2 = 0.331$ (p-value = 0.032 which is less than $\alpha 0.05$) hence we reject the null hypothesis and conclude that business alertness has significant effect on organizational performance in Plovdiv region. This indicates that for each unit increase in the positive effect of business alertness, there is 0.331 units increase in organizational performance. Furthermore, the effect of business alertness was stated by the t-test value =2.367 which implies that the standard error associated with the parameter is less than effect of the parameter.

Hypothesis four (**H04**) stated that risk taking has no significant effect on organizational performance. However, findings of the study revealed that risk taking had coefficients of estimate which was significant based on $\beta_2 = 0.273$ (p-value = 0.029 which is less than $\alpha 0.05$) hence we reject the null hypothesis and conclude that risk taking has significant effect on organizational performance in companies from food industry in Bulgaria. This indicates that for each unit increase in the positive effect of risk taking, there is 0.273 units increase in organizational performance. Also, the effect of risk taking was stated by the t-test value =2.876 which implies that the standard error associated with the parameter is less than effect of the parameter.

5. CONCLUSION

The purpose of this study is to examine how the formation of an innovative culture influences the effectiveness of the bio-economy in Bulgaria. The study concluded that innovation-supportive culture or lack of it has a major effect on business performance and if any organization is bended towards development and growth, it would have to embrace this concept.

Managers/owners with innovation-supportive culture see needs, problems and challenges as opportunities and develop innovative ways to address the challenges. The managers/owners must be able to always scan the environment and seek new business opportunities to stay ahead of competitors, he or she must also become very innovative to improve on processes and products to remain attractive and create customer loyalty. The managers must bring new processes and products into the market and companies must take modest levels of risk in order to succeed.

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PLACE OF THE BULGARIAN SUGAR INDUSTRY IN THE ECONOMY OF EUROPE

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Abstract: *Sugar industry is one of the industries that, in today's market relations, develops and grows very fast, both in Europe and in the world. Under the pressure of economic efficiency and international agreements, Bulgaria liquidated the traditional sugar beet growing. The article presents results of an analysis of the dynamics in the sugar industry development on a global and European level, aiming to identify the problems and to predict for its future development. The study supports the main research hypotheses, namely by identifying global trends for the sugar industry's development in conditions of strong competition and pinpoint the position of Bulgarian sugar industry in Europe economy, Bulgarian enterprises in the sector could increase their competitive potential by responding with adequate strategic tools.*

Keywords: *sugar industry, market analysis and forecasting, development trends*

1. INTRODUCTION

Sugar industry is one of the industries that, in today's market relations, develops and grows very fast, both in Europe and in the world.

Sugar industry is traditionally a well-developed industry with a significant contribution to the Bulgarian economy [1]. The hundred-year traditions of the sugar industry in Bulgaria are about to be eradicated. Established to process sugar beet produced in the country, since 2005, factories draw their inputs only from imports. Under the pressure of economic efficiency and international agreements, Bulgaria liquidated the traditional sugar beet growing. At the closure of the Agriculture chapter, the negotiating team agreed that the total quota for white sugar production would be 203,500 tons per year after Bulgaria's accession to the European Union (EU). The factories in the country will be able to produce 56 063 tonnes of isoglucose per year. The limitation in the production of sweet crystals is mainly due to overproduction in the EU.

Member States mainly work with local raw materials, one of which is sugar beet, encouraging the cultivation of culture not only at preferential prices but also with customs protection on imports of sugar from other countries [2]. However, due to the inability to satisfy the internal market, after 2007 Bulgaria had to buy additional quantities of the surpluses of European sugar factories.

Bulgaria's sugar consumption is in the range of 220-240 thousand tons per year. A number of large European companies are currently active on this relatively small market - mainly sugar beet sugar producers. Their purpose is to expand the markets and prepare for the time after 01.10.2017, when their production quotas will be abolished [3], [4].

The battle for every new market, including the Bulgarian one, is extremely heavy and is usually done by lowering prices even at below cost. In this battle, the Bulgarian refineries are disadvantaged, they have no free access to the world market for buying raw sugar and are forced either to work at a loss, buying expensive raw material with zero tariffs or to cease work.

Bulgarian producers work in an unfavorable macro environment, underdeveloped infrastructure and under conditions of intense competition. They must make efforts to adapt to the changing market environment [5],[6],[7]. Increasing the competitiveness of Bulgarian producers is related to the investment of capital that allow industry's renovation [7].

For this purpose, it is necessary to use local capital and to attract foreign investments for the purpose of technological renewal of the production base and the search for opportunities for switching to new markets. An important condition for the renovation of Bulgarian sugar factories is to implement the concept of business process management that will allow them to build an efficient process architecture and respond flexibly and adaptively to market challenges through innovations.

The aim of this article is to analyze the dynamics of the sugar market, to identify the main problems and to draw the trends for its future development.

The main task is to measure global trends in sugar and confectionery market developments and the expected technological and organizational changes for the period 2018-2026.

The research supports the main research hypothesis, namely by identifying the global tendencies for developing the sugar industry in the conditions of strong competition and determining the place of the Bulgarian sugar industry in the economy of Europe, the Bulgarian enterprises in the sector could increase their competitive potential using the adequate strategic business process management toolkit.

The following methods were used in the present study: analysis and synthesis; induction; analogy of comparison; quantitative methods; by statistical processing of SPSS (one-dimensional, two-dimensional, distribution, X-square, and correlation coefficient). Data and information from the NSI, Agrostatics Department of MAF, EUROSTAT, report of the European Commission were analyzed and synthesized.

2. EXPOSURE

The place of the sugar industry in Europe's economy.

The sugar market has always been attractive because of its dynamics, implying a rapid return on capital. While several years ago there were overcapacity of sugar in recent years, they have gradually melted and are now in a normal quantity. Sugar is a special kind of commodity and it is often speculated by classic futures trades on commodity exchanges, where funds invest very aggressively. The sugar market is a highly regulated market and in Europe there is a protected regime to protect local sugar beet production. For this reason, the discussions of the Sugar Commission with the European Commission are strictly confidential. EU countries produce a serious amount of sugar beet and by introducing quotas to avoid the onslaught of much cheaper cane sugar that comes from Australia, South America, Cuba or East Asia. At the same time sugar beet is sought from cane, but its production costs are higher. And according to experts, sugar consumption continues to grow. According to the European Commission directives each year a production quota is set for each member state of the community - sugar, isoglucose and inulin syrup, which is valid for the internal market of the community. The maximum quantity that can be exported by the EU to third countries is laid down in a specific Regulation 924/2008 (See Fig.1 & Fig.2).

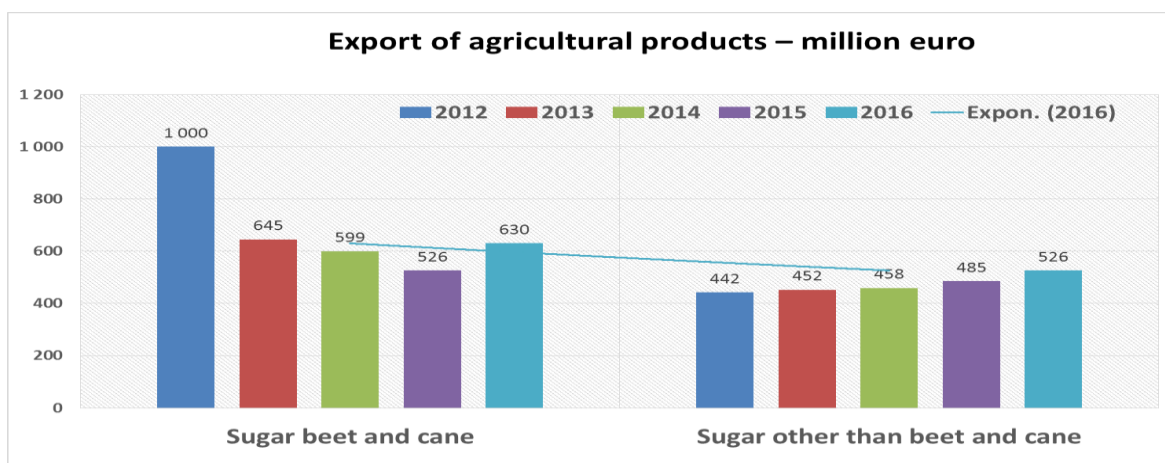


Fig.1. Export of agricultural products

Source: DG Agriculture and Rural Development & personal calculations

The sugar sector in Europe, as well as in the world, faces major challenges. Global oversupply of sugar encourages consumption that starts to exceed production and this leads to strong price increases on the world market. Under this new global market situation, the expiry of the sugar and isoglucose quotas in 2017 will affect the sweetener market in the EU. Despite lower domestic prices, EU production is expected to increase significantly in the first years following the quota. In the medium term, sugar production is expected to be approximately 6% above the current five-year quota. The increase will be concentrated in the most cost-effective regions.

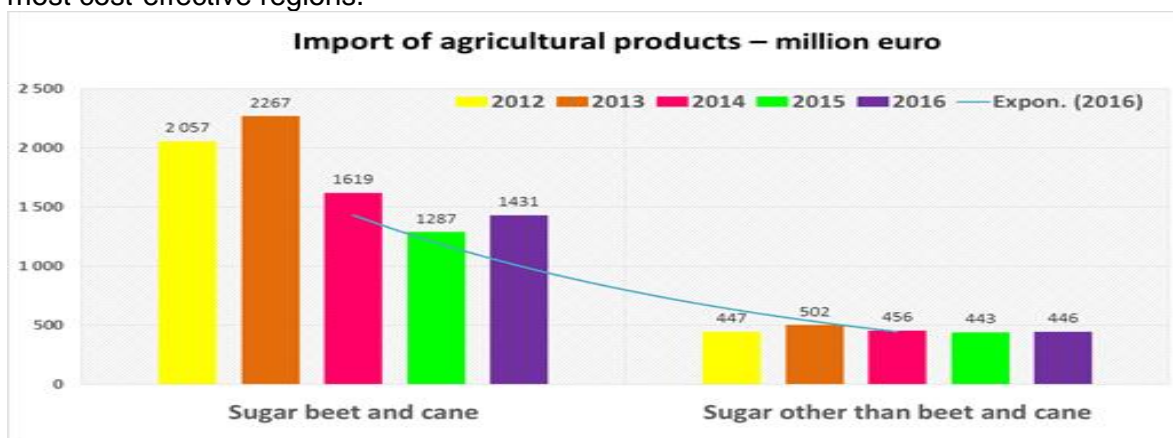


Fig.2. Import of agricultural products

Source: DG Agriculture and Rural Development & personal calculations

On the domestic market, EU sugar will have to compete with isoglucose for which there will be a production quota. By the end of the projection period, the EU must become in a net exporter of white sugar on nearby high value markets. Over the last decade, world sugar consumption has seen steady growth of about 4-5 million tonnes per year, driven by increased consumption of sugar per capita in large parts of the world. Despite this strong growth World sugar production is surpassed consumption in 2014-2015. High growth in sugar production occupies Brazil, which showed a strong devaluation of the factors favoring the profitability and competitiveness of the Brazilian sugar industry.

In 2015-2016, consumption is ahead of production and in the 2016-2017 marketing year a negative balance of production is expected. Research shows that global stocks are declining,



making the sector less flexible to possible adverse weather conditions, and this is contributing to the rise in the sugar prices in the coming months. In September 2017 the price of white sugar in London was EUR 510 per tonne, showing an increase of EUR 200 per tonne over the previous year. In addition, there is speculation on the investment market.

The price of white sugar in the EU experienced steady growth over the last year by 5%, but lags behind the world price of sugar. Since July 2017 the world market price is higher than observed. Research shows that the EU sugar price follows the natural course of world market prices with some delay, as it largely covers futures trades currently under negotiation. Estimates of the price of white sugar in the EU are on the rise, based on the expected low stock levels by the end of 2016-2017. This price increase is taking place at a very late stage to affect sowing for the 2016-2017 campaign, which is still determined by the EU's quota regime.

The production of white sugar in the EU for 2016-2017 is expected to be below 17 million tonnes, which classifies it as an average year of production compared to low production in 2015-2016. Combined with normal consumption and trade, this would lead to an approximate level of white sugar stocks in the EU of about 0.9 million tonnes. This low level of stocks stimulates the sugar industry to restrict the stocks entering it after the middle of the quota. The strong increase in white raw sugar production in the first year after the EU quota led to an expected decline in the later part of the period.

Place of the Bulgarian Sugar Industry in the Economy of Europe.

In Bulgaria the food industry is highly developed industry with a significant place in the economy and exports for the country. Over the period 2011-2016, the food industry is growing at a higher pace than other industries. In 2016, the Bulgarian food industry produces output of BGN 9 994 731 000 compared to 2015 when the value of production is BGN 9 339 529 000. Experts' forecasts show that the share of the food industry in the country's economy is growing (Department of MARD, 2017).

The European Union is using the quota system for sugar and glucose production to regulate production in the Union. Bulgaria has a national isoglucose production quota of 89 198 tonnes, expressed as dry matter (ICAP Bulgaria, 2017).

A fee of BGN 1 046 721 has been collected in 2015, of which 75% is allocated to the EU budget and the remaining 25% to the national budget. The fee collected is the same as in the previous period due to the unchanged amount of the national production quota. Additional amounts of taxable overproduction realized in the 2013/2014 marketing year were also established during the year. Some of the surplus quantities have been exported outside the EU with export licenses for out-of-quota glucose or have been shipped as manufactured in the following year.

In accordance with the provisions of European legislation in the sugar sector, the processors of raw cane sugar and producers of sugar and isoglucose are subject to approval. In the beginning of 2015, Bulgaria has an approved isoglucose plant and six enterprises approved for permanent refiners of raw cane sugar. Three of the refiners sold their assets under special bets and ceased to operate in October 2014. By the end of 2015, it had withdrawn approvals from 4 refineries and only 2 approved refineries remained. In 2013/2014 3 preferential imports of sugar subject to refining were fulfilled.

The imported and refined quantity under these licenses is 39 192 770 kg expressed in t equivalent weight. Four of the licenses issued for the preferential imports of sugar for refining in the same year amounted to 35 059 124 kg were not fulfilled.

In this respect, sanctions for non-fulfillment of refinancing obligations amounting to BGN 34 283 317 were imposed in 2017.

Mandatory licenses are covered by guarantees. In 2015, 143 guarantees amounting to BGN 7 062 859 were accepted, 138 guarantees were released for a total amount of BGN 6 529 556 and the penalties for non-performance amount to BGN 19 789.

12 licenses have been issued for sugar, 9 of which are for other types of sugar and 3 for sugar cane or beet or chemical solid sugar in pure state. They represent a relatively small share of the total number of licenses (290) and a small fraction of the total quantity for which they were issued (27 500 kg of the total of 943 714 kg).

The trade between Bulgaria and other countries in the trade in sugar and confectionery products for the period 2009-2016 shows that sugar imports (See Fig.3) tend to rise while exports remain relatively constant (See Fig.4). In the period 2009-2016 there is a sharp increase in consumption of sugar and confectionery in the years 2010 and 2011 - consumption reaches 360 million tons, immediately after the global financial crisis, then in 2014 it drops sharply to 191 million tons, and in 2016 consumption rises again to reach 258 million tons (See Fig.5).

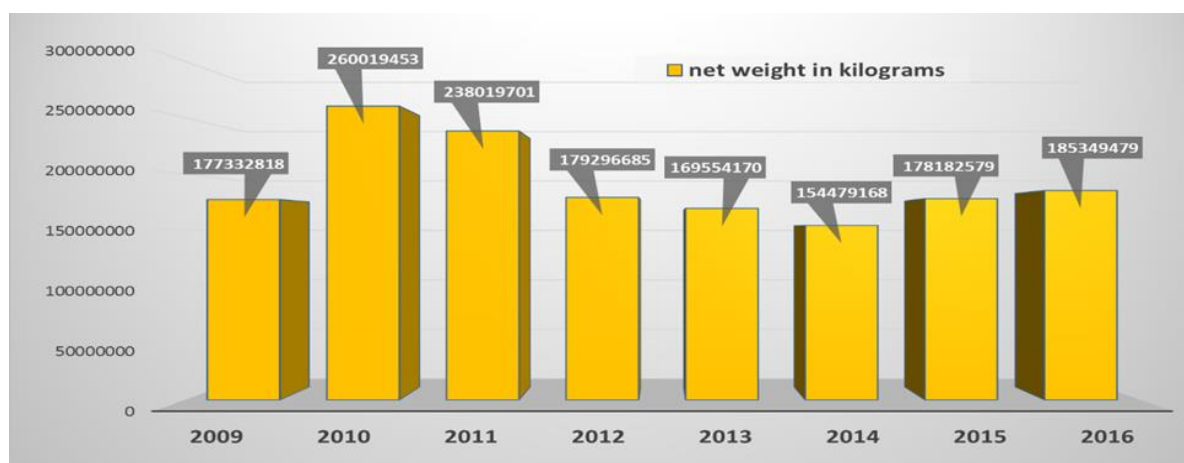


Fig. 3. Bulgarian Export of Sugar & sugar products

Source: Agrostatics, EUROSTAT & personal calculations

On average 7.7 kilograms of sugar consumed the Bulgarian in 2013, according to NSI data (www.nsi.bg). One hundred grams less, or 7.6 kilograms per person of the household, is the consumption of sugar for the previous 2012. In the period 1999 - 2011 the consumption does not fall below 8 kg. In 2010, the household per capita was an average of 8.1 kg and for 2009 - 8.5 kg. Over the period 2004-2016 household consumption of most basic food products increased. Sugar consumption increased with 3,641 kg in 2016, which means an increase of 57%, compared to 2009 (See Fig.6).

3. DISCUSSION

After 2008 there is a drastic drop in the profits of sugar-producing companies in the country - an effect triggered by the restrictive regulations set by the European Commission. The operating profit of two of the largest sugar factories "Zahar LTD" and "Burgas Sugar Factory LTD" has a relatively stable rate and is higher than that of the other enterprises. There is a significant drop in 2007 in the operating profits of the largest sugar factories -JSC, but then the company manages to stabilize its financial situation. A drastic decline in operating profit is seen in "Zahar bio" Joint -Stok Company and „Bulgarian Sugar 2002“ Single-Stock Company.

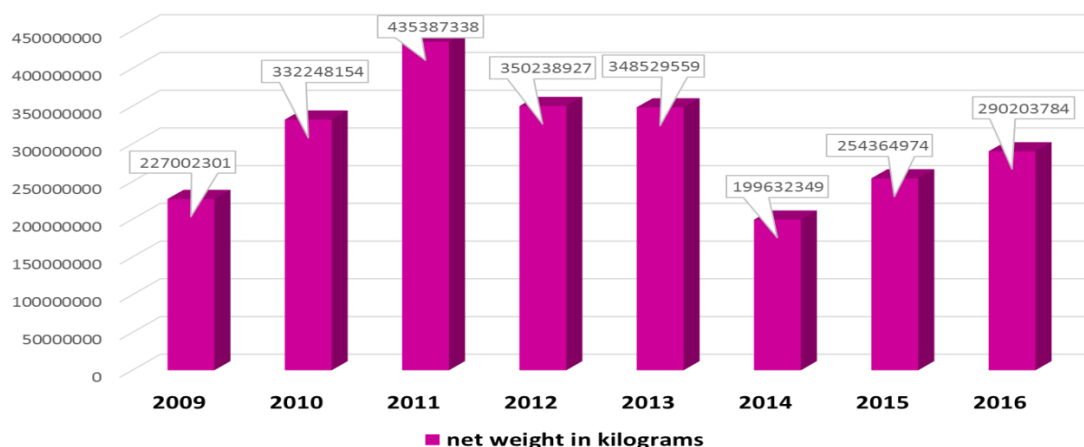


Fig. 4. Bulgarian Import of Sugar & sugar products

Source: Agrostatistics, EUROSTAT & personal calculations

The areas affected by the reform of the Bulgarian sugar sector can be divided on **several criteria**. In the **first place**, we have to distinguish the area of the affected industrial enterprises - Gorna Oryahovitsa municipality and Lyaskovets municipality. In this area, the companies affected by the restructuring "Zaharni Zavodi" JSC and "Zahar" SSC are the largest taxpayer and the largest employer. In Gorna Oryahovitsa there are also the production facilities of the Sugar Factory and the Alcohol Plant - the most affected industrial units.

Next, we should note the regions in which sugar beet growers are concentrated - the eastern region, including the municipality of Popovo, the municipality of Razgrad, the municipality of Targovishte, the municipality of Shumen; Central region - G. Oryahovitsa municipality, V. Tarnovo municipality, Lyaskovets municipality; North-West region - Svishtov Municipality, Belene Municipality, South Bulgaria Region - Nova Zagora Municipality, Stara Zagora Municipality. The distinction of these areas is determined by the actual performance of agricultural activity by farmers, determined on the basis of concluded contracts for supply of sugar beet with the only producer of white sugar from sugar beet in Bulgaria - "Zahar" SSC.

The problems related to the restructuring of the Sugar sector can be broken down according to the main groups of affected countries - Sugar Factory SSC as a sugar producer who has refused a production quota; Factory for alcohol to Zaharni Zavodi JSC as a producer, which as a result of the refusal is limited by the possibility of secure supply of raw material for production - molasses; the companies from the structure of Zaharni Zavodi JSC as the owner of the equipment for harvesting and planting sugar beet; beet growers.

Sugar Factory SSC - here the problems that arise in connection with the restructuring can be systematized in several aspects. First of all, a direct loss from the production of sugar beet production. The cessation of this production actually ends traditional production with over 100 years of history on the territory of the country. On the other hand, the domestic market is deprived of a domestic product which in any way should be replaced, while the company is deprived of an equivalent market share [5].

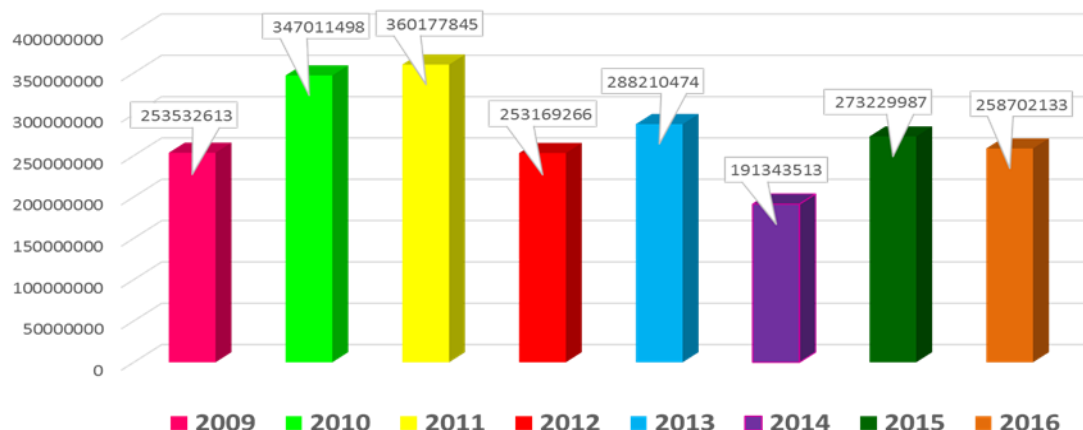


Fig. 5. Bulgarian Consumption of Sugar & sugar products (net weight in kg)

Source: Agrostistics, EUROSTAT & personal calculation

All this means direct financial losses for Zahar SSC. In connection with the restructuring plan of the Gorna Oryahovitsa Sugar Factory, it needs additional investments in the refinery of the plant. The aim of these investments is to modernize the remaining core refining of raw sugar with the clear refinery to meet the challenges of structural reform of the sector and the requirements of the European market.

As for sugar producers, the reform stimulates the improvement of the main factors for competitiveness: *increasing the average campaign duration, labor productivity, sugar production per hectare and the average production volume of one factory*. Since this improvement was not the same in the individual Member States, the reform contributed to increasing the competitiveness gap that existed between Member States before the reform. As far as full-time refiners are concerned, due to the combined effects of lower supply flows and increased production capacity, capacity utilization has decreased to a level where full-time refiners are less competitive.

When comparing sugar producers and full-time refiners, the ratio of potential industrial margins showed:

* Loss of competitiveness for sugar producers over the first four years of the reform, notably due to participation in the restructuring fund during the first three post-reform campaigns;

* Loss of competitiveness of refineries in 2010/2011, linked to the increase in raw sugar imports due to increased global market prices. The sugar industry's competitive system is oligopolistic - the sector is a concentrated market with high barriers to entry. Regulatory reform of the sugar sector has accelerated the dynamics of the markets, which has led to a smaller number of participants, yet the market in the European Union is still saturated and cynics are considerably lower, and the practice of unfair competition is on the rise. Moreover, as a direct effect of the reform, there is a greater differentiation of prices, and companies are taking advantage of them more and more to improve competitiveness [4]. In addition, less efficient local businesses could have a competitive advantage in their own market due to lower transport costs than more efficient but more distant competitors.

The most significant strengths and weaknesses of the Bulgarian Sugar sector can be summarized as follows:

Strengths- Existing traditions in production; Qualified manpower; Technological equipment meeting EU requirements; Rich manufacturing experience, staffing and research potential;

Weaknesses - Insufficient financial support to other sub-sectors; Poor organization of producers; Low motivation for work and staff development due to low wages;

The most significant opportunities and threats of the Bulgarian Sugar sector can be summarized as follows:

Opportunities - The only opportunity to increase profits remains an increase in the mark-up for the end-user; The European Commission wants to stimulate the sugar market;

Threats - Unfair competition; Another problem is the substitutes that seize part of the industry's income; The attitude of state institutions is a very serious problem; The industry is in an unsettled position as regards the national sugar policy priorities.

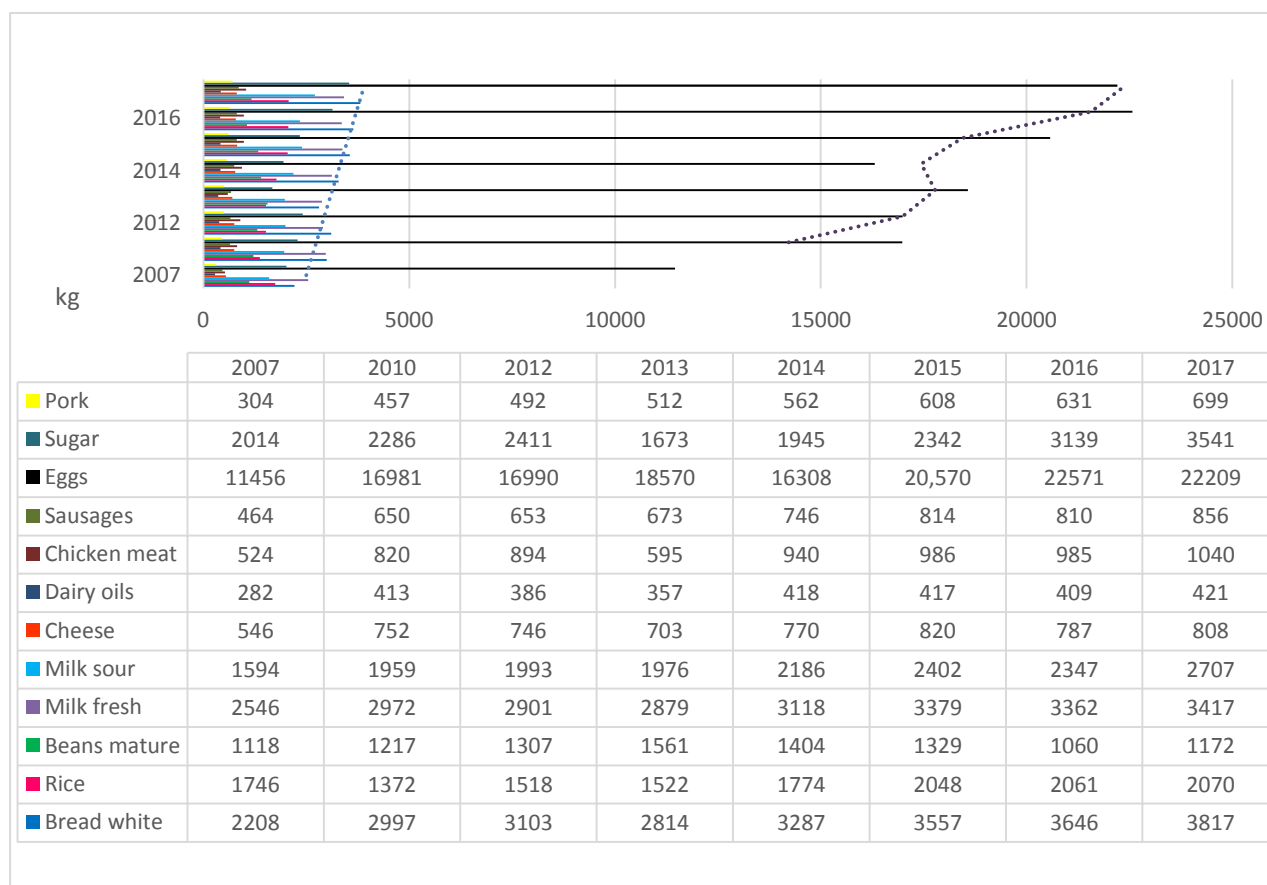


Fig. 6. Purchasing power of households, calculated on average income per person

Source: Personal calculation

The problems facing the development of the food industry in Bulgaria are related to the fact that some of the sectors lose some of the positions in the export structure.

There is a **tendency** of increasing the export potential of secondary processing sectors, which use finished and semi-finished products: *flour, sugar, cocoa, oils, dried milk, essences etc.*

The NSI information for the period 2015-2016 shows that the balance of the Bulgarian sugar industry is a negative one. The negative result is formed by the trade of Bulgaria with EU countries, where it is a net importer, which is an indicator of the direction of competitiveness towards the sugar industries of the other member states.

The following **trends** are observed in the domestic market: *increased competition intensity, smuggled sugar imports, shortage of raw materials from domestic sources.* External suppliers can not control *the price* and in unfavorable years *it can increase significantly.* Because of the **global obesity trend**, the pressure on manufacturers of processed foods to make their products healthier is increasing. Nestle and its competitors

are working on ways to reduce sugar, fat and salt, as consumers are increasingly choosing fresher and healthier options.

The world's largest food company, Nestle, has said it has developed a new technology that makes it possible to reduce sugar in some of its confectionery products by as much as 40 percent without affecting taste. The manufacturer of KitKat and Nestle Chocolates said that his research team has found a way to use only natural ingredients to change the structure of sugar particles. By making the crystals hollow, Nestle says that each particle melts faster on the tongue, so chocolate production will require less sugar.

Nestle is not the first company to experiment with the molecules of ingredients. In 2010, PepsiCo announced that it had found a salt molecule that would allow it to use less sodium without affecting the flavor of its food products, including the Walkers and Cheetos chips.

4. CONCLUSION

Worldwide, sugar consumption increases from 0.5% to 1% per year due to increased consumption in the third world. Innovative product processes are observed. They are related to the production of both crystal and liquid sugar.

In the short term, projections show that sugar consumption is not expected to decline. The most serious threat to the industry is substitutes. Therefore, a long maturity period and a slow transition to the last stage of decline in sugar consumption are expected. The actual cessation of demand may never happen.

There are **two opposing trends** - returning to natural foods and avoiding artificial substitutes and, on the other hand, reducing the consumption of high calorie foods.

For Bulgaria, there is a retention and a relatively gradual increase in consumption of sugar and sugar products. This is due to population decline, increased emigration and a relatively slow increase in exports of manufactured goods in order to better produce. There is a need to develop specialized departments related to the marketing marketing and foreign trade activities of the Bulgarian producers. To deal with complex processes, Bulgarian enterprises need to invest in new technologies, innovation and process rigor, by building process architecture, applying the principles and tools of process management.

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MONITORING OF NITRATE CONTENT IN POTATOUS FROM BULGARIAN MARKET

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Abstract: *The potatoes are common food for people of all ages and very often are used in Bulgarian kitchen as a main component of core dishes and also separately under different types of salad. The aim of this article is to give information about the nitrate content in potatoes from the commercial chain in Bulgaria. The monitoring have been conducted during June, July and August. The measurements of NO₃⁻ ions were carried out with a Greentest appliance, Model ECO 5. The samples from the conducted monitoring were with higher NO₃⁻ content for the fresh potatoes that have been accepted and recommended from EU as healthy one. The highest content of NO₃⁻ in fresh potatoes were 645 mg/kg measured for June, 340 mg/kg for August, and 500 mg/kg for fresh potato produces from BG measured in August, at the accepted safety level 250 mg/kg. The red potatoes were with average 287 mg/kg nitrate levels. The amount of nitrates are not eliminated during cooking processes, so that results are warning that the food from the commercial chain can be not enough healthy, especially for infants.*

Keywords: *nitrates, food safety, potatoes*

1. INRODUCTION

For most of the 20th century, Europe was the undoubted world leader in potato production and consumption in the world, approximately 90 kg per capita per year. In Bulgaria the production of potato was 227.815 t for 2017, with consumption approximately 31.07 kg/capita/year for 2011, according to FAOSTAT. While in Belarus the consumption was about 180 kg, more than any other country, which is almost half a kilogram a day, and with potato production 6,414,760 tonnes, in 2017 [1].

The potatoes provides substances that benefit human health, for example, as fibres, B6 and C vitamins, minerals as Mg, and K, and phytochemicals [2, 3, 6], even in a created from the researchers “healthy eating pyramid” potatoes are at the top as one of the most unhealthy foods, due to their high glycemic index [4]. A medium potato, supplies about 15 % of a daily need for Mg; and about 20 % of a daily K need [2]. The consumption of potatoes help ward off diseases, reducing inflammation and constipation, preventing osteoporosis, maintaining heart health, and reducing the risk of infection [3]. Potatoes contain folate that plays a role in DNA synthesis and repair, and prevents many types of cancer [3].

According to Ware [3], a 100 g of white potato, baked with skin, contains:

- 94 calories;
- 0.15 grams of fat;
- 0 grams of cholesterol;
- 21.08 grams of carbohydrate;
- 2.1 grams of dietary fiber;
- 2.10 grams of protein;
- 10 milligrams (mg) of calcium;
- 0.64 mg of iron;
- 27 mg of magnesium;

- 75 mg of phosphorus;
- 544 mg of potassium;
- 12.6 mg of vitamin C;
- 0.211 mg of vitamin B6;
- 38 micrograms (mcg) of folate.

Potatoes also provide niacin, choline, and zinc, as different varieties provide slightly diverse nutrients [3].

Potatoes are frequently used as a components of main dishes or separately under different types of salad. The most common pollutant in vegetables and in that case in potatoes are nitrates. The aim of article is to present the results of summer monitoring of the content of nitrates in vegetables, especially in potatoes.

2. MATERIALS AND METHODS

The vegetables were purchased from the food market during June and August. The NO_3^- ions measurements were carried out with a Greentest appliance, Model ECO 5. The appliance is certified and calibrated based on more than 1,000 studies of leading labs using spectrometric equipment. It has certificates: SGS, CCIC-SET, EMC, LVD, and SQC. Min/max amount of measured nitrate concentration: 0-9999 mg/ kg, with permissible error: <10%.

All samples were bought from the food chain supermarkets in BG, with a permission to be sell in EU. The measurements were repeated ten times per sample, processed with Excel using ANOVA – one tail, and standard descriptive analysis. The averaged values with variables, minimum and maximum in a single sample are represented in the results.

3. RESULTS AND DISSCUSSION

The results of conducted monitoring of nitrate content in potatoes are represented in Table 1.

Table 1. Content of nitrates in fresh potatoes, summer 2019 (mg/kg)

Nitrate content	acceptable level	average	SD	min	max
Fresh potatoes (bg)	250	501*	96	320	640
Fresh potatoes (1)	250	645*	160	390	900
Fresh potatoes (2)	250	367*	126	230	560
Red fresh potatoes	250	287*	117	130	130

*- exceed it the acceptable value;

All samples exceeded NO_3^- content from the maximum recommended levels 250 mg/kg for EU. The highest measured level of NO_3^- ions were 645 mg/kg with SD 160 mg/kg, and coefficient of variation 24%. The fresh potatoes samples from August also have higher NO_3^- content, average 367 mg/kg, 287 mg/kg, and 501 mg/kg with coefficient of variation 34%, 41%, and 19% for fresh and red potatoes respectively (table 1 and figure 1).

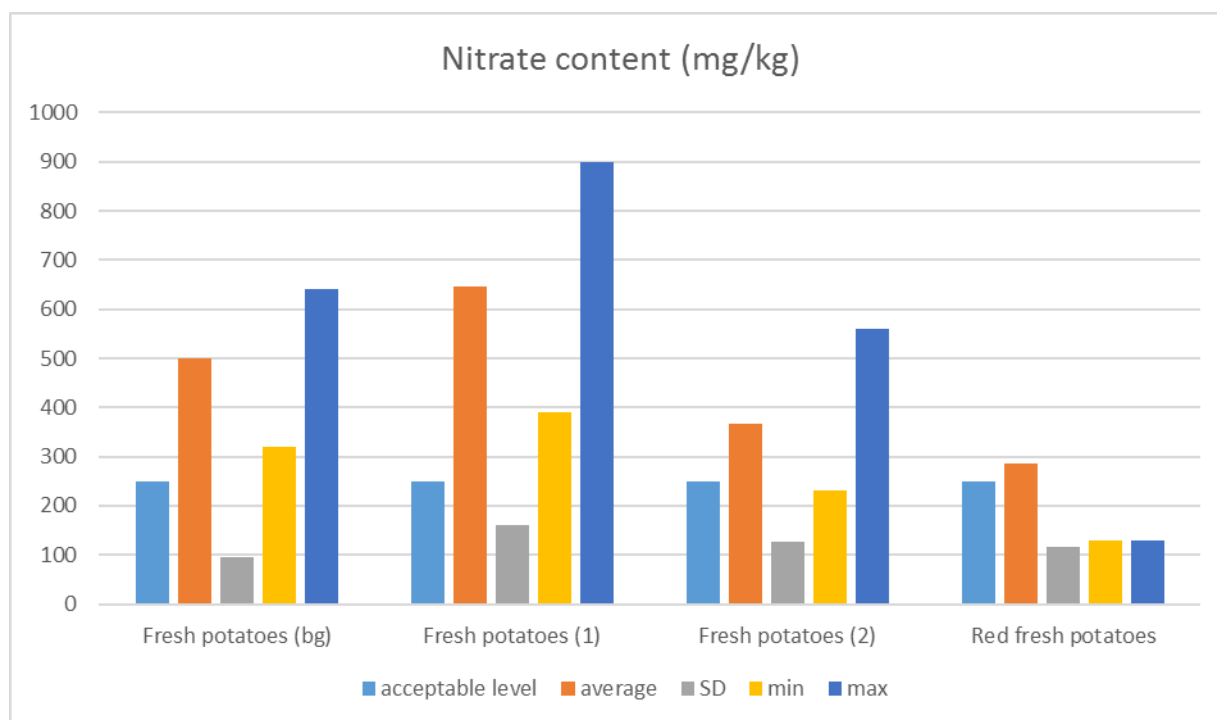


Figure 1. Content of nitrates in fresh potatoes (mg/kg)

Potato is an important and popular food in the EU, average of 73 kg kg/capita/year. The highest consumption per person per year is in Latvia - 178 kg, followed by Poland - 118 kg, and Greece 103 kg [5]. Global potato consumption in 2013 was on average 35 kg/capita/year, which is about 50% of the world's food energy needs [6]. Potatoes can be the main source of nitrate intake [5]. According to Santamaria [7], vegetables account for 97% of our nitrate intake, as 32% originates from potato consumption and 29% from lettuce consumption.

To date, no official limits for nitrate content of potato have been set by the EU. The Commission Regulation (EU) No 563/2002 sets limits for content of nitrates in vegetables, but only for leafy green once. Hence, some countries proposed their own guidelines to set limits to maximum levels of nitrate for trade of vegetables that form the main source of total dietary intake of nitrate. For instance, for potato in Germany the content should be less than 200 mg/kg fresh matter (fm), in Poland less than 183 mg/kg fm [5, 7]. In many countries that limits of nitrates in potatoes are exceeded [5, 8]. During 2017, the quality of domestic and imported vegetables in Slovene market in Ljubljana were investigated, and values over 1000 mg NO₃⁻ kg⁻¹ were found in 30% of randomly selected samples [8].

The nitrates are considered not so harmful by themselves but conversion of nitrates to nitrite, during cooking changes in nitrate content may reach up to 75% [9]. Even it was founded that cooking process caused a significant increase in the level of nitrate [10]. The conversion of nitrates to nitrite and further formation of nitrosamines are associated with gastrointestinal cancer and methaemoglobinemia. The positive effect of nitrate on the human organism is reflected in its conversion to NO, which control of blood pressure, improving cardiovascular health, and supporting gastrointestinal and immune function [9]. The monitoring of nitrate levels, during a period of 13 years in Slovenia, showed an average of NO₃⁻ content as follow: lettuce (962 mg/kg) > cabbage (795 mg/kg) > string beans (298 mg/kg) > carrot (264 mg/kg) > cauliflower (231 mg/kg) > potato (169 mg/kg) > cucumber (93 mg/kg) > pepper (69 mg/kg). With those results have been calculated that the daily intake per inhabitant is close to the acceptable DI permitted in EU just with the consumption of potato [11].

4. CONCLUSIONS

In our study the content of nitrates are significantly higher and that can lead to negative effects especially for infants. All types' of food pollution are undesirable and monitoring programmes control the possible toxic substances. Nevertheless, on the food chain market in BG are still in the trade food products with not enough quality, besides of the tough control that exist.

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EVALUATION OF EXTRACTS FROM DRY FRUITS BLACK BLUEBERRY (*Vaccinium myrtillus L.*) THROUGH ONE-DIMENSIONAL AND MULTIDIMENSIONAL REGRESSION ANALYSIS FOR PHENOLCARBOXYLIC ACIDS

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Abstract: *The purpose of the study is to develop a technology for the production of dried blackberry extracts. Basic extraction parameters are established. The influence of the technological parameters of the extraction process on the content of phenolcarboxylic acids in blackberry extracts is analyzed. The extracts obtained were determined with the amount of phenolcarboxylic acids for use in enriching fruit juices with biologically active substances.*

The effect of the type of extractant, the duration and temperature of the extraction and the hydromodule on the color parameters were investigated.

The results of the planned experiment were statistically processed with the Statistica program.

The residuals were estimated and analyzed by normal probability of the residual schedule, the scatterplot of the residuals from the predicted values, and the frequency histogram of the residuals. All results are presented analytically and graphically.

Keywords: *extracts, dried fruit blackberry, phenolcarboxylic acids, regression analysis.*

1. INTRODUCTION

Studies conducted in different countries confirm that one of the main causes of pathological changes in the human body leading to premature aging and development of cardiovascular diseases, cancer and diabetes is the excessive accumulation of free radicals and reactive oxygen species in the biological fluid of the biological fluid. .

Regular use of fruits and berries in which there are many natural phenolic compounds significantly reduce the risk of these diseases. The largest amount of antioxidants is found in blackcurrant, blackberry, grape, garden strawberry and more. Therefore, it is necessary to include natural plant antioxidants in foods, which protect them from oxidation.

Most of the natural antioxidants enter the human body with food. With the systematic use of foods containing natural antioxidants, the incidence of cardiovascular and oncological diseases is significantly reduced.

The healing potential of wild shrub plants lies in their antioxidant, anti-allergic, anti-inflammatory and antiviral properties, which depend on polyphenolic complexes.

Blackberry extracts serve as natural antioxidants.

As an alternative to the synthetic antioxidants, natural polyphenols from various plant species may be used. These compounds have an ideal chemical structure to “scavenge” free radicals, demonstrating, at the same time, higher antioxidant capacity (e.g., cyanidin and malvidin) than vitamins C and E [1].

Owing to these properties, polyphenols protect and support many functions of organs and systems and in particular the digestive [2], nervous and circulatory systems [3].

Anthocyanins are representative plant pigments widely distributed in colored fruits and flowers. They also exhibit antioxidant activities and therefore may contribute to the prevention of heart disease, cancer, and inflammatory disease [4, 5, 6, 7, 8, 9]. Berries have

been known to contain anthocyanin pigments abundantly and thus have been used globally as a medicine or a source of health food/dietary supplement.

In order to increase the nutritional value and antioxidant properties of the juice-containing beverages, extracts of wild raw materials having prophylactic and functional action can be introduced into production technologies.

The purpose of the study is to develop a technology for the production of dried blackberry extracts. Basic extraction parameters are established. The extracts obtained were analyzed for the purpose of enriching fruit juices with phenolic compounds.

2. MATERIALS AND METHODS

Object of study are the fruits of *Vaccinium myrtillus* L. In wild plants are contain a number of chemicals that can affect the vital processes occurring in the human body.

Phenolcarboxylic acids-Spectrophotometric by Pharmacopoeia Method [Pharmacopoeia Russia]. General method of analysis [10].

Mathematical methods. Mathematical data processing was performed by one-dimensional and multi-dimensional regression analysis. By which were studied and evaluated the possible functional dependencies between two or more random variables. The main questions are whether there is a functional dependence between two dependent random variables and if so - to find a function that describes it sufficiently accurately. Various models have been studied, with the best-described dependencies being selected. Estimates were made on the degree of influence of the factors as well as on their level of significance. Fischer's criterion is assessed, as well as its probability. Residue assessment and analysis was performed by normal probability plot of residues, the scatter plot of the predicted residual values and the residual histogram. All results are presented analytically and graphically.

The processing was done through the statistical program STATISTICA (StatSoft, Inc.).

All data are processed at level of significance $\alpha=0,05$.

3. RESULTS AND DISCUSSION

The experimental results obtained from the physicochemical studies of the dried blackberry extracts were used to obtain a regression model as well as to study its suitability. Multiple regression was found between phenolecarboxylic acids, % as a function of response, ethyl alcohol concentration in percent, and time in minutes. The best model turns out to be:

$$z = b_1x + b_2t + b_3t^2 \quad 1)$$

where (x) is the concentration of ethyl alcohol in percent, (y) is the time in minutes and (z) is the concentration of phenolecarboxylic acid in percent.

After the statistical processing of the data, it can be seen that the coefficient of determination

$R^2 = 0,72$ which means that 72% of the change in the parameter / Z / is due to the control factors / x / and / y / is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_1 = 0,0083 \quad b_2 = 0,001259 \quad b_3 = -0,000001$$

Fisher's criterion, $F(4,40) = 10,183$, $p < 0.00194$, and its corresponding probability indicate that the model describes a significant part of the change in Z . The model performs better than the so-called naive forecasts average values.

The regression equation is:

$$z = 0,0083x + 0,001259t - 0,000001t^2 \quad (2)$$

The resulting regression model describes the surface $z = f(x, y)$ that we can depict in R^3 .

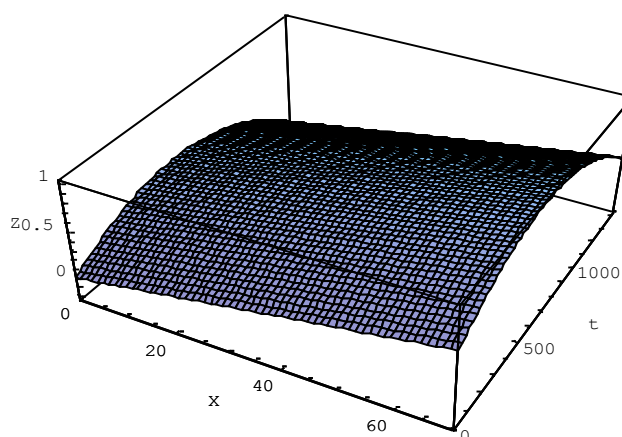


Figure 1. Model response line

The analysis of the residuals and their graphical representations are shown in Figure 2 in the so-called normal probability graph.

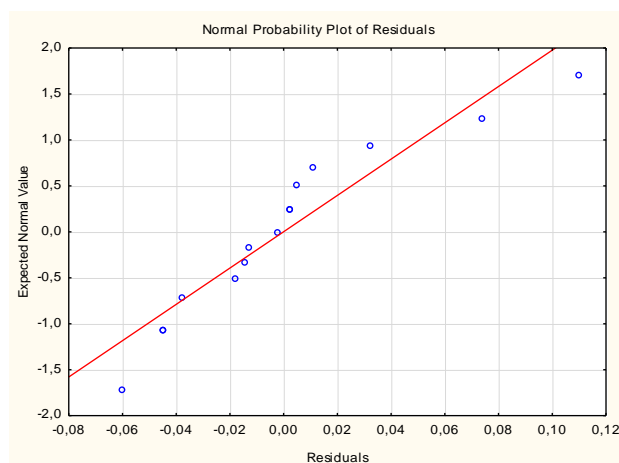


Figure 2. Normal probability plot of residuals

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIGURE. 4.

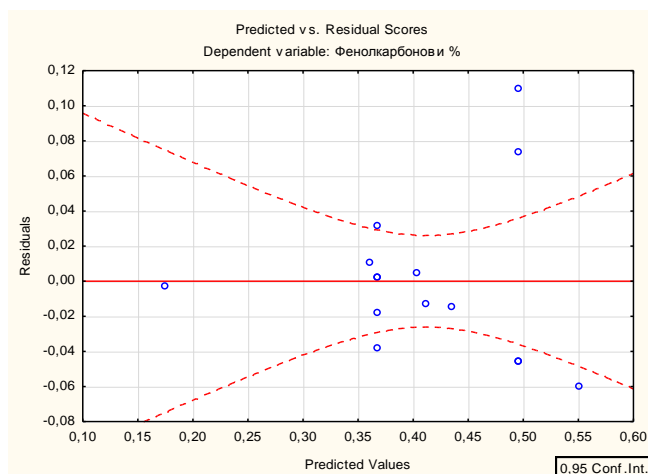


Figure 3. Scatterplot of residual values from predicted values

The obtained graph shows that the systematic residuals are lacking and are sufficiently chaotic in their distribution. We can conclude that the residuals do not depend on the predicted values.

Conclude. From the obtained results we can draw the following conclusions:

- The resulting model is quadratic and describes the experimental data obtained with great precision.
- From the residual analysis, we can conclude that our model is adequate.
- Concentration and time factors have a relatively similar effect.

The experimental results obtained were also used to obtain a regression model and to find multiple regression between phenolecarboxylic acids,% as a function of response, ethyl alcohol concentration in percent and temperature. The best model turns out to be:

$$z = b_1x + b_2T + b_3x^2 + b_4T^2 \quad (3)$$

where (x) is the concentration of ethyl alcohol in percent, (y) is temperature, and (z) is phenolecarboxylic acid in percent.

After the statistical processing of the data it is seen that the coefficient of determination $R^2 = 0,85$, which means that 85% of the change in the parameter / Z / is due to the control factors / x / and / y / and is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_1 = 0,008338, b_2 = 0,001281, \quad b_3 = -0,000072$$

$$b_4 = -0,000001$$

Fisher's criterion, $F(4,40) = 42,661$ $p < 0.00000$, and its corresponding probability indicate that the model describes a significant part of the change in / Z /. The model performs better than the so-called naive average forecasts.

The regression equation is:

$$y = 0,008338x + 0,001281T - 0,000072x^2 - 0,000001T^2 \quad (4)$$

The resulting regression model describes the surface $z = f(x, T)$ that we can depict in R^3 .

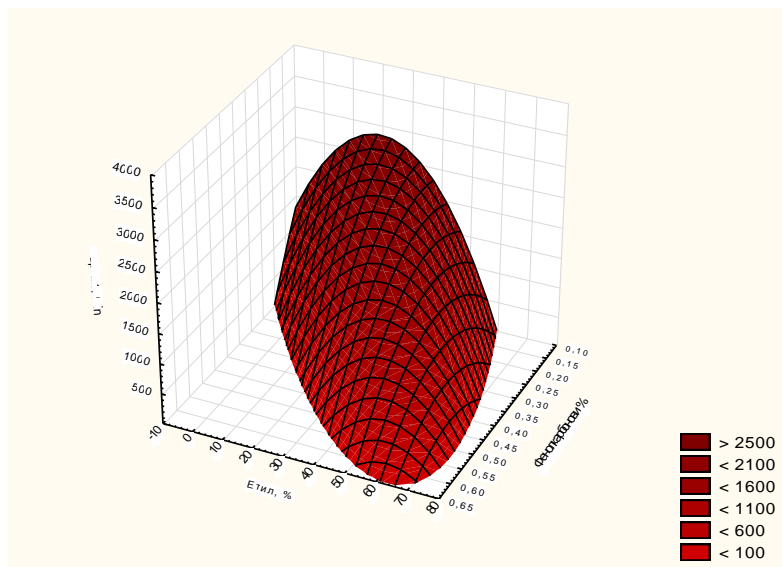


Figure 4. Model response line

The analysis of residues and their graphical representations are shown in Figure 5 in the so-called normal probability graph.

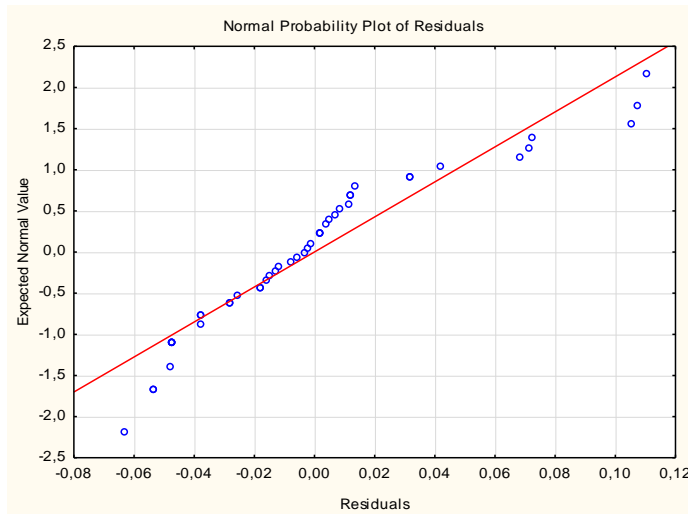


Figure 5. Normal probability plot of residuals

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIGURE. 6.

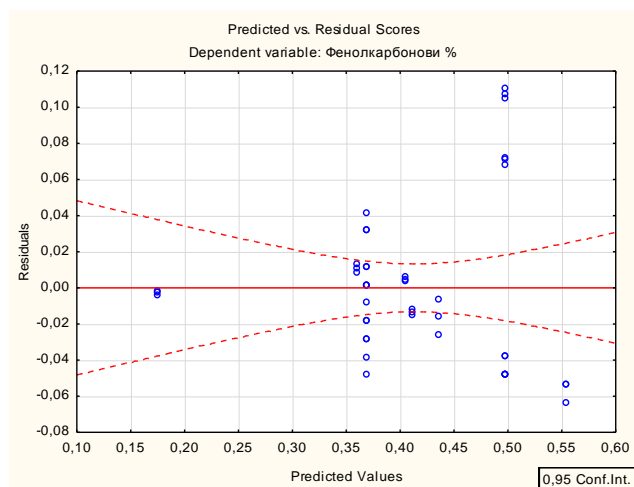


Figure 6. Scatterplot of residual values from predicted values

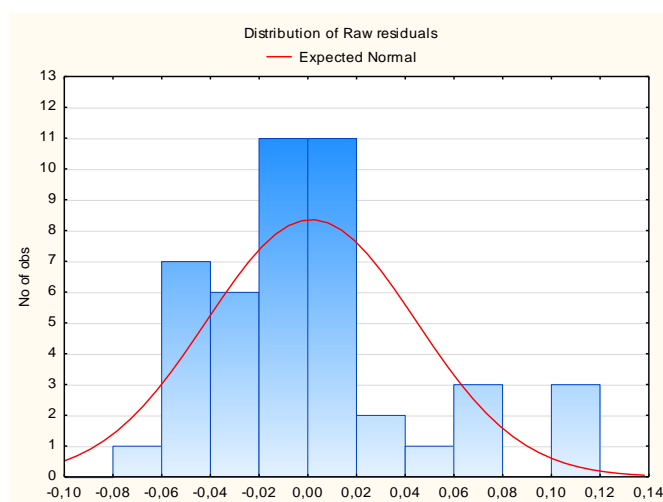


Figure 7. Residual histogram

The obtained graph shows that the systematic residuals are lacking and are sufficiently chaotic in their distribution. We can conclude that the residuals do not depend on the predicted values.

Conclude. From the obtained results we can draw the following conclusions:

- The resulting model is quadratic and describes the experimental data obtained with great precision.
- From the residual analysis, we can conclude that our model is adequate.
- From the analysis of the standardized bet coefficients, it can be concluded that the time parameter has a 4.5-fold greater influence on the concentration response.

A regression model was obtained based on the results obtained, and multiple regression was found between phenolcarboxylic acids,% as a function of response and concentration of ethyl alcohol in percent and hydromodule. The best model turns out to be:

$$z = b_0 + b_1x + b_2y \quad (5)$$

where (x) is the concentration of ethyl alcohol, (y) the hydromodule, and (z) is the concentration of phenolcarboxylic acids in percent.

After the statistical processing of the data it can be seen that the coefficient of determination $R^2 = 0,81$, which means that 81% of the change in the parameter / Z / is due to the control factors / x / and / y / is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_1 = 0,008324, b_2 = 0,011228$$

Fisher's criterion, $F(3,40) = 16.56$, $p < 0.00022$, and its corresponding probability indicate that the model describes a significant part of the change in / Z /. The model performs better than the so-called average estimates.

The regression equation is:

$$y = 0,008324x + 0,011228y \tag{6}$$

The resulting regression model describes the surface $z = f(x, y)$ that we can depict in R^3 .

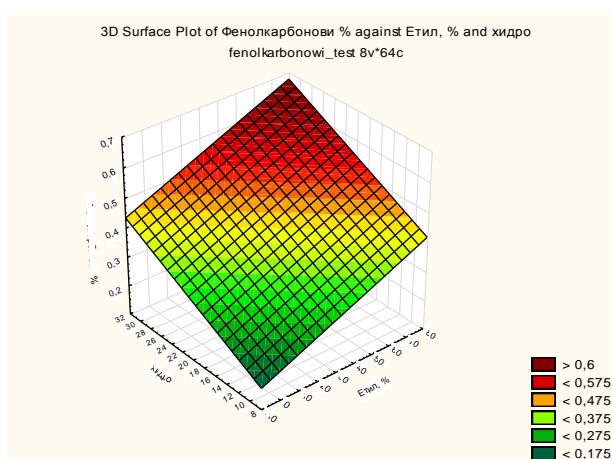


Figure 8. Model response line

The analysis of the residuals and their graphical representations are shown in Figure. 9 in the so-called normal probability graph.

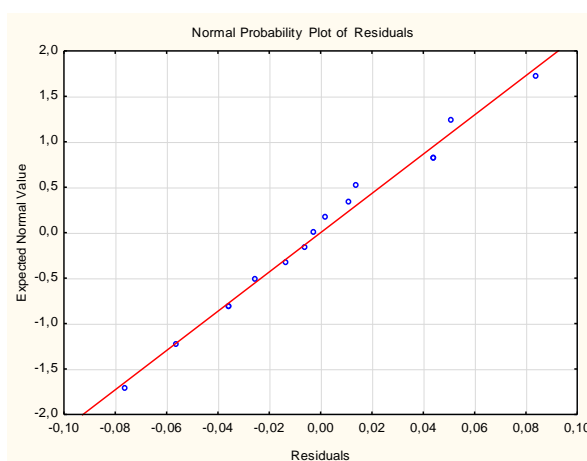


Figure 9. Normal probability plot of residuals

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIGURE. 10.

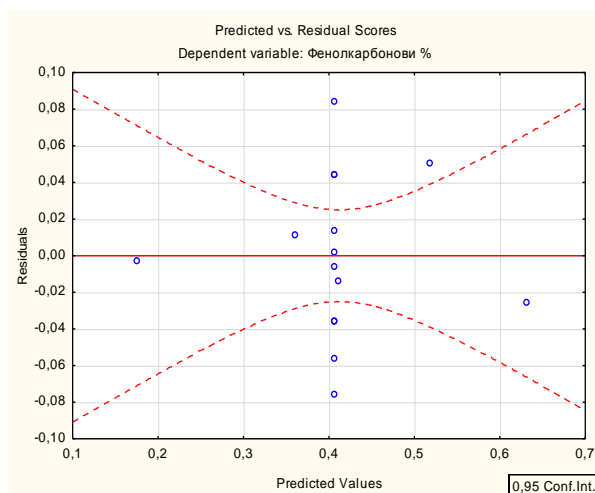


Figure 10. Scatterplot of residual values from predicted values

The obtained graph shows that the residuals are not systematic and are sufficiently chaotic. We can conclude that the residuals do not depend on the predicted values.

4. CONCLUSION

From the obtained results we can draw the following conclusions:

- From the residual analysis, we can conclude that our model is adequate.
- The resulting model is linear and describes with great precision the experimental data obtained.
- Ethyl alcohol concentration has a greater influence on the model of the hydromodule

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EVALUATION OF EXTRACTS FROM DRY FRUITS BLACK CURRANT (*Ribes nigrum L.*) THROUGH ONE-DIMENSIONAL AND MULTIDIMENSIONAL REGRESSION ANALYSIS FOR PHENOLCARBOXYLIC ACIDS

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Abstract. *The purpose of the study is to develop a technology for the preparation of blackcurrant extracts. Basic extraction parameters are established. The influence of the technological parameters of the extraction process on the content of phenolcarboxylic acids in the extracts of and currant was analyzed.*

The extracts obtained were determined with the amount of phenolcarboxylic acids for use in enriching fruit juices with biologically active substances.

The effect of the type of extractant, the duration and temperature of the extraction and the hydromodule on the color parameters were investigated.

The results of the planned experiment were statistically processed with the Statistica program.

The residuals were estimated and analyzed by normal probability of the residual schedule, the scatterplot of the residuals from the predicted values, and the frequency histogram of the residuals. All results are presented analytically and graphically.

Keywords: *extracts, blackcurrant, phenolcarboxylic acids, regression analysis.*

1. INTRODUCTION:

The production of healthy and wholesome food is an important and priority task related to the development and implementation of functional food products.

One of the conditions for creating a functional product is to achieve the highest possible level of its nutritional and biological value and guaranteed safety.

Drinks are the optimal form of food product that can be used to enrich the diet with essential nutrients and biologically active substances that have a beneficial effect on the metabolism and immune resistance of the body [1].

Studies conducted in different countries confirm that one of the main causes of pathological changes in the human body leading to premature aging and development of cardiovascular diseases, cancer and diabetes is the excessive accumulation of free radicals and reactive oxygen species in the biological fluid of the biological fluid. .

Regular use of fruits and berries in which there are many natural phenolic compounds significantly reduce the risk of these diseases. The largest amount of antioxidants is found in black currant, blackberry, grape, garden strawberry and more. Therefore, it is necessary to include natural plant antioxidants in foods, which protect them from oxidation.

Increasing the content of free radicals in cells creates the conditions for so-called oxidative stress, in which free radicals oxidize the walls of vessels, protein molecules, DNA and lipids. These radicals actively interact with lipid membranes containing unsaturated bonds and alter the properties of cell membranes [2].

The healing potential of wild shrub plants lies in their antioxidant, anti-allergic, anti-inflammatory and antiviral properties, which depend on polyphenolic complexes.

Black currant extracts serve as natural antioxidants.

In order to increase the nutritional value and antioxidant properties of the juice-containing beverages, extracts of wild raw materials having prophylactic and functional action can be introduced into production technologies.

Small berries black currant, are widely recognized for their nutritional quality and potential health benefits. Black currants are a good source of sugars and organic acids as important primary metabolites, vitamins, antioxidants and phenolic acids that contribute to the quality of taste and aroma [3].

Bordonaba and Terry [4] reported that sugar and acid content and sugar to acid ratio in black currants and other fruits are essential in flavour formation. Also, black currants are an inexhaustible source of vitamins, especially vitamin C, which along with minerals make the fruit highly physiologically valuable. Major minerals and essential trace elements are very important in biological processes, play a vital role in normal growth and development, and are also involved in the prevention of some chronic diseases [5].

The purpose of the study is to develop a technology for the preparation of blackcurrant extracts. Basic extraction parameters are established. The extracts obtained were analyzed for the purpose of enriching fruit juices with phenolic compounds.

2. MATERIALS AND METHODS

Object of study are the fruits of *Ribes nigrum* L. In wild plants are contain a number of chemicals that can affect the vital processes occurring in the human body.

Phenolcarboxylic acids - Spectrophotometric by Pharmacopoeia Method [Pharmacopoeia Russia]. General method of analysis [6].

Mathematical methods. Mathematical data processing was performed by one-dimensional and multi-dimensional regression analysis. By which were studied and evaluated the possible functional dependencies between two or more random variables. The main questions are whether there is a functional dependence between two dependent random variables and if so - to find a function that describes it sufficiently accurately. Various models have been studied, with the best-described dependencies being selected. Estimates were made on the degree of influence of the factors as well as on their level of significance. Fischer's criterion is assessed, as well as its probability. Residue assessment and analysis was performed by normal probability plot of residues, the scatter plot of the predicted residual values and the residual histogram. All results are presented analytically and graphically.

The processing was done through the statistical program STATISTICA (StatSoft, Inc.).

All data are processed at level of significance $\alpha=0,05$.

3. RESULTS AND DISCUSSION

The experimental results obtained from the physicochemical studies of the extracts of the dried fruits of the black currant were used to obtain a regression model and to investigate its suitability. Multiple regression was found between phenolecarboxylic acids,% as a function of response, ethyl alcohol concentration in percentages and time in minutes. The best model turns out to be:

$$z = b_1 x + b_2 y \quad (1)$$

where / x / is the time in minutes, / y / is the temperature in degrees Celsius, and / z / is the concentration of phenolecarboxylic acids in percent.

After the statistical processing of the data it can be seen that the coefficient of determination $R^2 = 0,90$, which means that 90% of the change in the parameter / Z / is due to the control factors / x / and / y / and is described with the model used. Of all the models studied,

the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

Fisher's criterion, $F(5,41) = 25.86$, $p < 0.00000$, and its corresponding probability indicate that the model describes a significant part of the change in Z . The model performs better than the so-called average estimates.

The regression equation is:

$$z = 0.0118 + 0.0007 * x + 0.001 * y - 3.5544E-7 * x * x - 7.025E-6 * x * y + 2.2037E-7 * y * y \quad (2)$$

The resulting regression model describes the surface $z = f(x, y)$, that we can depict in R^3 .

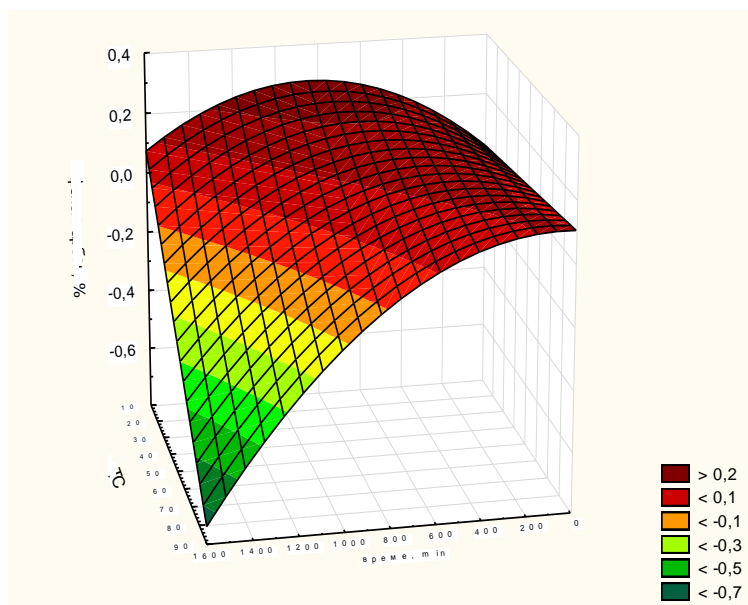


Figure 1. Model response line

The analysis of the residuals and their graphical representations are shown in Figure 2 in the so-called normal probability graph.

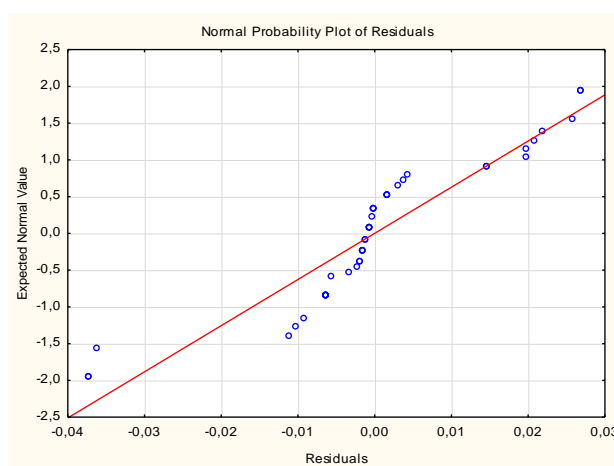


Figure 2. Normal probability plot of residuals

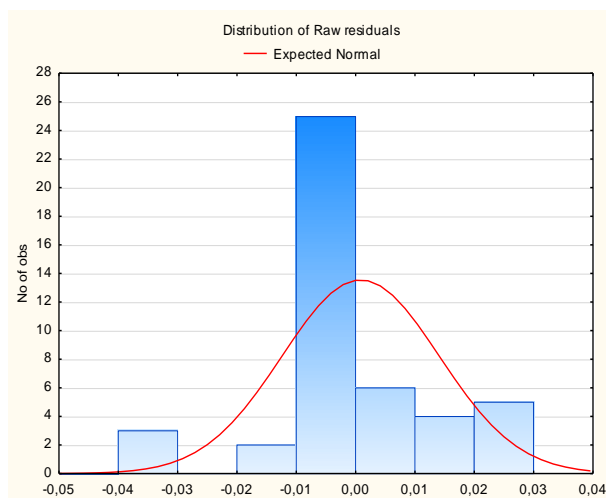


Figure 3. Frequency histogram of residues

The analysis shows a lack of systematic deviation of the actual data from the theoretical curve, which indicates a normal distribution of residues.

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIG. 4.

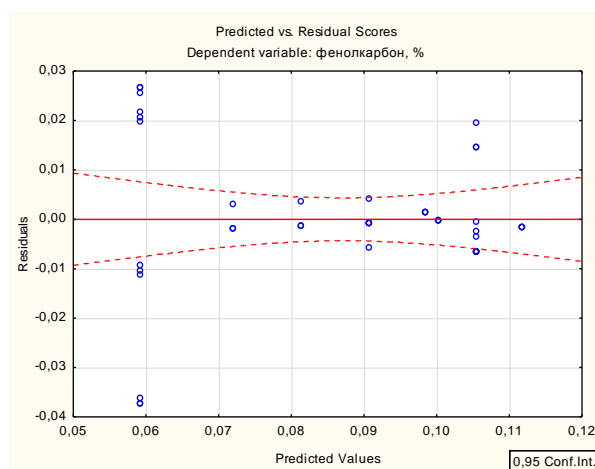


Figure 4. Scatterplot of residual values from predicted values

The obtained graph shows that the residuals are not systematic and are sufficiently chaotic. We can conclude that the residuals do not depend on the predicted values.

Conclude. From the obtained results we can draw the following conclusions:

- The resulting model is quadratic and describes the experimental data obtained with great precision.
- From the residual analysis, we can conclude that our model is adequate
- From the analysis of standardized bet coefficients, it follows that time and then temperature have the greatest influence on the model.

The experimental results obtained were also used to obtain a regression model and to find multiple regression between phenolcarboxylic acids, % as a function of response, ethyl alcohol concentration in percentages and time in minutes. The best model turns out to be:

$$z = b_1 x + b_2 y \quad (3)$$

where (x) is the concentration of ethyl alcohol in percent, (y) is the time in minutes and (z) is the concentration of phenolcarboxylic acid in percent.

After the statistical processing of the data, it can be seen that the coefficient of determination

$$R^2 = 0,90$$

, which means that 90% of the change in the parameter / Z / is due to the control factors x and y is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_1 = 0,000964, \quad b_2 = 0,000177$$

Fisher's criterion, $F(4,41) = 107,86$, $p < 0,00000$, and its corresponding probability indicate that the model describes a significant part of the Z change. The model performs better than the so-called naive forecasts by averages.

The regression equation is:

$$y = 0,000964 x + 0,000177 y \quad (4)$$

The resulting regression model describes the surface $z = f(x, y)$, that we can depict in R^3 .

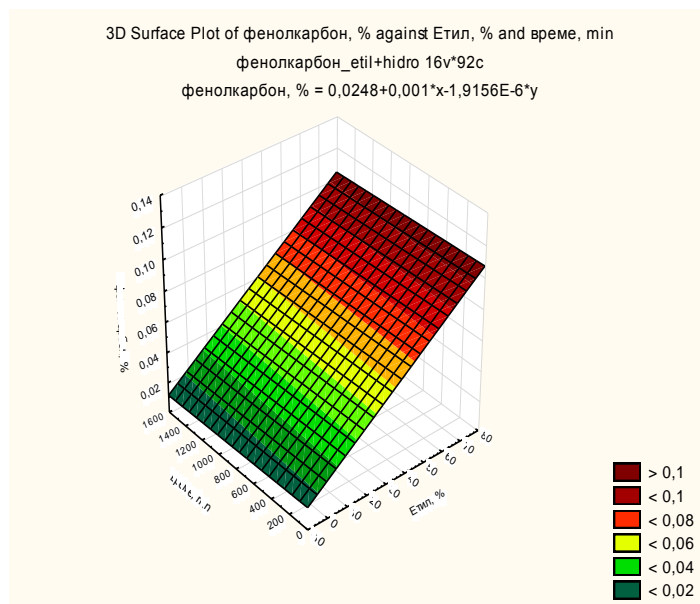


Figure. 5. Model response line

The analysis of the residuals and their graphical representations are depicted in Fig. 6 in the so-called normal probability graph.

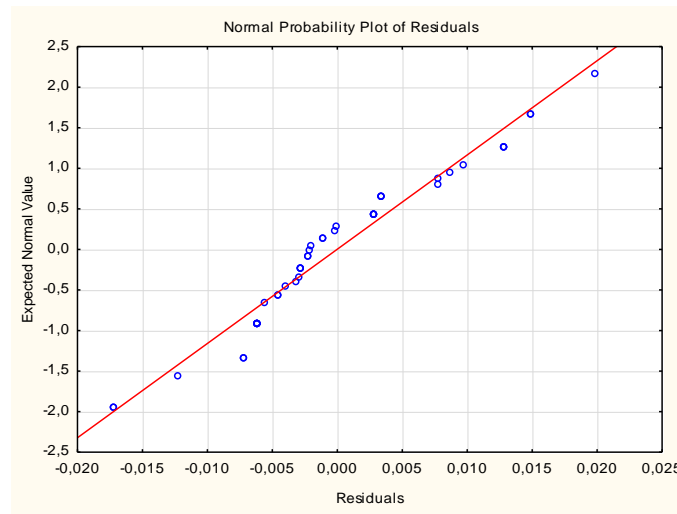


Figure 6. Normal probability plot of residuals

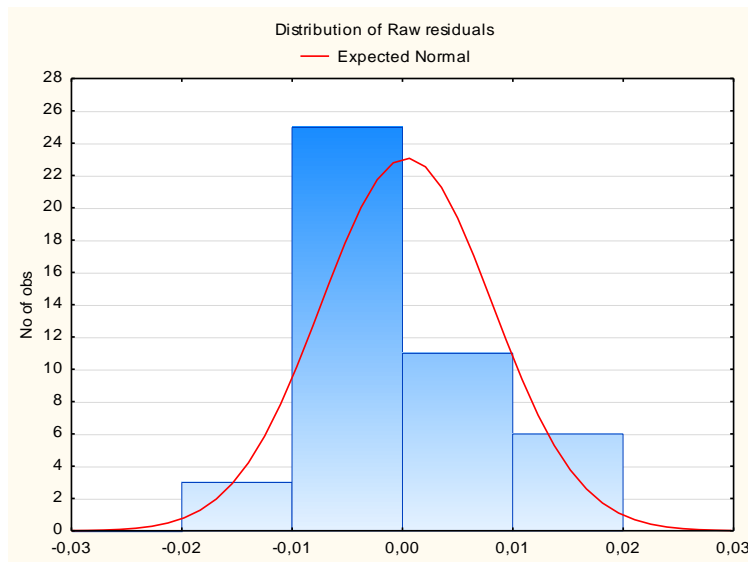


Figure 7. Frequency histogram of residues

The analysis shows a lack of systematic deviation of the actual data from the theoretical curve, which indicates a normal distribution of residues.

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIG. 8.

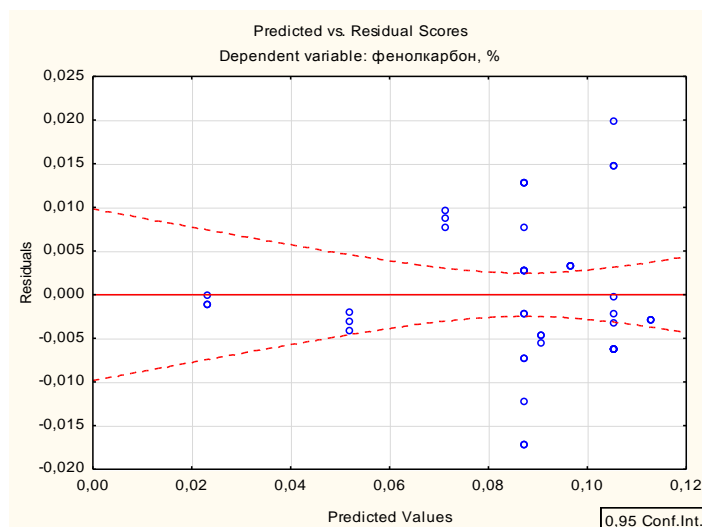


Figure 8. Scatterplot of residual values from predicted values

The obtained graph shows that the residuals are not systematic and are sufficiently chaotic. We can conclude that the residuals do not depend on the predicted values.

Conclude. From the obtained results we can draw the following conclusions:

- The resulting model is linear describes the experimental data obtained with great precision.
- From the residual analysis, we can conclude that our model is adequate.
- From the analysis of standardized bet coefficients, it follows that time and then concentration have the greatest influence on the model.

The experimental results obtained were also used to obtain a regression model and to search for multiple regression between phenolecarboxylic acids,% as a function of response, ethyl alcohol concentration in percent and temperature.

The best model turns out to be:

$$z = b_0 + b_1x + b_2y \tag{5}$$

where (x) is the concentration of ethyl alcohol in percent, (y) is the temperature, and (z) is the concentration of phenolecarboxylic acid in percent.

After the statistical processing of the data it can be seen that the coefficient of determination

$$R^2 = 0,86$$

, which means that 86% of the change in the parameter / Z / is due to the control factors / x / and / y / and is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_0 = 0,018221 \quad b_1 = 0,000805 \quad b_2 = 0,000378$$

Fisher's criterion, $F(4,42) = 100,41$, $p < 0,00000$, and its corresponding probability indicate that the model describes a significant part of the change in / Z /. The model performs better than the so-called average estimates.

The regression equation is:

$$y = 0,018221 + 0,000805 x + 0,000378 y \tag{6}$$

The resulting regression model describes the surface $z = f(x, y)$, that we can depict in R^3 .

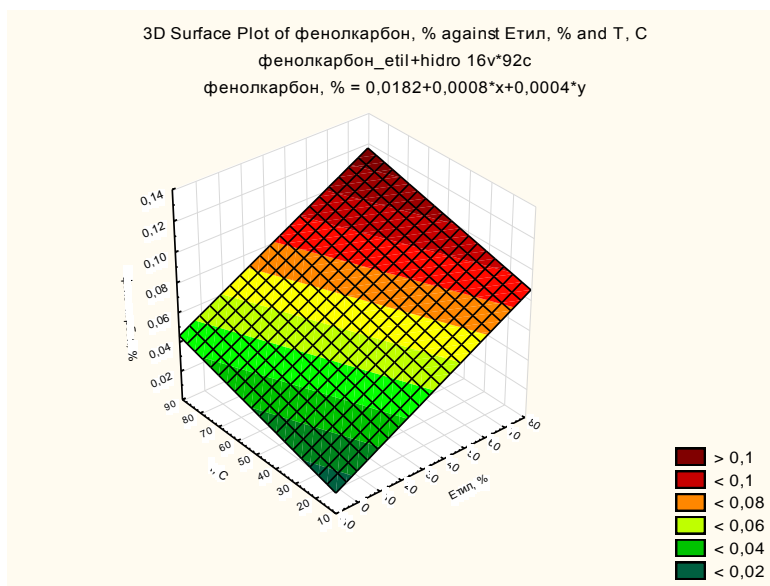


Figure 9. Model response line

The analysis of residuals and their graphical representations are shown in Figure 10 in the so-called normal probability graph.

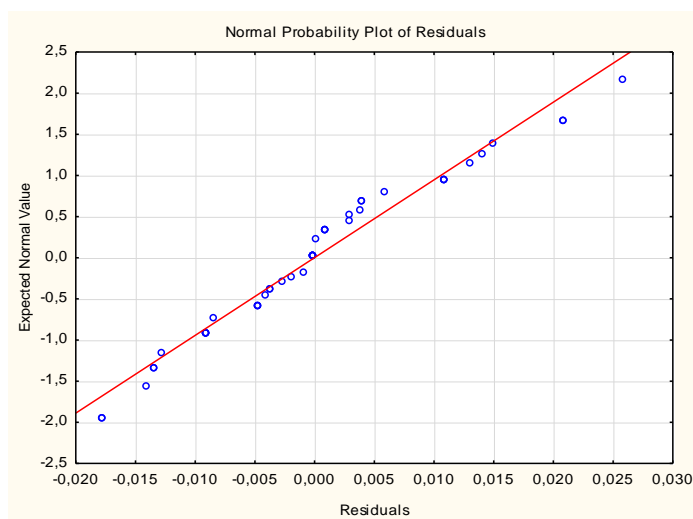


Figure 10. Normal probability plot of residuals

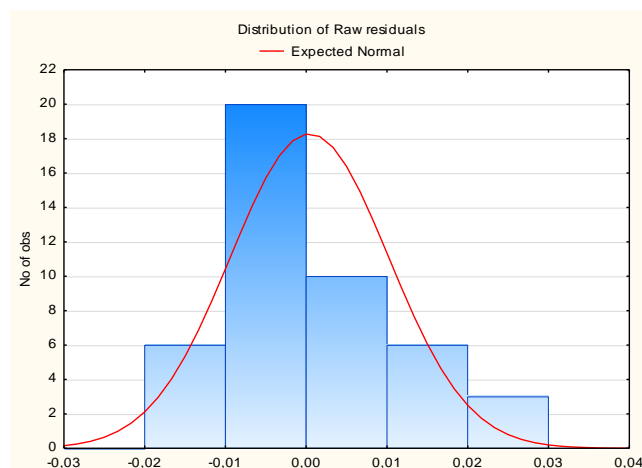


Figure 11. Frequency histogram of residues

The analysis shows a lack of systematic deviation of the actual data from the theoretical curve, which indicates a normal distribution of residues.

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIG. 12.

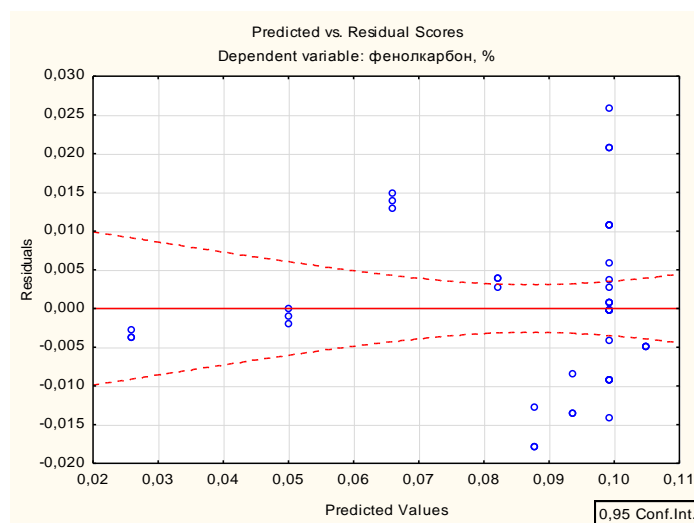


Figure 12. Scatterplot of residual values from predicted values

The obtained graph shows that the residuals are not systematic and are sufficiently chaotic. We can conclude that the residuals do not depend on the predicted values.

Conclude. From the obtained results we can draw the following conclusions:

- The resulting model is linear and describes with great precision the experimental data obtained.
- From the residual analysis, we can conclude that our model is adequate.
- From the analysis of standardized bet coefficients, it follows that concentration and then temperature have the greatest influence on the model.

The results of the physicochemical studies of the extracts of the black currant fruits were used to obtain a regression model for finding multiple regression between phenolecarboxylic

acids,% as a function of response and concentration of ethyl alcohol in percent and hydromodule.

The best model turns out to be:

$$z = b_1x + b_2y \tag{7}$$

where (x) is the concentration of ethyl alcohol in percent, (y) is the hydromodule, and (z) is the concentration of phenolcarboxylic acid in percent.

After the statistical processing of the data it can be seen that the coefficient of determination $R^2 = 0,86$, which means that 86% of the change in the parameter / Z / is due to the control factors / x / and / y / and is described with the model used. Of all the models studied, the coefficient of certainty is the highest. The statistically significant coefficients of the model are as follows:

$$b_1 = 0,001008, b_2 = 0,001359$$

Fisher's criterion, $F(4,42) = 126.32, p < 0.00000$, and its corresponding probability indicate that the model describes a significant part of the change in / Z /. The model performs better than the average estimates.

The regression equation is:

$$y = 0,001008x + 0,001359y \tag{8}$$

The resulting regression model describes the surface $z = f(x, y)$, that we can depict in R^3 .

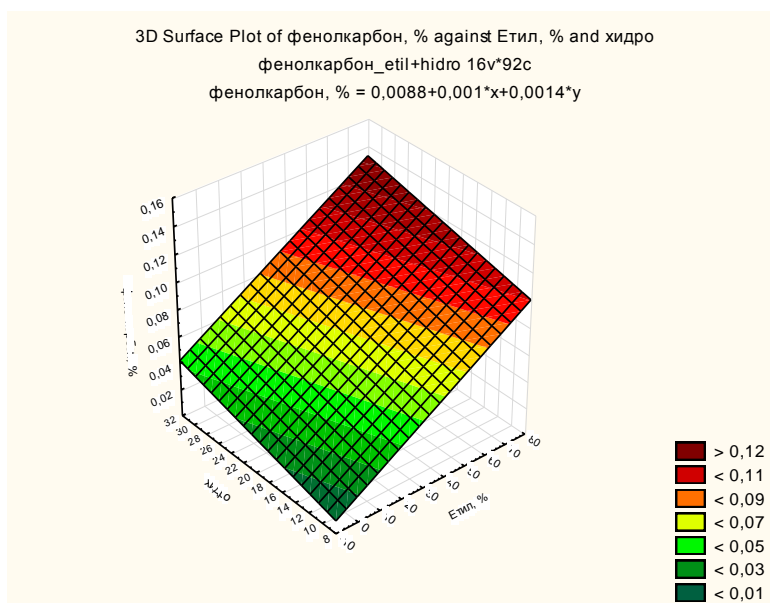


Figure 13. Model response line

The analysis of the residuals and their graphical representations are depicted in Fig. 14 in the so-called normal probability graph.

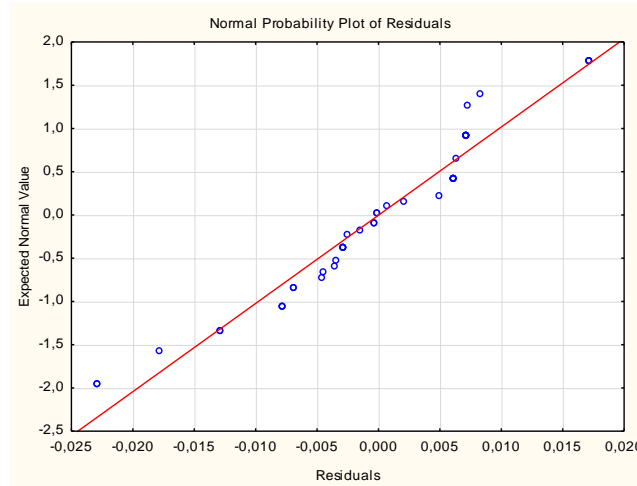


Figure 14. Normal probability plot of residuals

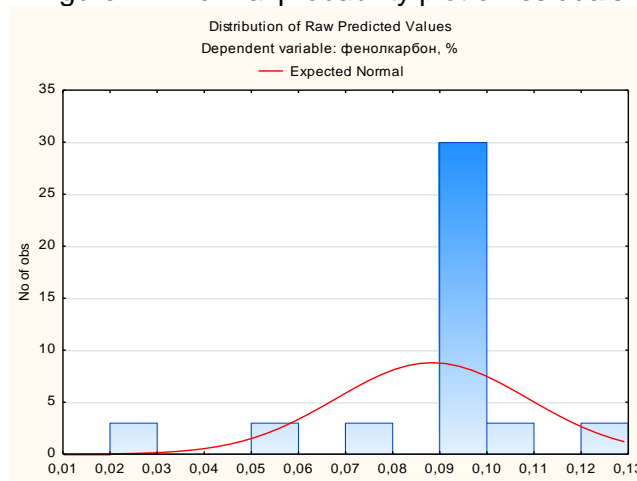


Figure 15. Frequency histogram of residues

The analysis shows a lack of systematic deviation of the actual data from the theoretical curve, which indicates a normal distribution of residues.

We will check for residual dependence on predicted values from the model. For this purpose, we will analyze the scatterplot of the residuals from the predicted values - FIG. 16.

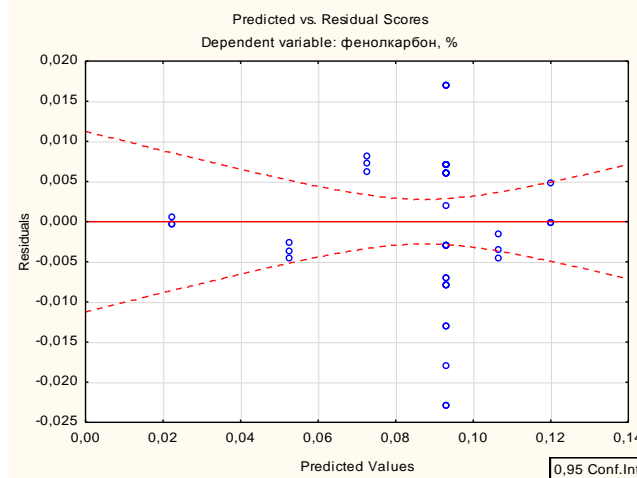


Figure 16. Scatterplot of residual values from predicted values



The obtained graph shows that the residuals are not systematic and are sufficiently chaotic. We can conclude that the residuals do not depend on the predicted values.

4. CONCLUSION

From the obtained results we can draw the following conclusions:

- The resulting model is linear and describes with great precision the experimental data obtained.
- From the residual analysis, we can conclude that our model is adequate.
- From the analysis of standardized bet coefficients, it follows that the concentration and then the hydromodule have the greatest influence on the model.

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RESEARCH ON THE PHYSICOCHEMICAL COMPOSITION OF BLACK BLUEBERRY AND BLACK CURRANT USED AS THE SOURCES OF BIOLOGICALLY ACTIVE SUBSTANCES IN MAKING FUNCTIONAL BEVERAGES

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Abstract: *The physicochemical composition of the dried fruits *Vaccinium myrtillus L.* and *Ribes nigrum L.* was investigated in order to use them as a raw material for the production of functional drinks.*

In the course of the work it has been found that berries are a valuable raw material for the production of plant extracts for the production of functional drinks.

They are the source of many biologically active substances such as vitamins, polyphenolic compounds and pigments.

Keywords: *berries, biologically active substances, general phenols, flavonoids, anthocyanins, vitamins.*

1. INTRODUCTION:

In today's context, the problem of rational nutrition is one of the main factors determining the state of human health, its working capacity and the sustainability of the influence of various adverse environmental factors. Reduced consumption of natural plant products has caused the development of functional disorders of the gastrointestinal tract and diseases related to metabolic disorders.

An analysis of the modern nutrition structure shows that further improvement and development of technologies for the production of biologically complete products with high content of biologically active substances is needed to improve nutritional status.

In this context, it is important to develop a technology for extracting biologically active substances from the fruits of wild raw materials, in particular from blueberries and currants, and to include them in the development of new assortments of beverages.

The possibility of creating juices and juice-containing beverages enriched with biologically active substances as a priority area in the field of healthy nutrition has been explored. It is related not only to the problem of obtaining a wide range of products, but also to the current task of developing products with increased nutritional and biological value.

The production of healthy and wholesome food is an important and priority task related to the development and implementation of functional food products.

One of the conditions for creating a functional product is to achieve the highest possible level of its nutritional and biological value and safe safety.

Drinks are the optimal form of food product that can be used to enrich the diet with essential nutrients and biologically active substances, which have a beneficial effect on the metabolism and immune resistance of the body [1].

The most promising are functional juice-containing beverages with all-natural properties based on natural juices using extracts of plant materials with biologically-active substances. Herbal extracts increase the body tone, adaptive capacity of the nervous system and the body's resistance to the effects of adverse environmental factors.

Studies have confirmed that one of the main causes of pathological changes in the human body leading to premature aging and development of cardiovascular disease, cancer and diabetes is the excessive accumulation of free radicals and reactive oxygen species in the body's biological fluid.

Antioxidants are substances that can slow down or prevent oxidation processes.

In order to increase the nutritional value and antioxidant properties of the juice-containing beverages, extracts of wild raw materials having prophylactic and functional action can be introduced into production technologies.

The healing potential of wild shrub plants lies in their antioxidant, anti-allergic, anti-inflammatory and antiviral properties, which depend on polyphenolic complexes. Particular attention is given to the content of flavonoid phenolic compounds and anthocyanin pigments.

Wild plants and fruits are multicomponent systems with complex interactions that can be embedded in the physiological antioxidant system of cells in the body, be drawn to it, and form new relationships and interactions between all components of the system [2,3].

It tasteful fruits are a rich source of vitamin C and other health beneficial substances such as: routine, organic acids, pectins, micro- and macro nutrients and essential oils [4].

Blackcurrant fruits contain polyphenolic substances with antioxidant, antimicrobial, antiviral, and antibacterial properties [5–9].

The extracts serve as natural antioxidants.

2. MATERIALS AND METHODS

Object of study are the fruits of *Vaccinium myrtillus* L. and *Ribes nigrum* L.. In wild plants are contain a number of chemicals that can affect the vital processes occurring in the human body.

- General Phenol Compounds (AFS) spectrophotometric method with Folin-Denisa reagent, % as gallic acid [10].
- Phenol Carbonic Acid - Spectrophotometric by Pharmacopoeia Method [Pharmacopoeia Russia]. General method of analysis [10].
- Flavonoid phenolic compounds - spectrophotometric as a rutin, % by pharmacopoeial method [Pharmacopoeia Russia]. General method of analysis [10].
- Anthocyanins - spectrophotometric such as cyanidine-3,5-diglucoside, by pharmacopoeial method [Pharmacopoeia Russia]. General method of analysis [10].
- Tanning substances - titrated with 0.02M potassium permanganate, % by pharmacopoeial method [Pharmacopoeia Russia]. General method of analysis [4].
- Organic acids - titrimetric method
- Vitamin C [Ascorbic acid] - titrative of 0,001M sodium chloride 2,6-dichloropheninophenol, mg% BDS 11812-91
- β -Carotin - spectrophotometric such as β -carotene, mg% by pharmacopoeial method [Gosardar Pharmacopoeia Russia]. General method of analysis.
- Vitamin P - bioflavonoid (routine, citrine, catechins, etc.) is a complex of compounds called bioflavonoids [10].

3. RESULTS AND DISCUSSION

The purpose of this study is to provide a scientific and experimental justification for the need to develop a functional orientation extraction technology based on the use of the dried fruits of *Vaccinium myrtillus* L. and *Ribes nigrum* L. The physicochemical composition of the dried fruits of *Vaccinium myrtillus* is investigated and *Ribes nigrum* for their use in the preparation of extracts for the production of functional drinks with antioxidant properties.

Based on complex physicochemical studies, they have been found to contain many biologically active substances, a significant phenolic and vitamin complex that determines not only their high nutritional value but also their antiradical activity.

The sugars contained in the fruits of the test raw materials mask their sour taste, and the polyphenolic compounds enhance and make the taste slightly tart.

The content of total phenolic compounds in the tested fruits is different and is 6.77% for *Vaccinium myrtillus* and 2.13% for *Ribes nigrum* L. - Fig. 1. Polyphenols determine the color, taste, aroma of raw materials and their products. They remove heavy metal ions from the body and have an antioxidant effect.

The content of phenolcarboxylic acids reaches 1.07% for dried cranberries and 0.26% for dried currants - Fig. 1

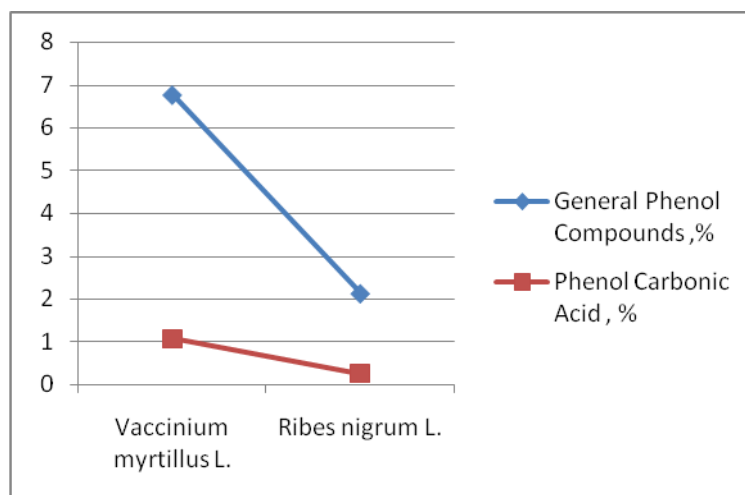


Figure 1. Investigation of total phenolic compounds and phenolcarboxylic acids in blackberry and blackcurrant fruits

Of particular interest are the phenolic compounds and their individual groups. The amount of flavonoid phenolic compounds in blackberry and blackcurrant fruits is 772 mg / 100 g of dried raw material and 108 mg / 100 g of blackcurrant fruit - Figure 2.

Flavonoids are compounds that have P-vitamin activity.

Three groups of substances relate to vitamin P: flavones, anthocyanins and L-catechins. In nature, these groups mutually convert, whereby flavonols via leucoanthocyanidins can be converted to either anthocyanidins or catechins.

The transformation process is ongoing, so in the plant world, these groups accompany each other.

Anthocyanins refer to P-active substances - substances of red color contained in the studied wild plants. Their quantity is higher than other fruits. Therefore, they are considered to be products of healthy and rational nutrition, help to boost immunity, heal and strengthen the body and are useful in various diseases. The content of anthocyanins in the fruits of blackberry and blackcurrant is different and is 237 mg% and 300 mg% respectively for *Vaccinium myrtillus* L. and *Ribes nigrum* - Fig. 2.

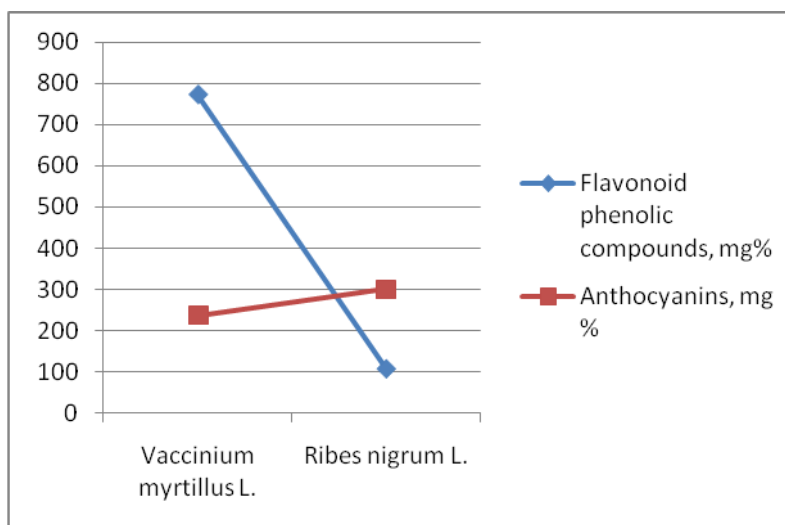


Figure 2. Investigation of flavonoid phenolic compounds and anthocyanins in blueberry and blackcurrant fruits

The organic acid content of the fruits of *Vaccinium myrtillus* and *Ribes nigrum* under study were 5.36 and 5.52%, respectively - Fig. 3. They play an important role in the storage of berries, increase their shelf life, cause acid taste, excite the secretion of the pancreas, stimulate bowel peristalsis, have bactericidal action.

Tanning agents are high molecular weight polyphenolic compounds and their content in plants depends on the growing season, age, etc. factors. Depending on their chemical structure, they are divided into hydrolysable (halothanes and ellotanins) and non-hydrolysable (catechins).

They are found in almost all plants and are well extracted with water and water-alcohol solutions.

The amount of tannins extracted is calculated from absolute dry matter and for blackberry and blackcurrant fruits is 22.10% and 13.98% respectively - Fig. 3.

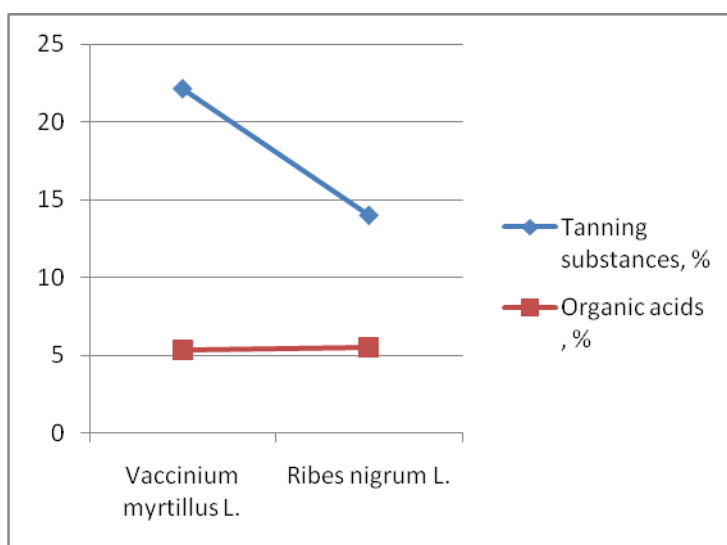


Figure 3. Examination of tannins and organic acids in blackberry and blackcurrant fruits

The nutritional value of *Vaccinium myrtillus* and *Ribes nigrum* is also determined by the vitamins they contain. As can be seen from Figure 4, the raw materials tested contain: in the

dried fruits of *Vaccinium myrtillus* 541 mg% ascorbic acid and 18.8 mg% β -carotene; in the dried fruits of *Ribes nigrum* 398 mg% ascorbic acid and 57.8 mg% β -carotene. The fruits of *Vaccinium myrtillus* and *Ribes nigrum* contain a significant amount of vitamin P - figure 4.

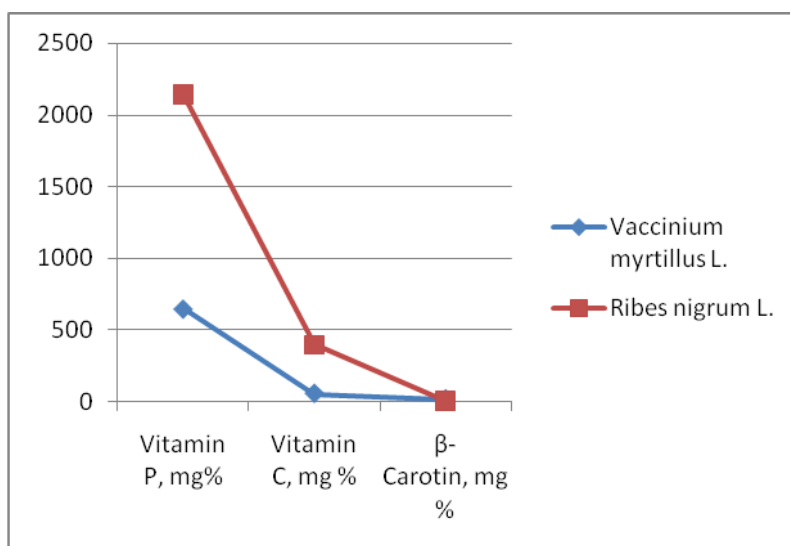


Figure 4. Vitamin P, Vitamin C and β -carotene studies in blackberry and blackcurrant fruits

On the basis of the conducted researches, the development of technology for the production of extracts with very good organoleptic properties was started, which allows to increase their antiradical activity and to be used for the preparation of functional drinks.

4. CONCLUSION

The experimental work carried out and the analysis of the results obtained lead to the conclusion:

1. The dried fruits of *Vaccinium myrtillus* and *Ribes nigrum* under study are high in biologically active substances and can be used to obtain extracts for the enrichment of fruit juices with polyphenolic compounds and vitamins.

2. The healing potential of *Vaccinium myrtillus* and *Ribes nigrum* lies in their antioxidant, anti-allergic, anti-inflammatory and antiviral properties, which depend on the phenolic complexes.

3. On the basis of the results of the studies, the development of a technology for the preparation of the dried fruit extracts of *Vaccinium myrtillus* and *Ribes nigrum* with a maximum content of phenolic compounds has begun.

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SPECIFIC LEGAL CHARACTERISTICS OF THE CARDS FOR RESTORED PROPERTY OF AGRICULTURAL AND FORESTRY TERRITORIES

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Abstract. *The maintenance of the map of the restored property as specified in the text of Article 15, paragraph 1 of Ordinance No 49 for the maintenance of the card of the restored property [www.ciela.net] [2] shall be carried out by the Municipalities of Agriculture by land.*

An essential point reflected in the text of Article 30 of Ordinance No 49 [2] is the legal requirements for the numbering of the properties subject to a map of the restored property. Each landed property is designated with a specific number.

The characteristic of this number is that it cannot be repeated with another property number on the territory of the country.

The estate number is also the number of newly formed property under a project for consideration or consolidation of a land property.

The sketch of the project for partitioning, splitting or merging of properties is made by the contractor of the technical activities for maintaining a map of the restored property, determined by the order of the Public Procurement Act [www.ciela.net] [7].

The sketch should contain ten items, nine technical and one administrative.

Keywords: *map of the restored property, municipal office of agriculture, land property, estate number, sketch, in agricultural territory, forest territory, property, law, ordinance.*

1. INTRODUCTION

According to the text of Article 1, Paragraph 2 of Ordinance No. 49 [2] on Maintenance of the Restored Property Card [www.ciela.net], the Restored Property Card combines the data from:

- Land-division plan;
- Maps of existing old real borders;
- The map of the redevelopable old real borders and the agricultural lands, which were created in accordance with the Law on the Ownership and Use of the Agricultural Land [www.ciela.net] [5].;
- A map of the restored ownership of forests and lands of the forest fund, created by the order of the Law of restoration of ownership of forests and lands of the forest fund [www.ciela.net] [4].

The map of the restored ownership of agricultural and forest territories has a wide range of applicability, reflected in the norm of art. 2 of the said ordinance.

The subject of the report is one of the main areas of applicability of the map of restored property - when disposing, dividing or transferring real parts of land located on agricultural or forest territory.

Some specific legal regulations and their characteristics in the implementation of the relevant legal and technical actions are subject to review and analysis.

2. METHODS, EXPERIMENTS, RESULTS

A / For the purposes of the report, the following methods are used:

a / a legal and legal method by which the individual highlights of the regulatory package on the topic of the report are reviewed;

b / an analytical method by which to analyze the legal rules and regulations on the topic of the report - legal standards for the repossession map, agricultural land maps and so on.

B / Experiments in this area arise from the application and compliance with legal regulations and participation in the implementation of legal regulations of legal and natural persons.

C / In this regard, an indicator of the permanence of the process of experimentation of legal norms is the practical results in the legal field under consideration.

It is because of the specific characteristics of this experiment that the results, positive or negative, are related to some imperfections of individual elements of the regulatory package. In this way, the experiment provides feedback on the need for corrections to legal norms or their replacement with others.

2.1. Common standards for the applicability of the repossession map for the division and consolidation of properties in agricultural and forest territories.

Maintaining the repossession card as specified in the text of art. 15, para 1 of Ordinance No. 49 [2]., shall be carried out by the Municipal services of agriculture on lands.

In this connection it is necessary to point out one more specification from the text of Article 15, Paragraph 2, namely:

Landed properties in agricultural and forest territories are subject to all activities to maintain the map of the restored property, regardless of:

- type of ownership;
- the method of repossession.

Land real estate transactions such as: disposal, division or transfer of a real part of the landed property are included in the range of specific requirements reflected in the texts of Section IV of Ordinance No. 49[2].

Who are they?

First, when ordering, dividing or transferring a real part of the landed property, it is not allowed to separate such parts of the landed property, which are smaller than the sizes stipulated in the texts of two laws:

- Article 72 of the Law on Inheritance [www.ciela.net] [3], according to the requirements of which the text, when drawing up units, does not allow the division of the levels into parts less than 3 decares into meadows into parts, smaller than 2 decares, and vineyards and orchards in parts smaller than 1 decare;
- Paragraph 3, Paragraph 1 of the Additional Provisions of the Law on Restoration of the Ownership of Forests and Land by the Forest Fund [www.lex.bg] [4], according to the text of which, upon the order or division of restored own forests or lands from the forest fund, the real shares may not be under - less than 1 decare.

In addition, when separating real parts of a property into separate properties or when dividing a property, the requirement for access to newly created properties is regulated according to the texts in the other two laws:

- Art. 37 of the Law on the Protection of Agricultural Property [www.lex.bg] [1], according to the text of which, when the agricultural land is unavailable as a result of sale, exchange, partition or it is made available for personal use, the seller, the substitute, the co-owner or the grantor of the land is obliged to provide access without being entitled to damages;

- Art.145 of the Forest Law [www.ciela.net] [6].



Photo 1 Map of agricultural land (Source: internet)

It is permissible to merge real estate (Photo 1) subject to the following conditions, according to the regulation of Art. 26, Para 3 of Ordinance No. 49 [2], namely:

- the properties belong to one owner;
- the properties have a common border;
- the properties are located on the territory of one land.

An important point, reflected in the text of Article 30 of Ordinance No. 49 [2], are the legal requirements for the numbering of the properties, subject to a map of the restored property (Photo 2).

Each landed property is identified by a specific number.

The characteristic of this number is that it cannot be repeated with another property number on the territory of the country.

A property number is also the number of a newly created property under a project for consideration or merging of landed property.

The property number is indicated in:

- all acts conferring ownership;
- all acts establishing, transferring, amending or terminating rights in rem over the property;
- in rental, lease or use contracts;
- when preparing a property valuation.

The acts shall be accompanied by a sketch approved by the Municipal Agriculture Office.



Photo 2 Map of agricultural land (Source: internet)

2.2. Specific standards and requirements.

The specific standards and requirements for the area of applicability of a repossession card can be divided into two groups:

First group, legal and technical requirements;

Second group, requirements related to the package of details of the sketch - project for division, division and merging of properties.

What are the legal and technical standards reflected in the provision of Article 27 of Ordinance No. 49 [2]?

Separation of real parts of the property is carried out in compliance with the following mandatory requirements:

a / the person of the landed property may not be less than:

- 12 meters for a property in agricultural territory;

- 10 meters for a property in forested area when the property borders a road.

b / the direction of the largest slope, wherever possible, is the shorter side of the property in agricultural territory and a ratio of the parties to at least one eighth of the longest side of the property;

c / the width of the road or right-of-way approach is 2.5 meters for agricultural areas;

d / specific agro-technical, construction, hydromelioration, anti-erosion or other rules and regulations of land and forest management nature.

The sketch project for the division, division or consolidation of real estate is made by the contractor of the technical activities for maintaining a map of the restored property (Photo 3),

determined in accordance with the procedure of the Public Procurement Act [www.ciela.net] [7].

The sketch must contain ten details, nine of which are technical and one administrative, namely:

- Property boundaries;
- Property number;
- The numbers of the neighboring properties;
- Method of permanent use of the property and the neighboring properties;
- Existing buildings and facilities with their easements;
- Border point numbers;
- Project boundaries;
- The numbers of newly designed properties;
- Limits to the established right of passage through neighboring properties;
- Date, signature and stamp of the contractor.



Photo 3 Map of agricultural land (Source: internet)

The sketch project, according to the regulation in Article 28, paragraph 2 of Ordinance No. 49 [2] shall be accompanied by documentation containing the following data package, representing the specific legal characteristics of the respective property, namely:

- Details of the properties that are divided or merged;
- Details of the owner of the property being divided or of the properties being merged;
- Mortgages and other encumbrances of the property being divided or of the properties being merged;
- Administrative restrictions on the property being divided or the properties being merged;
- Data on the newly created properties;
- Details of the owners of the newly created properties.

3. SCOPE OF ACTIVITIES INCLUDED IN THE CREATION OF AGRICULTURAL LAND USE MAPS.

According to the wording of the norm of Article 40 of Ordinance No. 49 [2], the creation of maps for the use of agricultural lands and the registers to them cover 4 / four / types of activities, namely:

The first regulated activity is the preparation of registers for the use of real estate on the basis of the data from the declarations under Article 69 and Article 70 of the Regulations for the implementation of the law on the ownership and use of agricultural land and recording on a copy of the map of the restored property [8].

According to the text of Article 69 of the Rules for Implementation of the Law on the Ownership and Use of Agricultural Land [8], the owners of agricultural lands declare by June 31 in the Municipal Agriculture Office the location of the property, the form of management and the way of permanent use of each from the properties.

The users of agricultural land, in accordance with the provision of Article 70 of the Regulations for the implementation of the law on the ownership and use of agricultural land [8], may also submit to the Municipal Agriculture (Photo 4) Office at the location of the property an application stating the properties used on a legal basis under current legislation.



Photo 4 Map of agricultural land (Source: internet)

The second activity is to determine the arrays for use and the form of management of these arrays, according to an agreement under Art. 37c of the Law on the Ownership and Use of Agricultural Lands [5] and their entry in the Register and in The repossession card.



Photo 5 Map of agricultural land (Source: internet)

According to the text of Article 37c of the Law on the Ownership and Use of Agricultural Land [5], arrays for the use of agricultural land are created by agreement between the owners and / or users of agricultural land.

An integral part of such an agreement is the allocation map for the arrays (Photo 5).

The drafters, after completing this process, sign the card and the agreement.

The reflection of any objections that have occurred and accepted is the essence of the third of the four activities.

Through the regulated fourth activity, the final map of the arrays for use and registers for the respective business year (from 1 October of the current year to 31 September of the following year) is prepared, or for terms specified in the agreement.

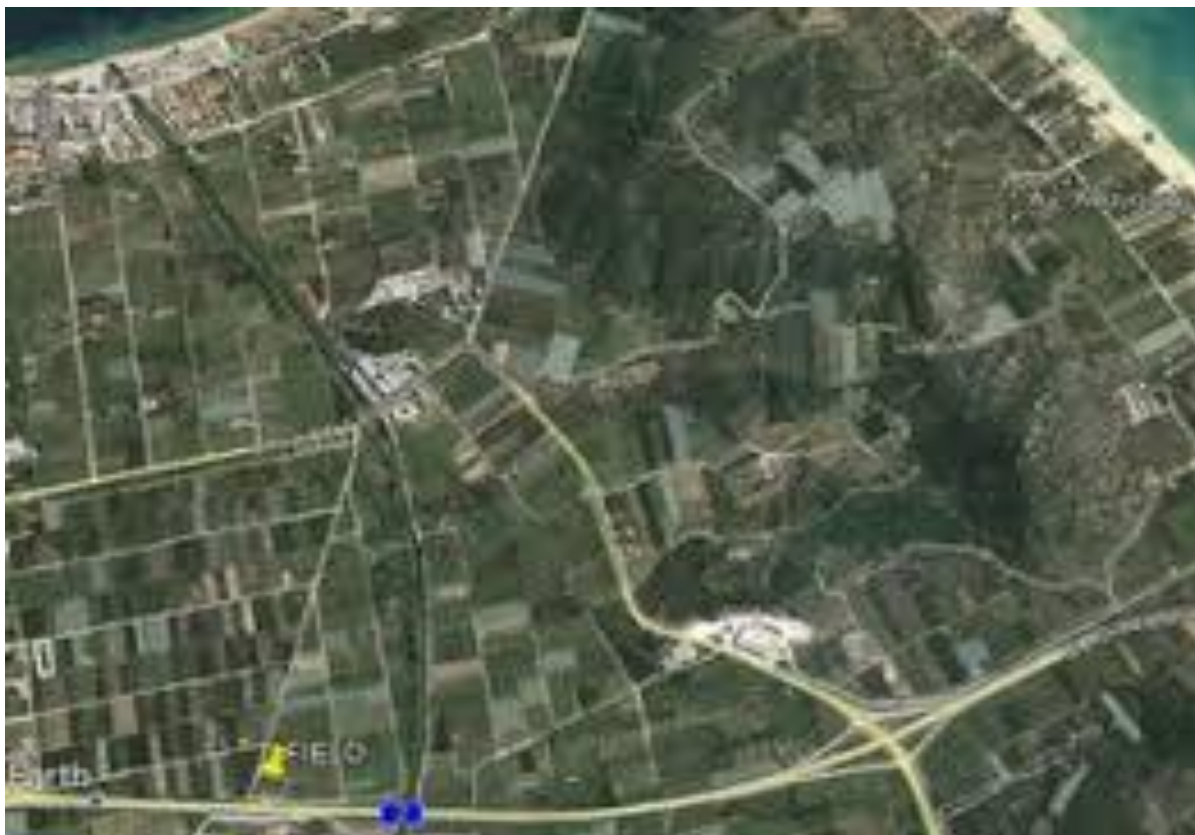


Photo 6 Map of agricultural land (Source: internet)

The materials, which the contractor of the technical activities, submits to the Municipal Agriculture Service, according to the regulation, reflected in the norm of Article 41 of Ordinance No. 49 [2], are the following:

- a / Map of the arrays for land use - in digital and graphic form / on paper / (Photo 6);
- b / Register of land use arrays-in digital and textual form / on paper /;
- c / Register of owners and users of arrays for use in the land - in digital and text form / on paper /;
- d / Tracing carnet in the cases of art. 76, para 2 of the Regulations for the implementation of the law on the ownership and use of agricultural lands [8].

According to the text of the norm of art. 76, para 2 of the Regulations for the implementation of the law on the ownership and use of agricultural lands [8], at the written request of the owners and users, the boundaries of the arrays for the use of agricultural land may be traced partially or fully.

In view of the above, it is necessary to note the essential legal commitments of the Ministry of Agriculture, Food and Forests of the Republic of Bulgaria, reflected in the norm of art. 43, related to the financing of the process of creating the maps of the massifs for use and registers.

The funds for the creation of the map of the arrays and registers are at the expense of the budget of the Ministry of Agriculture, Food and Forests.

The maintenance of the map of the arrays shall cover the amendments to the agreement under the already analyzed Article 37 c of the Law on Ownership and Use of the Agricultural Land [5], by amending the map and in the registers of the arrays for agricultural land use.

4. CONCLUSION

In its current form, the package of normative documents in the Republic of Bulgaria related to the map of the restored property, its legal regulation and its relation with other laws reflect the need for synchronization of legal norms in this field.

The case-law provides some examples that illustrate, at the same time, the need to refine the texts and regulations in this package, and in particular in Regulation No. 49 [2].

For example, the text of Article 29, paragraph 2 of Ordinance No. 49 [2] states that the head of the Municipal Agriculture Office approves the project submitted by the applicant.

In this case, several questions arise:

First, how can the applicant be qualified - as in the wording of Article 18 (1) or otherwise, all the more given the involvement of multiple legal entities in the process of disposing, partitioning or transferring part of a landed property ?

Second, who and on whose behalf is preparing a project to separate parts of the property, voluntarily divide or merge the properties?

Are the texts of Art. 18 and Art. 19 [2] applicable to the case, or is it a specific aspect of that applicability?

Third, authorizing the Head of the Municipal Agriculture Office to approve the project submitted (or refuse) by the applicant allows for subjectivity in the actions of that legal entity.

Such an action could be entrusted to a committee of experts (most independent) in this area, which is too specific, or at least to apply in the case of the texts of Article 19 of Ordinance No. 49 [2].

5. CONCLUDE

First: It is imperative to speed up the transformation of repossession cards into cadastral maps throughout the country;

Second: To this end, it is of utmost importance that new advanced digital models are implemented;

Third: Municipal agricultural services and municipal administrations must be trained by surveyors in order to be able to participate actively and competently in the transformation process;

Fourth: The legal framework requires the introduction of judicial control over the results of transformations.

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INCREASING PRODUCTIVITY BY USING A MIXER TRANSPORT UNIT FOR LOADING SPRAYERS

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Abstract: *Spraying of plants against diseases and pests should be carried out within a short time. One way to increase the performance of sprayers is by reducing the unproductive spray time. For this purpose, a transport mixing unit is available on the market, which reduces the preparation time of the working solution. This unit and the benefits of using it are not well known to many farmers. Existing research shows that its use results in a double increase in productivity compared to transporting water from the sprayer itself. This article proposes a methodology for determining the variation in sprayer performance when loaded with a working solution by transport mixing unit compared to loading it with water by an ordinary tank with the same parameters. Analytical dependencies have been generated for determining the duration of individual operations during operation of the sprayer and mixing unit, as well as for calculating the percentage increase in the productivity of the sprayer. The methodology has been demonstrated for specific sprayers and mixers under specific conditions. In this case, it was found that filling the sprayer with a solution instead of pure water could increase its productivity by 34.5%.*

Keywords: *mixing transport unit, sprayer, performance, spray solution.*

1. INTRODUCTION

Chemical protection of plants from diseases and pests and weed control is carried out through the introduction of pesticides using sprayers. Typically, the solution of the respective preparation is prepared in the sprayers themselves, for which purpose they are equipped with mixing vessels (at a larger volume of the tank) or with mesh mixers placed in the reservoir neck. Stirring of the solution to achieve and maintain a constant concentration is carried out by means of various types of stirrers. For good stirring it usually takes about 10-15 minutes. Loading the sprayer's tank with water can be done by their own pump or by other water tank. The water charging time depends on the flow rate of the pump being used – on the sprayer or on the water tank.

A mixing transport unit (Figure 1) is produced in Russia, which is intended for the preparation of the spraying solution, transporting it to the field and charging the sprayers [3]. The machine consists of a large volume tank (5 or 11 m³), a tank for placing the pesticide and a high-flow pump (1000 l/min). With this machine, the spray solution is prepared and loaded into the sprayer tank, saving time and increasing sprayer performance. In addition, a constant solution concentration is maintained which is more difficult to achieve when the sprayer is loaded with water only in the field and subsequent solution preparation since in this case a portion of the solution is left in the tank after the last working move. When using a mixing unit, the number of spraying machines can be reduced by 1.5 times according to some authors [1]. According to others, using the same mixing unit with a tank volume of 5 m³ the productivity is increased by about 2 times compared to the transport of water with the sprayer itself [2].



Figure 1. Mixing transport unit

Such a mixing unit is not used in our country because it is still unknown to the farmers. The advantages described by the manufacturers and some researchers raise the question the extent to which the use of a tank combined with a mixer for the preparation of the spray solution will result in an increase in sprayer performance in comparison with sprayers refill with water from an ordinary tank.

The objective of this work is to determine how the use of a mixing transport unit to prepare and transport the solution to the field affects the performance of the sprayers.

2. MATERIAL AND METHOD

An analytical method is used to determine the parameters of the working process. Dependencies have been drawn to determine the duration of the individual operations during the working process of the sprayer and the mixing transport unit. The duration of the sprayer cycle and the mixer cycle are determined. A comparison is made between the performance of the sprayer when charging it with water and charging it with a mixer-prepared solution. It is assumed that charging is done under the same conditions - tank volume and pump flow. An example is given with specific parameters of the working machines on the basis of which the corresponding conclusions are made.

3. RESULTS AND DISCUSSION

The performance of the sprayer is determined by the dependence

$$W = B \cdot v \cdot \tau, \text{ da/h} \quad (1)$$

where B is the working width of the sprayer (wing length), m;

v – the working speed, km/h;

τ – the coefficient of utilization of working time.

The coefficient of utilization of the working time is a ratio between pure working time (operating time) and total time for one working shift:

$$\tau = \frac{T_W}{T_T} \quad (2)$$

where T_W is the pure working time for one working shift, h;

T_T – the total time for one working shift, h.

The total time for one working shift is

$$T_T = T_C \cdot N_C + t_R + t_D = (t_W + t_N + t_{CW} + t_{CP})N_C + t_R + t_D, \quad h \quad (3)$$

where T_C is the duration of one working cycle of the sprayer, h;

N_C – the number of working cycles per one working shift;

t_W – the pure working time of one cycle, h;

t_N – the time for carrying out non-working moves (turns) within one cycle, h;

t_{CW} – the charging time with water of one sprayer tank, h;

t_{CP} – the charging time with pesticide and mixing, h;

t_R – the time for rest during the shift, h;

t_D – the time lost for different reasons, during which the sprayer does not work, for example, due to awaiting the arrival of the tank to the field.

The number of working cycles, which carried out the sprayer for one shift, is

$$N_C = \frac{T_{WS}}{T_C}, \quad h \quad (4)$$

where T_{WS} is the duration of working time during the shift without breaks. In spraying the total length of the working shift is 7 hours.

The result obtained in (4) must be rounded to the lower integer in order not to exceed the maximum permissible operating time with preparations, which is 6 h.

Using the dependency (3), the coefficient of utilization of working time can be presented in the following way

$$\tau = \frac{t_W \cdot N_C}{T_C \cdot N_C + t_R + t_D}, \quad h \quad (5)$$

When the sprayer is charged from a tank with clean water and a pesticide is placed in it separately, its performance is determined by the dependence

$$W_0 = B \cdot v \cdot \frac{t_W \cdot N_C}{(t_W + t_N + t_{CW} + t_{CP})N_C + t_R + t_D}, \quad \text{da/h} \quad (6)$$

In the case that the tank has a mixer and the solution is prepared in advance, i.e. when using the unit shown in Fig. 1, the sprayer performance is

$$W_1 = B \cdot v \cdot \frac{t_W \cdot N_C}{(t_W + t_N + t_{CW})N_C + t_R + t_D}, \quad \text{da/h} \quad (7)$$

as there is no time to prepare the solution.

The relative increase in sprayer productivity using a mixing transport unit to prepare the solution compared to preparing the solution in the sprayer itself is

$$W_{\%} = \frac{W_1 - W_0}{W_0} \cdot 100 = \frac{t_{CP} \cdot N_C}{(t_W + t_N + t_{CW})N_C + t_R + t_D} \cdot 100, \quad \% \quad (8)$$

The times in the last formula are determined in the following way.

Time for carrying out working moves

It is determined by the dependency

$$t_W = \frac{n_w \cdot l_w}{1000 \cdot v}, \quad \text{h} \quad (9)$$

where n_w is the number of work moves carried out with one tank volume;

l_w – the length of a work move, m.

The length of one work move when spraying perennial crops is equal to the length of the row, and when spraying field crops it is [4]

$$l_w = L_f - 2E = L_f - 2B, \quad \text{m} \quad (10)$$

where L_f is the length of the field, m;

E – the width of the headland (usually equal to the working width of the sprayer), m.

The area that is sprayed with one tank of the sprayer is calculated by the dependence

$$S = \frac{V_s}{D}, \quad \text{ha} \quad (11)$$

where V_s is the volume of the tank of the sprayer, dm^3 ;

D – the expenditure rate of solution, l/ha.

From here, the number of work moves that will make the sprayer until its next charging is

$$n_w = \frac{1000 \cdot S}{l_w \cdot B}. \quad (12)$$

The result obtained must be rounded to the lower integer. The expenditure rate of the solution should be selected so that the number of working moves is an even number. In this way, the sprayer will only be charged on one side of the field and one mixing unit is required. The expenditure rate of the solution to fulfill this condition can be determined by the dependence

$$D_n = \frac{10000 \cdot V_s}{n_w \cdot l_w \cdot B}, \quad \text{l/ha} \quad (13)$$

where D_n is the required expenditure rate of a solution to carry out an even number of working moves with one sprayer tank, l/ha. A new expenditure rate is chosen that is smaller than the resulting one, i.e. adjusted expenditure rate D_k in l/ha.

Time for carrying out non-working moves (turns)

The number of non-working moves is with 1 less than the number of working moves when the work moves are an even number, i.e.

$$n_n = n_w - 1 \quad (14)$$

The time for making non-working moves for one working cycle of the sprayer is

$$t_N = \frac{n_n \cdot l_n}{1000 \cdot v_n} = \frac{(n_w - 1) l_n}{1000 \cdot v_n}, \quad \text{h} \quad (15)$$

where l_n is the length of a non-working move, m;

v_n – the speed of the sprayer during the non-working moves, km/h.

The sprayers usually carried out shuttle moves into the field and at the end of the field they make oblong turns with length depending on the type of sprayer (for perennial crops or for field crops), the working width and the possible minimum turning radius of the unit. Pear-shaped turns are virtually inaccessible, as they require a larger width of the headland, which is particularly limited in perennial plantations. Pear-shaped turns are avoided as working moves are carried out through one or several rows and the sprayer moves overlapping the work moves. The length of the non-working moves (turns) in which the sprayer is off is determined with the following dependencies:

- for boom sprayers – oblong turn

$$l_n = 2B - 0.86R, \text{ m} \quad (16)$$

where R is the radius of the turn of the unit, m

- for fan sprayers in perennial plantations – oblong turn [4]

$$l_n = 2.14R + X + 2l_k, \text{ m} \quad (17)$$

where X is the distance between consecutive working moves (it is multiple of the width of the row), m;

l_k – the kinematic length of the unit (the distance from the rear axle of the tractor to the spray nozzles), m.

Time for charging sprayer tank

In the tank of the sprayer will always remain a certain amount of solution before the next charging

$$Q_r = V_s - Q_c, \text{ l} \quad (18)$$

where Q_r is the remaining amount solution in the sprayer tank, l;

Q_c – the amount of solution consumed in the working moves, l. It is determined by the dependence

$$Q_c = \frac{n_w \cdot l_w \cdot B \cdot D_k}{10000}, \text{ l} \quad (19)$$

This amount of solution should be added to the sprayer tank from the mixing transport unit. The time for which the fill is performed is

$$t_{CW} = \frac{Q_c}{60 \cdot q_{mu}}, \text{ h} \quad (20)$$

where q_{mu} is the flow rate of the pump of the mixer unit, l/min.

Time for charging with pesticide and mixing

The time for placing the pesticide in the mixing tank of the sprayer and mixing until a homogeneous solution is obtained before spraying starts depends on the type of preparation and volume of the sprayer tank, but is usually no more than $t_{CP} = 10 - 15 \text{ min}$.

Time for rest during the working shift

The duration of the rest t_R is regulated. Lunch breaks can not be longer than 30 minutes. Other breaks may be made during the shift. It is best if the breaks coincide with the waiting time for the arrival of the water tank to the field.

Loss of time for different reasons

Losses of time t_D may occur due to a malfunction of the machine, poor organization of work, waiting of the tank with water, etc.

Performance characteristics of the mixing transport unit

The minimum amount of solution to be prepared in the mixer unit is determined by the dependence

$$Q_l = N_C \cdot Q_C, \quad (21)$$

The amount of solution Q_l can be used to select the volume of the mixer unit. Other factors such as charging location, sprayer working cycle and mixer unit cycle, as well as the ability to load the mixer into the field, should be considered here. The number of charges of the mixer unit tank for one working shift is determined by the dependence

$$n_{mu} = \frac{Q_l}{V_{mu}}, \quad (22)$$

where V_{mu} is the volume of the mixing unit tank, dm^3 .

The result obtained in (22) should be rounded to the larger integer. At the start of the working shift the mixer and sprayer tanks are filled and transported full to the field. After the solution is discharged from the mixer tank, the tank is recharged with water in the field or moved to the charging place. The number of moves to the place of loading with water and pesticide is

$$N_{mu} = n_{mu} - 1, \quad (23)$$

since the first move is performed before the spraying began. The length of the charging cycle of the mixing unit and its transport to the field and vice versa is

$$T_{mu} = t_{mu} + t_{tmu}, \quad \text{h} \quad (24)$$

where t_{mu} is the time for loading the mixer unit tank, h

t_{tmu} – the time for the transport of the mixer unit, h.

Loading of the tank of the mixing unit with water and pesticide is done at the same time and is determined by the dependence

$$t_{mu} = \frac{V_{mu}}{60 \cdot q_{mu}}, \quad \text{h} \quad (25)$$

The transport time is determined by dependence

$$t_{tmu} = \frac{2 \cdot l_t}{v_t}, \quad \text{h} \quad (26)$$

where l_t is the transport distance, km;

v_t – the transport speed of the mixer unit, km/h.

Several factors influence the performance of the sprayer and therefore it is not possible to determine unequivocally the extent of increase in productivity when using a mixing unit. This

can be done on a case-by-case basis using the above dependencies. Below is an example with the following output data:

- length of field – $L_f = 1000 \text{ m}$;
- working width of the bar sprayer – $B = 18 \text{ m}$;
- volume of the tank of the sprayer – $V_s = 1500 \text{ l}$;
- working speed of the sprayer – $v = 10 \text{ km/h}$;
- speed of the sprayer during the non-working moves – $v_n = 8 \text{ km/h}$;
- radius of the turn of unit – $R = 6 \text{ m}$;
- expenditure rate of solution – $D = 250 \text{ l/ha}$;
- flow rate of the pump of the mixer unit – $q_{mu} = 1000 \text{ l/min}$;
- transport distance – $l_t = 5 \text{ km}$;
- transport speed of the mixer unit – $v_t = 12 \text{ km/h}$;
- time for rest during the working shift and losses of time for different reasons – $t_R + t_D = 1 \text{ h}$;
- charging time with pesticide (concentrate) and mixing – $t_{CP} = 0.17 \text{ h}$.

Based on these data are defined:

- length of the non-working move

$$l_n = 2B - 0.86R = 2 \cdot 18 - 0.86 \cdot 6 = 30,84 \text{ m}$$

- length of the working move

$$l_w = L_f - 2E = L_f - 2B = 1000 - 2 \cdot 18 = 964 \text{ m}$$

- area sprayed with one tank of the sprayer

$$S = \frac{V_s}{D} = \frac{1500}{250} = 6 \text{ ha}$$

- number of working moves

$$n_w = \frac{1000 \cdot S}{l_w \cdot B} = \frac{1000 \cdot 6}{964 \cdot 18} = 3,45 \Rightarrow 3 \text{ working moves}$$

In this case, the work moves are an odd number and a change in the expenditure rate is required. The maximum rate at which work moves will be an even number and closest to the result obtained, i.e. 4 moves is

$$D_n = \frac{10000 \cdot V_s}{n_w \cdot l_w \cdot B} = \frac{10000 \cdot 1500}{4 \cdot 964 \cdot 18} = 216 \text{ l/ha}$$

- selection of new expenditure rate less than the resulting – $D_k = 200 \text{ l/ha}$
- the area sprayed by one tank and the number of working moves are recalculated for verification

$$S = \frac{V_s}{D} = \frac{1500}{200} = 7,5 \text{ ha}$$

$$n_w = \frac{1000.S}{l_w.B} = \frac{1000.7,5}{964.18} = 4,3 \Rightarrow 4 \text{ working moves}$$

- used amount of solution for carrying out the work moves

$$Q_c = \frac{n_w.l_w.B.D_k}{10000} = \frac{4.964.18.200}{10000} = 1388,16 \text{ l}$$

- time for charging sprayer tank

$$t_{cW} = \frac{Q_c}{60.q_{mu}} = \frac{1388,16}{60.1000} = 0,023 \text{ h}$$

- time for carrying out working moves

$$t_w = \frac{n_w.l_w}{1000.v} = \frac{4.964}{1000.10} = 0,386 \text{ h ,}$$

- time for carrying out non-working moves

$$t_N = \frac{(n_w-1)l_n}{1000.v_n} = \frac{(4-1)30,84}{1000.8} = 0,012 \text{ h}$$

- duration of one working cycle of the sprayer

$$T_C = t_w + t_N + t_{cW} = 0,386 + 0,012 + 0,023 = 0,421 \text{ h}$$

- number of cycles carried out by the sprayer for the maximum allowable operating time of 6 hours

$$N_C = \frac{T_{WS}}{T_C} = \frac{6}{0,421} = 14,25 \Rightarrow 14 \text{ cycles}$$

- amount of solution prepared by mixing unit

$$Q_l = N_C \cdot Q_c = 14.1388,16 = 19434 \text{ l}$$

From here the tank volume of the mixing unit can be selected. It is available in two versions – volume of 5000 l and 11000 l. In order to reduce the number of charges on the mixing unit and the time to move it to the filling station, we select an unit with a tank volume of 11000 l.

- number of charges of the mixer unit tank for one working shift

$$n_{mu} = \frac{Q_l}{V_{mu}} = \frac{19434}{11000} = 1,77 \Rightarrow 2$$

- number of moves to the place of loading with water and pesticide (without the first one)

$$N_{mu} = n_{mu} - 1 = 2 - 1 = 1$$

- charging time of the mixing unit

$$t_{mu} = \frac{V_{mu}}{60 \cdot q_{mu}} = \frac{11000}{60 \cdot 1000} = 0,183 \text{ h} ,$$

- time for moving the mixing unit

$$t_{tmu} = \frac{2 \cdot l_t}{v_t} = \frac{2,5}{12} = 0,833 \text{ h}$$

- duration of the cycle of the mixing unit

$$T_{mu} = t_{mu} + t_{tmu} = 0,183 + 0,833 = 1,016 \text{ h}$$

When using the mixing unit with a capacity of 11000 l, is required one moving to the place for charging. If immediately after charging the sprayer tank the mixing unit moves to the place for charging, the stoppage of the sprayer after emptying the tank is $1,016 - 0,421 = 0,595 \text{ h}$. It can coincide with the time for rest to the operator of the sprayer.

- coefficient of utilization of working time

$$\tau = \frac{t_W \cdot N_C}{T_C \cdot N_C + t_R + t_D} = \frac{0,386 \cdot 14}{0,421 \cdot 14 + 1} = 0,78$$

- relative increase of the performance of sprayer

$$W_{\%} = \frac{t_{CP} \cdot N_C}{(t_W + t_N + t_{CW}) N_C + t_R + t_D} \cdot 100 = \frac{0,17 \cdot 14}{(0,386 + 0,012 + 0,023) 14 + 1} \cdot 100 = 34,5 \%$$

It is seen that the coefficient of utilization of working time is considerably higher than that reported in the literature (0.45 – 0.55) [4]. The performance of the sprayer in the case under consideration is increased by 34.5 %. If a mixing unit with a volume of 5000 l is used, the effect on performance will be less. Therefore, using a mixing unit instead of a standard tank for loading the sprayer can significantly improve the efficiency of the process. The calculations here do not take into account the spraying of the headland as its length depends on the area and shape of the field. However, this could not have a significant effect on the result obtained.

When the sprayer is fitted with a mixing vessel located outside the tank, loading with a pesticide is carried out simultaneously with the loading with water. In this case, it may be necessary time only for mixing, but this is performed during movement. With such sprayers, the effect of using a mixed transport unit will be minimal.

4. CONCLUSIONS

1. Analytical dependencies have been determined for calculation of various indicators of technological process of the spraying when using a mixing transport unit for preparing the solution and loading the sprayer. Dependence has been obtained to determine the increase

in the productivity of the sprayer when loaded with a solution by a mixing unit compared to its loading with water by an ordinary tank with the same parameters.

2. It has been found that the use of a mixing transport unit results in an increase in sprayer productivity by reducing the preparation time of the solution. The use of a mixing unit is particularly effective for sprayers without own mixing vessel outside the tank. For the specific units considered, the sprayer productivity could increase by 34.5 % when loaded with solution instead of pure water.

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STUDY AND ANALYSIS OF THE STRUCTURE OF THE WORKING TIME OF COMBINE HARVESTER FOR HARVESTING OF WHEAT

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Abstract: The harvesting is one of the most difficult and responsible operations in the crops growing. It should be done in the short term, in order to prevent losses of production. This requires efficient use of the operating time of the combine harvesters. A study of the working time of a combine harvester was carried out throughout the whole period of wheat harvesting. Unloading of the hopper is carried out when the combine harvester is stationary. It was found that the time to prepare and finish work was 24.754% of the total working time. It includes time for maintenance of the combine harvester, the time for coupling and uncoupling of the combine header, the time for transport of the combine harvester to and from the field, and the time for moving inside the field. It was found that the time of harvesting is 53,158% of the working time. Non-productive time in the field represents 22,088% of the total working time. It includes the time for the movement of combine harvester to the place of unloading and vice versa, the time for waiting before unloading, the unloading time, the time for making turns, the time for updating of the technological settings, the time for searching and troubleshooting. For unloading of grain tank is lost 14.842% of working time. On the basis of the study, an algorithm for the operation of a combine harvester was made when unloading in stationary.

Keywords: combine harvester, harvest, working time, algorithm

1. INTRODUCTION

One of the most labor-intensive processes in agriculture is the harvesting of cereals. It is related to a rather complex organization of work of combine harvesters, transport units, organization of grain reception points. Furthermore, harvesting must be carried out in a short time to prevent grain losses due to the extended harvesting period [2].

Many farmers, in order to cope with the short harvest time, increase the number of combine harvesters or buy combines with high theoretical performance, but this does not automatically lead to greater actual performance. The organization at harvest is also essential. A proper work organization aims to increase the productive time at the expense of non-productive time. The unloading of the hopper of the grain harvester can be done in motion and in a stop position (Figure 1). The unloading of the combine hopper when combine is stopped leads to an increase in non-productive time, and hence a reduction in combine performance. This way of unloading is widely used in Bulgaria. It was found that in 91% of the farms unloading is carried out in a stopped position and in only 9% of them unloading is carried out in motion [4].

Unloading of the hopper can be carried out in the field or outside the field depending on the operating conditions and the means of transport used. When there is a great distance between field and the place of unloading may be used grain trucks for the transportation of

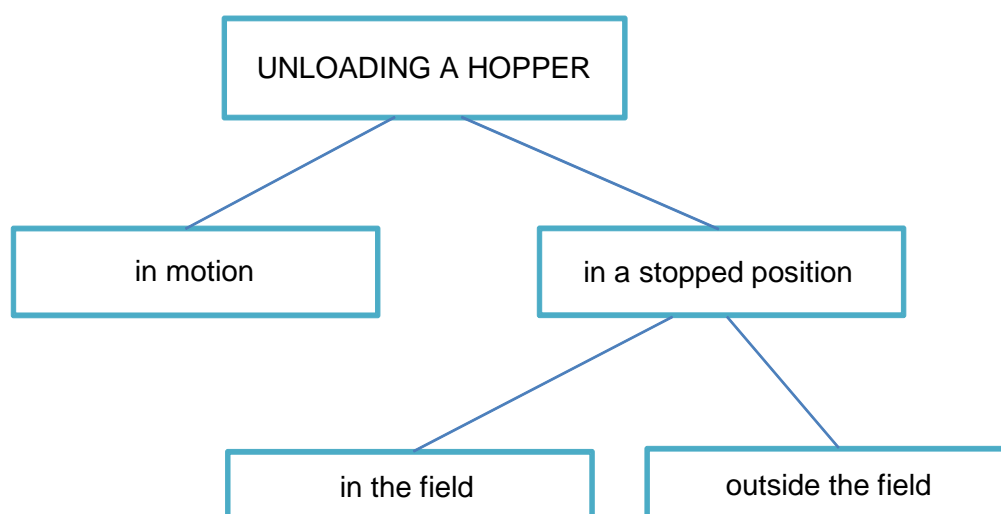


Figure 1. Ways to unload the grain hopper of the combine

grain. In this case, the unloading is carried out outside the field for a number of reasons, such as reducing soil compaction, etc.

According to some authors, when unloading the grain hopper in stopped position in the field, the combine harvesting performance is reduced by 14 % and in unloading at the end of the field by 23 %. The processing time per unit area is increased by 15% and 30% respectively [1]. When unloaded in stopped position, an incomplete hopper is usually unloaded. Approximately 1 m³ of the hopper is not used and the number of unloading stops increases by about 11%, resulting in lower productivity [3]. Only 37% of the unloading time is used for work of unloading auger. The rest of the time is lost for moving the combine or the truck and positioning for unloading [2]. Because an average of 73% of the flow rate of the unloading auger is used, the unloading time is 43% greater than the theoretical [5]. The work of individual authors provides detailed information on the duration of separate operations in harvesting and mainly for unloading the grain hopper. No information is available on all processes such as preparation of the harvester, its transportation and service during the harvest.

The purpose of the study is to examine and analyze the full working time of the combine harvester for the entire duration of the harvesting of wheat.

2. MATERIAL AND METHOD

The study was carried out during the harvest campaign in 2017 between 21.06 and 15.07 and covered a period of 25 working days. The total area occupied by wheat is 2160 ha. It is in the lands of the villages of Dryanovo, Drama, General Inzovo and Krumovo in Yambol province. The work of the CLAAS LEXION 570 grain harvester, working in a group with three grain combines (1 combine CLAAS LEXION 600, and 2 combines CLAAS LEXION 470) was observed. The combine harvester has a grain hopper volume of 10500 l, unloading auger flow rate of 100 l/s, working width of 7.5 m. The harvested crop is wheat variety Enola. The average yield was 5700 kg/ha, and the average humidity measured by the on-board moisture

meter of the combine harvester – 12.1%. Unloading of hopper is carried out in a stopped position of combine. By measuring with a stopwatch is determined duration of:

Time for prepare and finish work

- time for maintenance;
- time for coupling and uncoupling the header;
- time for transport the combine harvester to and from the field;
- time for moving the combine harvester in the field.

Productive time

- time for filling the hopper.

Non-productive time in the field

- time for the movement to combine harvester to the place of unloading and vice versa;
- time for stay before unloading;
- time for unload hopper;
- time for making turns;
- time for update the technology settings
- time for search and troubleshoot.

Total working time is determined by summing the times for the individual operations and the percentage of each operation of the total working time is determined. On the basis of the data obtained about the operations performed, an algorithm for work of combine harvester was designed.

2. RESULTS AND DISCUSSION

The results of the experimental study are shown in Table 1.

Time for prepare and finish work

The maintenance of the combine harvester is carried out at the beginning of the working day. It includes cleaning of dust and accumulated plant debris, refueling, lubricating, daily inspection of engine, header, thresher, separator and cleaner, as well as the condition of the screw connections. The study found that the maintenance time was 1642 min or 10.914% of the total working time. This time increases due to poor theoretical and practical training of the service staff, not knowing the machine, little practical experience, etc.

When the combine harvester moves from one field to another, coupling and uncoupling the header is performed. The time to perform this operation is 365 minutes or 2.426% of the total working time. This time can be reduced by improving the qualifications of the staff and reducing the number of combine harvesters working in the group. In this case, a group of four combine harvesters is used. After harvesting of one field, the whole group moves to the next field. This requires the header to be uncoupled and coupled each time when the combine is moved to a new field. In the case of a small number of combines in the group, the number of uncoupling and coupling of the header is reduced as the combine will work longer in one field.

Transport of combine harvester to and from the field is carried out after preparing the combine harvester to work made on the farm, after harvest the field, on completion of the working day and for return to the farm. The total transport time is 1530 min or 10.17% of the total working time. It may be reduced if after the end of the working day the combine harvesters are left in the field.

The time for moving of the combine harvester in the field include time for movement of the combine at idle to and from the working position in the field for various reasons. For the entire harvest period this time is 187 min i.e. 1.243% of total working time.

Table 1. Result of experimental study

Structure of working time	Value	
	in minutes	in %
Time for prepare and finish work		
- time for maintenance	1642	10.914
- time for coupling and uncoupling the header	365	2.426
- time for transport the combine harvester to and from the field	1530	10.170
- time for moving the combine harvester in the field	187	1.243
Total	3724	24.754
Productive time		
- time for filling the hopper	7997	53.158
Total	7997	53.158
Non-productive time in the field		
- time for the movement to combine harvester to the place of unloading and vice versa	529	3.516
- time for stay before unloading	806	5.357
- time for unload hopper	898	5.969
- time for making turns	390	2.592
- time for update the technology settings	50	0.332
- time for search and troubleshoot	650	4.320
Total	3323	22.088
Total working time	15044	100

The total time for prepare and finish work is 3724 minutes or 24.754% of the total working time. It is seen that a significant part of the time is used for preparatory operations. Good organization and the high qualification of the staff may reduce this time to a minimum.

Productive time

The time for the real work of the combine is determined by the time to fill the grain hopper. From the table is seen that the combine harvester work 7997 min, i.e. 53.158% of the total working time. The relative share of productive time can be increased by decreasing the time for prepare and finish work as well as the other non-productive time in the field.

Non-productive time in the field

After filling the grain hopper, the grain harvester leaves the place on which it operates, moves to the transport unit and after unloading the hopper, returns to the working place in the field. This way of unloading is necessary because the fields are far away from the point of acceptance the grain and the transport is done by trucks that cannot move in the field or they too much compact the soil. The time for moving the combine to the unloading point and vice versa is 529 min or 3.516% of the total working time. It can be reduced by placing the vehicles in such a way as to reduce the distance traveled by the combine harvester to them.

The time for stay of the combine harvester before unloading includes the waiting time for the arrival of the vehicle from the point of acceptance the grain. It can be seen that this time is 806 min or 5.357% of the total working time. The downtime can be reduced by better organization at the point of accepting, quick unloading and returning to the field or by increasing the number of transport vehicles.

The time for unload the grain hopper of the combine is the time from switching on the unloading auger to shutting down the auger. Unloading is performed for 898 min or 5.969% of the total time.

The combine makes turns at the end on the field. These are non-working moves with total duration of 390 minutes or 2.592% of the total working time. The proportion of this time can be reduced by choosing the correct way of moving in the field and performing a turn.

Changing of the technology settings of combine takes 50 minutes or 0.332% of the total time. This time can be reduced by improving the qualifications of the staff and performing settings in movement wherever possible.

Time for search and troubleshoot include the time that the combine harvester passes from a workable to a malfunctioning state, detecting a malfunction, and removing it. The table shows that 650 minutes or 4.320% of the total working time is spent on these operations. It can be reduced by improving the qualifications of the staff and using modern diagnostic tools.

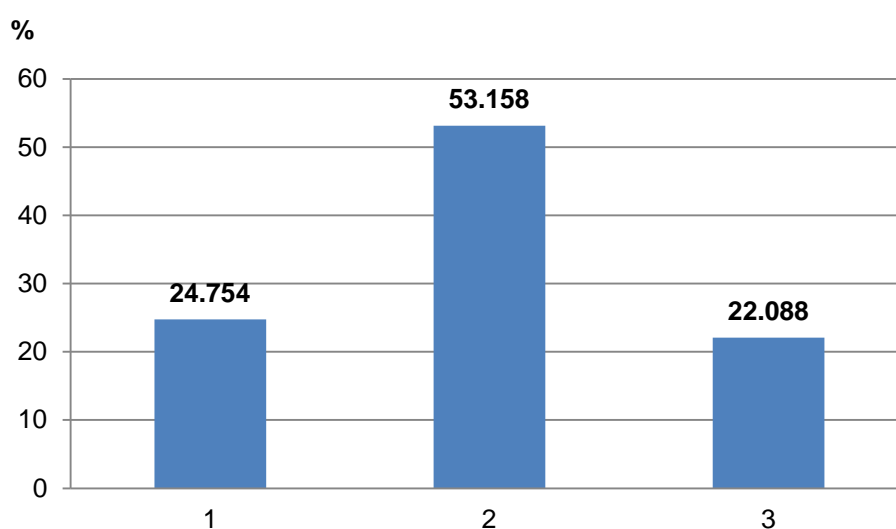


Figure 2. Percentage distribution of working time of combine in wheat harvesting:
1 – time for prepare and finish work, 2 – productive time; 3 – non-productive time in the field

Figure 2 shows the percentage distribution of the working time of the combine harvester. It can be seen that the preparatory and finish time is almost equal to the non-productive time of the field. Good organization of work and high staff qualification would reduce these times, which in turn will lead to a higher share of productive time, and the combine harvester performance will increase.

On the basis of the conducted study, an algorithm for working the combine harvester during the working day was made when unloading the grain hopper is carried out in stopped position (Figure 3).

The working day starts with maintenance, after which the combine harvester moves to the field, couples the header and the harvester moves into the field where it will work.

After beginning of harvest, there are several options:

- in case of malfunction the combine stops for repair;
- at the end of the field (at headland) the combine makes a turn;
- when loading the hopper the combine stops for unloading.

These three cases form the non-productive time of combine harvester in the field. After troubleshooting, turning or unloading grain the combine continues harvesting. When the

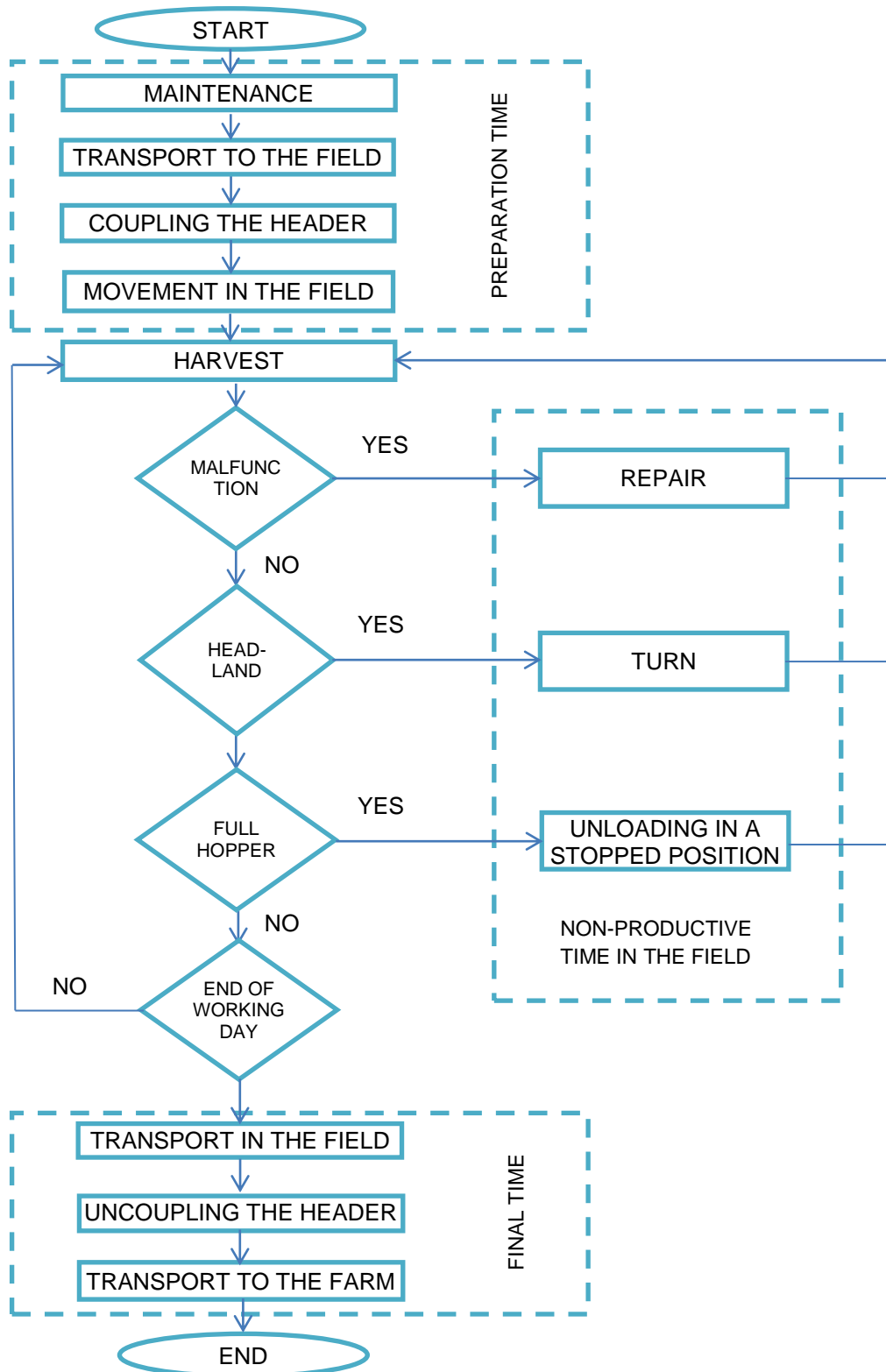


Figure 3. A algorithm of work of combine harvester when unloading of grain hopper in stopped position

working day is over and the field is not harvested, a transport is carried out to the end of the field, the header is uncoupled and the combine harvester is transported to the farm.

4. CONCLUSIONS

From the study of the work of the combine harvester throughout the harvesting campaign, it was found that the productive time of the combine harvester was 53.158% of the total working time. For preparatory and final operations, 24.754% of the time is spent. The non-productive time in the field is 22.088% of the total working time. The unloading of grain hopper takes 14.842% of the total working time. It is recommended in adjacent smaller fields to work with fewer combine harvesters in the group, which will reduce the time lost for moving the combines between the fields.

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ANALYSIS OF EUROPEAN AND NATIONAL REGULATION TO ENSURE THE ROAD TRAFFIC

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Abstract: Road safety is a key indicator of the development of any society. Not only average life expectancy, but also mobility, transport costs, the environment, social affairs, health care and the well-being of the nation as a whole are strongly dependent on this socio-economic phenomenon.

In 2010, The UN and the EU have declared war on the causes of loss of life in the use of motor vehicles, such as 2011-2020 was declared a decade of active road safety action. A number of initiatives have been launched to promote and strengthen a safety culture, improve general knowledge of the causes of road accidents and help create preventive solutions. However, with an average of 1.35 million casualties annually, worldwide road injuries remain unacceptably high.

Since 2010, the average annual fall in EU road deaths has been 2.8%, which is equivalent to a 21% decrease between 2010 and 2018. Most of this reduction was achieved in 2011, 2012 and 2013. In 2018 decrease in EU death toll compared to 2017 is 1%. The decrease in deaths compared to their base value since 2010 is 20% with a planned decrease of 43%. In 2018 25100 people have lost their lives on EU roads, and 135000 have been seriously injured, many of them vulnerable road users: pedestrians, cyclists and motorcyclists. European statistics show values well in excess of the Union's target values (50% less dead and 20% less injured by 2020 compared to baseline 2010).

All this demonstrates the utmost urgency of ensuring that adequate measures are in place to immediately improve the regulatory framework in the field of road safety.

This report proposes an analysis of European and national regulations on road safety and proposals for updating them.

Keywords: European and National Policies, Safety traffic, Road safety

1. INTRODUCTION

Globally, according to the World Health Organization [2], the number of road traffic deaths continues to rise steadily, reaching 1.35 million in 2016 and costing countries an average of 3% of their gross domestic product. More than 9/10 (93%) of deaths are in low- and middle-income countries, with injuries in crashes being the leading cause of death among young people between the ages of 5 and 29. The consequences of road accidents are called an "epidemic" in the World Health Organization's annual report. Data on the numbers and rate of road traffic death per 100,000 population for the period 2000–2016 by data of the World Health Organization are represented in Fig. 1.

There continues to be a strong association between the risk of a road traffic death and the income level of countries. With an average rate of 27.5 deaths per 100,000 population, the risk of a road traffic death is more than three times higher in low-income countries than in high-income countries where the average rate is 8.3 deaths per 100,000 population. This is closely related to the number of vehicles on the country's roads (fig.2).

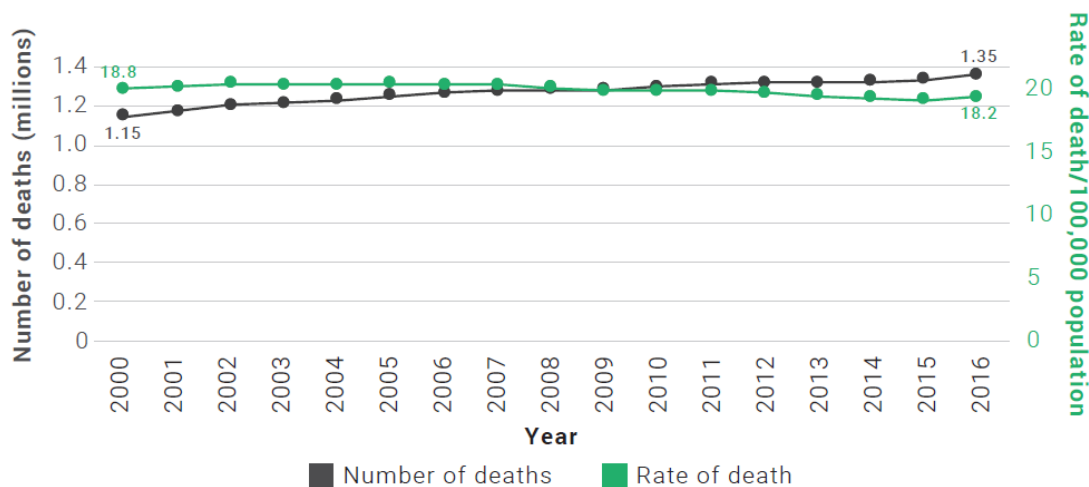


Fig.1. Number and rate of road traffic death per 100,000 population 2000–2016

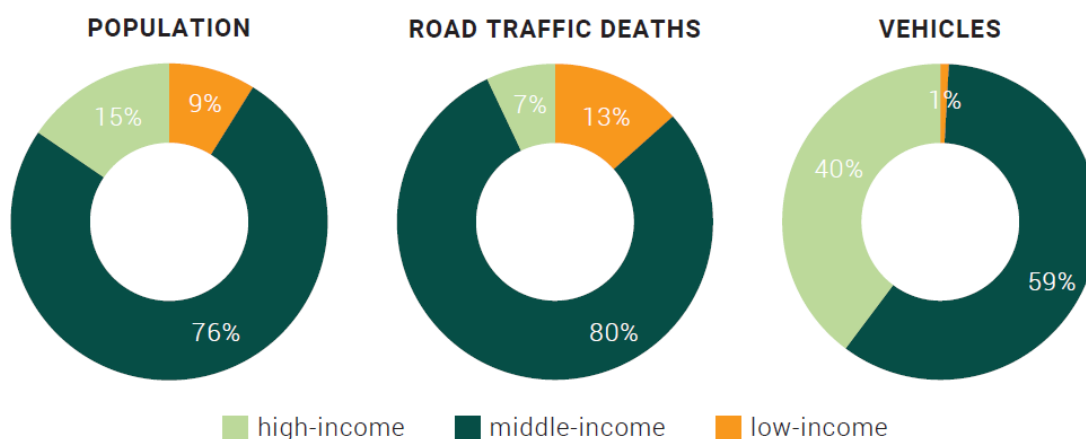


Fig.2. Proportion of population, road traffic deaths, and registered motor vehicles by country income category*, 2016

*based on 2017 World Bank classifications

In the EU the road safety has improved significantly in recent decades, but the challenges remain. Europe is at the top of the list of the safest roads, with an average of 49 deaths per million people. However, traumatism continues to be too high.

According to the annual report of the European Transport Safety Council [3], the death toll on EU roads has been reduced by only 1% in 2018 and by a total of 4% over the last five years. Significant efforts are being made at global, European, national, regional and local levels to address this challenge.

This report aims to analyse the European and national legislation to ensure traffic safety. Some conclusions have been made about the weaknesses of the current legislation, the effectiveness of the measures taken and proposals to improve them.

2. ANALYSIS OF EUROPEAN LEGISLATION TO ENSURE SAFETY OF THE ROAD

An international effort to regulate traffic was first introduced with the Geneva Convention for traffic by 1949. At its sixty-fourth session in September 2009 [4], the United Nations adopted a resolution to improve road safety, announcing the period 2011-2020 for the Decade of Road Safety to stabilize and reduce the predicted level of road traffic fatalities across the world through multiple actions at national, regional and global levels. A number of events are held annually under the auspices of the United Nations in different countries to improve the situation on the roads and the victims of road accidents.

The European Union works closely with the Member States, adopting directives, supporting campaigns, promoting exchanges and securing funding. The European policy guidelines set ambitious goals that underpin national strategies. The EU's global target for halving road deaths by 2020. However, as of 2010, it remains unattainable.

The Commission Communication of 20 July 2010 to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, which is entitled "Towards a European Road Safety Area: Guidelines for Road Safety Policy 2011-2020" set out the strategic objectives of the Union to halve road fatalities by 2020 compared to 2010 and reduce their numbers to zero by 2050 [1]. However, no considerable progress has been made in recent years towards these goals.

In its conclusions of 8 June 2017 on road safety, the European Council approved a new intermediate target of halving the number of serious injuries by 2030 compared with 2020, approving the Declaration of Valletta from March 2017, where an objects of the law are no longer just victims of the road accidents but also more minor injuries. This requires much more effort to achieve these two goals.

The resolution from 2009 was updated in 2018 [5]. On 17 May 2018, the European Commission announced a new target for halving road fatalities and, for the first time, a target for halving serious injuries by 2030 compared to 2020. For this overall purpose, the coverage of road accident victims is increased compared to the previous road safety action program, clearly indicating Europe's commitment in this regard.

Working closely with Member States' authorities on road safety issues, the EU focuses on targeted policies and national initiatives, through strategic planning, regulatory regulation, support for public education campaigns, promoting exchange of experience between countries and ensuring appropriate financing.

As a result of the regulatory and legislative measures taken for the period 2010-2018 (Fig.3), a decrease of an average of just over 20% across the European Union is observed.

However, this is not the expected rate of reduction of road accidents, with the target set for 2020 being a decrease of 42.6%.

3. ANALYSIS OF NATIONAL LEGISLATION TO ENSURE SAFETY OF THE ROAD

The difficulties associated with reducing the traumatism with the planned ambitious rates are also valid for Bulgaria. In 2018 6684 road accidents were registered in the country, with 611 dead and 8471 injured. The people died on the roads in 2018 compared to 682 in 2017 is 10% reduction.

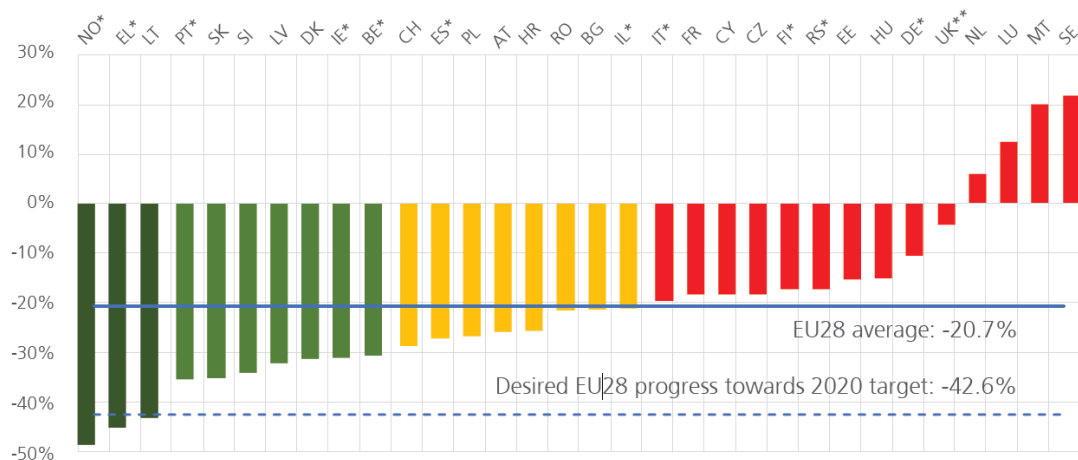


Fig.3. Relative change in road deaths between 2010 and 2018 according to the information from European Transport Safety Council

Since 2010, the number of road deaths was reduced by 21% but Bulgaria still has the second highest road mortality in the EU with 87 deaths per million inhabitants compared to the EU average of 49 (fig.4).

For the period 2011 - 2018 data on crashes with dead and wounded persons change in different directions. Fluctuations in statistics indicate a lack of sustained tendencies to reduce trauma with the desired dynamics. This necessitates the integration of new methods for more effectively meet the objectives of reducing road traffic injuries.

The state policy of the Republic of Bulgaria in the field of traffic safety is in line with the world and European goals, priorities and vision. The Bulgarian Government has paid special attention to this topic, as evidenced by the existence of a specialized national strategy, from the Management Program for the period 2017 - 2021 and from the 2019 adoption by a decision of the Council of Ministers, a package of measures to limit road traffic injuries by 2020, aimed at creating an additional organization to reach the targets set by 2020 goals.

Despite the taken measures, the lack of a specialized national legal body to monitor and synchronize actions between the various institutions, involved in ensuring road safety poses significant obstacles to the effectiveness of the measures taken. With the establishment of the State Agency for Road Traffic Safety in January 2019 the Bulgarian government has declared its will to prioritize the road safety policy by entrusting a new specialized structure with leadership, coordination and control functions.

The mission [6] of the agency is to pursue an active policy for improving the road safety in the Republic of Bulgaria, ensuring coordination between the institutions as well as between the institutions and the public in order to take adequate measures based on prevention, objective and systematic analysis, to significantly reduce the negative effects of road accidents.

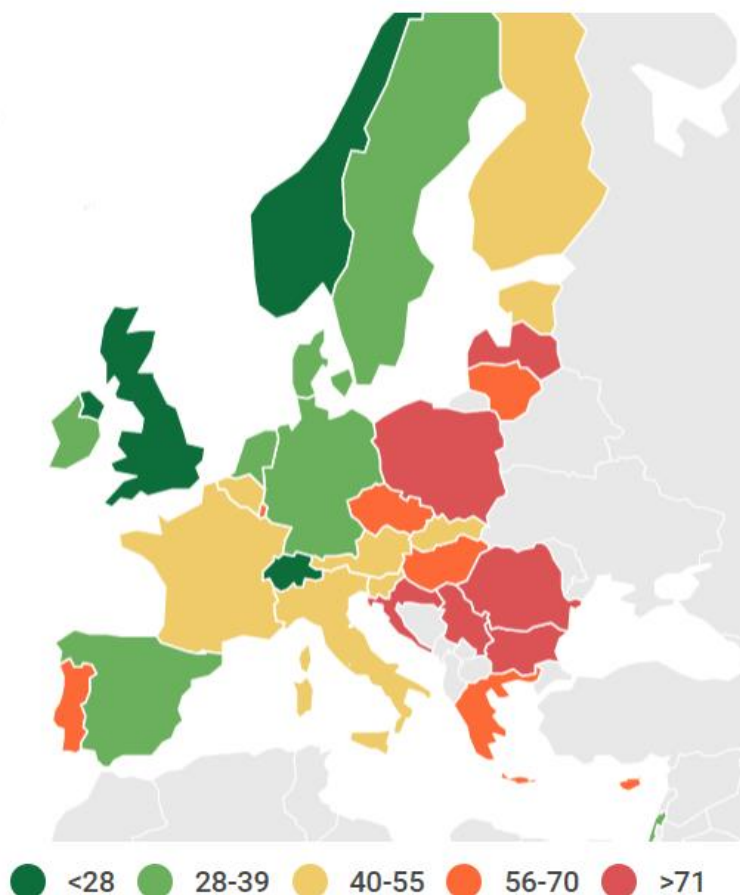


Fig.3. Road deaths in Europe per million inhabitants for 2018

4. CONCLUSION

Reducing the number of people killed and injured in a road accident and achieving the goals set by the EU for the implementation of the Vision Zero approach requires a lasting settlement of public relations in the regulations. Complex legislative measures are needed, given the existing deficiencies in the regulation of the functions and responsibilities of the competent structures.

The the road safety policy is not yet fully integrated into the relevant sectoral policies. Databases between institutions are not synchronized.

In the analysis of the regulatory framework, it is noted that its improvement requires more availability of data related to road accidents. Existing statistical databases contain deficiencies related to the causes of the accident and the effect on the participants, and they represent an important source for research and development in the field of safety measures to initiate improvement of the legislative base. There is also a lack of a multidimensional analysis of data related to road accidents, which would allow for the trending and identification of the most adequate impact measures. Last but not least, there is no single concept for the promotion of road safety issues (information, training, public debate).



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CHARACTERIZATION OF RUBBER-LIKE MATERIAL OBTAINED FROM WASTE BIODIESEL

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Abstract: A new polymeric material as result from long term polymerization of waste biodiesel was synthesized. The rubber-like material was produced for six years storage in open container at normal conditions and air presence. The block synthesis of rubber materials may be very useful comparing with the expensive emulsion and solution processes used in the rubber industry. The nature of the new material, called by authors Nanifam, can be described definitely as polyacrylate rubber in oligomeric state and density of 0.95 kg/m^3 .

Polyacrylate rubbers have significant usage in the polymer industry. They have very strong resistance to oils and solvents as well as good behaviour at high temperatures (up to $150 - 200 \text{ }^\circ\text{C}$). The most popular application of this rubber is as insulations and protective coatings.

The identification of invented by spontaneous polymerization reaction rubber was carried out using standard chemical techniques, color analytical reactions and FT-IR spectroscopy as a primary structural instrumental method.

The peaks in registered spectra of new polyacrylate rubber have typical shape and wave numbers described polymer with hydrocarbon chain ($-\text{CH}_2-\text{CH}-$), carbonyl groups ($-\text{C}=\text{O}$) and typical functional acrylate groups.

The results from reaction of Liebermann-Morawski definitely show behaviour similar as poly(chloroprene) rubber and poly(isoprene) rubber.

The aim of present work is study on the full spectroscopic characterization of a new rubber material with polyacrylate nature and proving of the possibility for producing in block from waste biodiesel of this new polymer.

Keywords: polyacrylates, biodiesel, FT-IR spectroscopy, rubber-like material.

1. INTRODUCTION

Elastomers are an important class of polymeric compounds and rubber products are daily on all aspects of life due their unique mechanical properties. The main technical methods for industrial producing of synthetic rubbers are emulsion polymerization and polymerization in solution [1]. Both of the methods are very well developed and have long history in their improvements. At the present state block polymerization which leads to production of solvent- and emulsifier-free polymer have been developed and used only in a few plastics production industrial methods.

The polyacrylate elastomers were first developed in the USA during the 1940s [2]. The first commercial introduction of these rubbers was in 1947 by B.F. Goodrich. In the recent years many upgrades in the quality and technical capabilities of these elastomers have been developed [2]. Polyacrylate, designated ACM by ASTM, is a cost-effective type of heat and oil resistant polymers with a long history of use by the automotive industry, and to a much lesser extent for mechanical goods. These polymers operate very well at 150°C to 175°C in oil, hence are used in applications operating above the capability of nitrile rubber, (NBR) [3]. Polyacrylate is also better alternative of the others expensive specialty elastomers [4].

The biodiesel (fatty acid methyl esters) is widely used in transportation sector and a huge amount of this fossil fuel alternative is produced annually in the world [5]. After long time

storage biodiesel loses their capabilities and required properties [6]. If biodiesel will be stored for longer than about four to five months, especially in more southern climate, the fuel capabilities and required properties are lost. This relative short storage time period leads to forming of huge amounts of biodiesel wastes. In literature many ways for alternative usage of fatty acid methyl esters are developed [7-9]. The main goal of these researches is producing of useful renewable raw materials for the chemical industry [10].

The complete analysis of the spectra of high polymers is complex and several workers have been engaged in obtaining detailed structural information on polymers from infrared spectroscopy [11]. The limitations of infrared spectroscopy are mostly due to difficulties in interpretation of the results rather than due to experimental problems.

Infrared spectroscopy is used extensively in the analysis of rubbers [12]. It is a very good, relatively quick technique for the determination of the polymer present in a rubber compound [13, 14].

The aim of present work is detailed study on the spectroscopic characterization of a new rubber material with polyacrylate nature and proving of the possibility for production using block polymerization from waste biodiesel of this new elastomeric polymer.

2. EXPERIMENTAL AND METHODS

The biodiesel used in this research was synthesized using the following procedure well described in our previous works [15, 16].

In the reactor the needed amount of vegetable oil was loaded. Then the equipment was placed in a bath at a constant temperature and heating at 45 °C. The alkaline catalyst (KOH) completely dissolved in methanol was added to the reactor. Beginning of the reaction was reported with the addition of an alcoholic solution of the catalyst and continues for a time of 4 hours. The average speed of stirring is 600 rounds per minute. After completion of the reaction, the reaction mixture was transferred into a funnel, allowing glycerol to separate gravitically for 2-3 hours. After glycerol layer was separated, excess of methanol was removed by evaporation at 70 °C. The fatty acid methyl esters (biodiesel) were washed with phosphoric acid (5 %) several times.

The open glass containers with different biodiesel samples were placed at 70 °C in closed furnace. After a week time long storage the biodiesel samples were transferred at room standard conditions with direct oxygen access from the air. The obtained rubber-like material called by authors Nanifam was formed during spontaneous polymerization for six years long term storage after the initial thermal treating.

The pyrolysis of the obtained rubber compound was performed in a closed flask at the temperature of 400 °C. During the process volatile products were cooled and turned into a liquid phase which was analysed by the same procedure as solid and liquid film samples of rubber.

In this study the obtained rubber compound called by authors Nanifam was analyzed according to the specifications of ISO 4650:2012 standard for infrared spectrometric identification of rubber by liquid layer and KBr pellet technique. The infrared spectra of the different rubber samples were recorded with a Fourier transform infrared spectrometer, Bruker Tensor 27, interfaced to a personal computer operating under Windows-based software OPUS 6.5. All spectra were recorded from 4000 to 400 cm^{-1} with resolution better than 4 cm^{-1} , co-adding 32 interferograms with frequency resolution better than 0.01 cm^{-1} . The frequency of each band was obtained automatically using command of the instrumentation software OPUS 6.5.

3. RESULTS AND DISCUSSION

A complete analysis of rubber materials is a complex, difficult and time-consuming task. To fully characterise an unknown polymer the following type of information are required: type of polymer, type and amounts of monomers, water content, types and amounts of impurities. To successfully identify the polymer it should be separated from processing additives and fillers present. This will avoid the complication during the polymer identification at visa versa.

The numerous polymers cannot be identified by a simple touch and feel exercise, nor by the visual appearance [17]. Simple observation will not reveal the chemical nature of a polymer.

For these reasons an identification schemes based on simple tests such as the behaviour of polymers in solvents were developed. The main benefits of these methods are that the examination is quick and only basic knowledge of chemistry is required in their using.

The first stage of investigation consists of visual examination of obtained material and comparison with physical appearance of other elastomers. The visual appearance of the obtained rubber compound is presented on Fig. 1. It is clearly visible that solid material appears as typical coagulated rubber and has high elasticity and stickiness typical of elastomers.



Figure 1. Image of synthesized rubber compound

At the second stage of examination of obtained rubber compound a typical color reaction (Liebermann-Morawski test) was performed. The results from conducted reaction of Liebermann-Morawski definitely show behaviour similar as poly(chloroprene) rubber and poly(isoprene) rubber. But this fact makes it difficult to explain the true chemical nature of the synthesized rubber compound.

The main goal of this study was the most detailed analysis of infrared spectra obtained from the synthesized rubber-like material and definitely proving of its polyacrylate nature and structure. In this research we have followed the standard procedure in the spectral interpretation of vibrational frequencies in registered spectra of the rubber material. Analyzing the infrared spectra of the three different forms of the rubber-like compound we have moved on to simple organic compound where many functional groups are added to the skeletal polymeric molecule [18]. To assist in the identification of polymers, infrared spectral libraries are available, such as those published by Forrest and co-workers [19]. The registered spectra of obtained rubber compound in two different forms are shown on Fig. 2.

Functional groups in polymers can presented over wide range of concentration. A wide range of physical and chemical techniques have been employed in functional group analyses, especially procedures based on infrared spectroscopy and pyrolysis of the polymer followed by analysis of the volatile products produced, condensed in liquid phase.

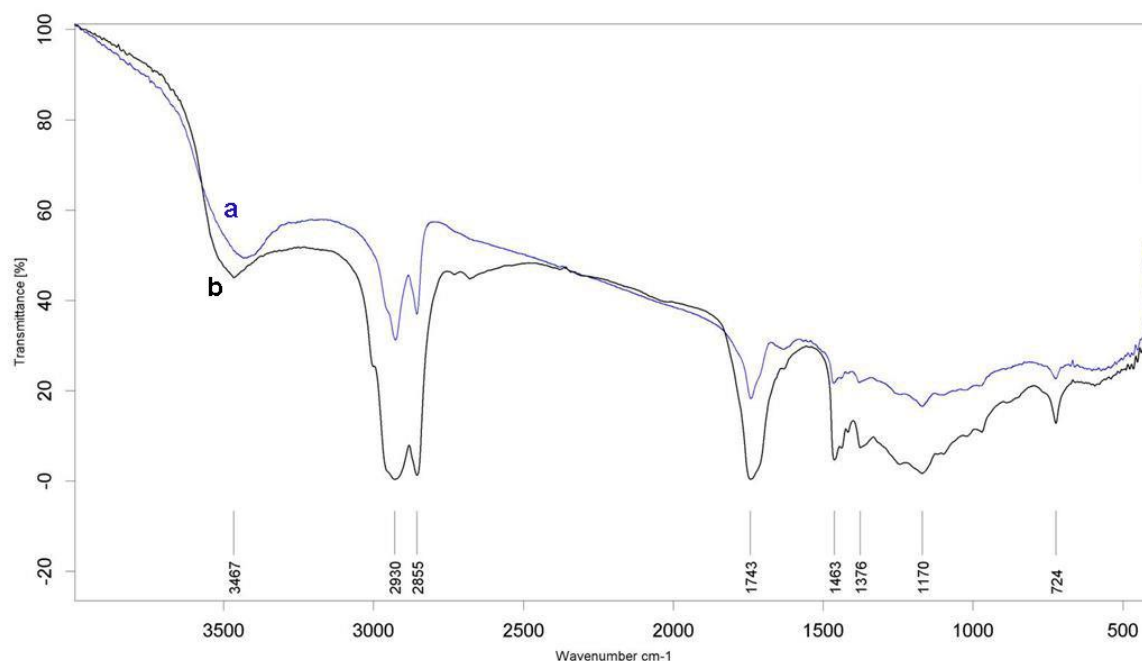


Figure 2. FT-IR spectra obtained from analysis through different techniques: (a) rubber transmission (liquid film), (b) rubber transmission, KBr pellet

The determination of most important and intense peaks was performed and the list of the obtained peaks and their frequencies are shown in Table 1. The intensities and group assignments of the peaks are shown too. These data confirm that the sample of acrylic rubber premarily exhibits FT-IR peaks similar to those reported in literature [19].

Table 1. Assignments of characteristic absorption peaks from FT-IR spectra of the rubber samples

Peak value, cm ⁻¹	Intensity	Functional groups assignments
3400	medium	OH stretching in acrylate compounds
2930	strong	CH ₂ asymmetric stretching
2855	strong	CH ₂ symmetric stretching
1743	strong	C=O stretching for carbonyl group
1463	strong	-CH ₃ asymmetric deformation
1380	strong	C-H deformation
1170	weak	R-CO-R symmetric stretching
725	medium	Methylene -(CH ₂) _n - rocking (n≥3)

The rubber spectrum can be divided into three main regions: the methyl and methylene group region (2840–2980 cm⁻¹), the carbonyl region (1760-1665 cm⁻¹), and the fingerprint region between 1470 and 500 cm⁻¹.

The band at 3400 cm⁻¹ always occurs in presence of OH functional group vibrations. The bond strength of the O-H is strongly dependent on hydrogen bonding [20]. When hydrogen bonding is formed the O-H band appears weaker and the vibration frequency lowers. The band on 3434 cm⁻¹ in the spectra of solid rubber phase shows lower frequency and intensity compared to the band on 3467 cm⁻¹ registered in the rubber liquid film. Also in the liquid phase each O-H has slightly different hydrogen bond geometry and this change the shape of the peak.

In the first studied infrared region (2840–2980 cm^{-1}) two strong peaks are observed (Fig. 2). Both of the obtained infrared spectra contain bands originating from vibrations of C-H and CH_2 functional groups (2930 and 2855 cm^{-1}) and they are characterized by a very steep slope of the lineshape and appear predominant in whole spectrum. These stretching vibrations prove structure of main polymer chain consisting of $-(\text{CH}_2)-$ repeating units. This type of macromolecular structure is suitable for conclusion that investigated rubber definitely has hydrocarbon chain structure of polyacrylates. The CH_3 methyl end groups of long-chain hydrocarbons produce stretching bands around 2955 cm^{-1} as is viewed on Fig. 2.

In the second studied infrared region (1760-1665 cm^{-1}) a very strong characteristic band 1743 cm^{-1} occurs. The position and intensity of peak show that the carbonyl stretching vibration are strong and determine the functional groups connected to the main polymer chain.

Carbonyl compounds are very important in the interpretation of infrared spectra. The C=O absorption is almost always one of the most characteristic in the entire spectrum, and it is also most likely to be the most intense spectral feature.

Carbonyl groups absorb at frequencies around 1680-1750 cm^{-1} . The frequency also depends on the specific functional group and the rest of the molecule. In studied spectra the frequency can be associated with simple aliphatic ester which absorb around 1750-1735 cm^{-1} .

In the third studied infrared region (1470-500 cm^{-1}) three very intense absorption bands at 1463, 1380 and 1170 cm^{-1} are presented.

The peaks of bending vibrations of C-H bonds appear at 1463 and 1380 cm^{-1} . The peak at 1380 cm^{-1} can be assigned with weak methyl band of alkane compounds. The mentioned above characteristic bands additionally confirm that investigated polymer compound has polyacrylate nature.

The peak of stretching vibration of C-O bonds of ester groups appears at 1170 cm^{-1} . The C-O stretch next to the COOH group of the ester appears between 1300 and 1150 cm^{-1} for most common esters.

Noteworthy is the almost complete disappearance of bands at 730, 910, 965 and 1640 cm^{-1} , associated with unsaturation. This leads to conclusion that the main chain is fully saturated such as macromolecules of polyacrylate rubbers.

The analysis of the infrared spectra of the synthesized rubber gives an option for recognizing of the phase behaviour of the polymeric material. The band at 725 cm^{-1} associated with rocking vibrations of the poly(methylene) chain has strong uniform shape which proves absence of crystalline regions in the amorphous material. In the case of crystalline rubber this band becomes a doublet [21]. The absence of doublet at 1463 cm^{-1} also confirms that rubber structure is fully amorphous.

The pyrolysis of the rubber compound was performed in the presence of oxygen from air. The obtained condensate from cooled volatile products was studied in the same middle infrared region (4000-400 cm^{-1}) such as solid rubber and liquid film.

The pyrolyzat spectrum obtained from pyrolysis of rubber compound is shown in Fig. 3.

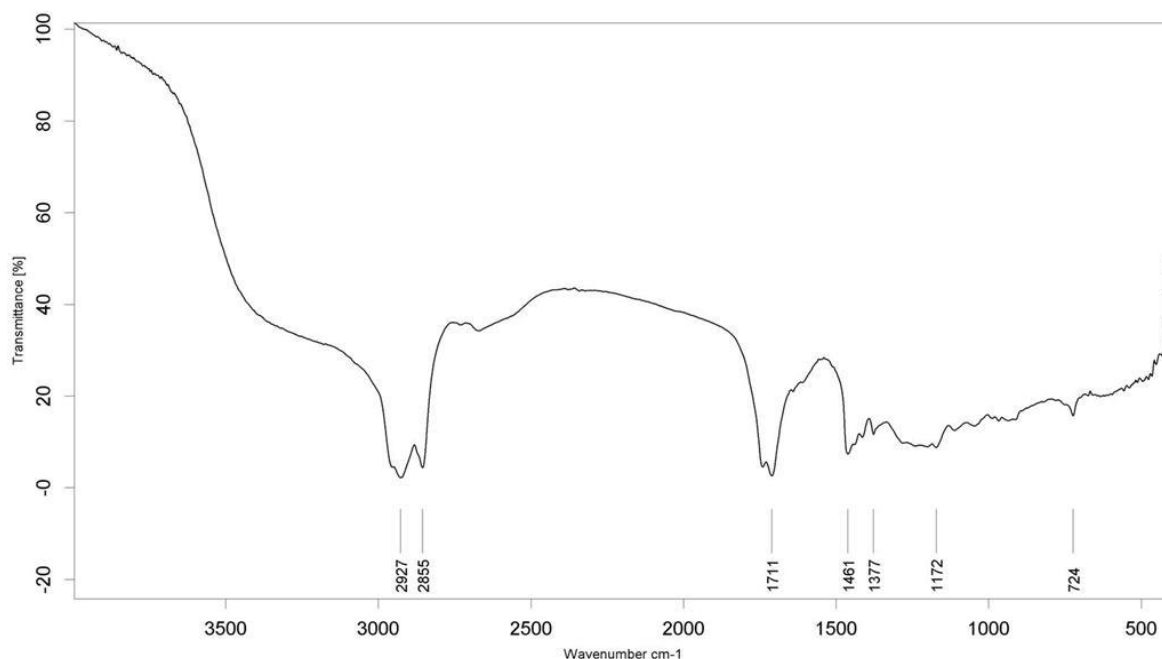


Figure 3. FT-IR spectrum of rubber pyrolysis condensates (liquid film)

Two main differences between the rubber spectra and pyrolyzate can be easily identified. The first significant change in the spectrum is disappearance of the peak at 3400 cm^{-1} which is turned into broad shoulder. The second difference consists in the splitting and shifting of band at 1743 cm^{-1} into two new peaks of acid / ketone and ester groups at 1711 and 1742 cm^{-1} respectively.

The infrared literature contains numerous examples of monocarbonyl compounds that exhibit two or more prominent bands between 1903 and 1650 cm^{-1} [22].

The cause of the split C=O peak has been attributed to Fermi resonance interaction between the normal CO vibration and the first overtone of a vibration occurring at about one half the C=O frequency [23].

That the two bands arise from the monomeric species and not from dimers or other associated aggregates is indicated by the independence of the relative intensities of the bands on the concentration and by their molecular weights. Certain types of unsaturated lactones exhibit two bands in the region of the spectrum associated with the C=O stretching vibrational mode [23].

Other bands that are associated with the C-O and O-H components tend to be less pronounced, and sometimes may be overlapped with other fingerprint absorptions of the molecule. These are located in the ranges $1320\text{--}1210\text{ cm}^{-1}$ (CO stretch) and $960\text{--}850\text{ cm}^{-1}$ (hydrogen-bonded O-H out-of-plane bending). A carboxylic acid produces characteristic broad O-H absorption in addition to the intense carbonyl stretching absorption.

4. CONCLUSIONS

A new polymeric material during spontaneous polymerization of biodiesel wastes was synthesized. The obtained polymer has elastomeric nature and can be described as typical rubber-like material. The chemical nature of the rubber compound was studied using mainly FT-IR spectroscopy. The results from the analyzed spectra show behaviour of polyacrylate elastomer. The pyrolysis of the new rubber compound was performed and the products were studied too. The differences between spectra of rubber compound and pyrolyzate are

reported. The perspective for production of the polyacrylate rubber by block polymerization of waste biodiesel was investigated, discussed and proved.

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SYNTHESIS OF STRUCTURAL SCHEMES OF LINKAGE MECHANISMS FOR PORTAL GANTRY CRANE JIB SYSTEM

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Abstract: The most common crane structural scheme used in the practice includes 4-link guiding mechanism and 4-link balancing mechanism. Some special crane construction as such designed by Kranbau – Eberswalde contains a 6-link balancing mechanism with structural scheme obtained by conjunction of 2 consecutive 4-hinged units. Similar construction is a subject of research, related to synthesis of 6-links mechanism during designing of new crane constructions. Another paperwork presents an approach for development of jib system of existing gantry crane type. Such approach relates to keep both – jib and arm without changes in their mass, shape and loading conditions. Still another paperwork revealing an approach for synthesis of existing gantry crane allowing minor structural changes by addition of small-sized links to the scheme of balance mechanism without changes in the structure of jib, arm and frame. According Assur's classification the number of links in each mechanism would be theoretically unlimited although it would cause significant difficulties during production of such systems. Practically, not any crane constructions designed with 8-link or 10-link structural scheme exists. At other side, increasing the number of links is a precondition to more accurate dimensional movement of balance unit. Structural schemes for plain linkage mechanisms appropriate for application in a portal crane are being synthesized. At the synthesis the limitations of the links must be no more than ten and they save the configuration of the crane's mechanism that is mostly used in practice. Potential applications of 4 different structural schemes indicated as H_1Y_1 , H_2Y_1 , H_1Y_2 and H_2Y_2 , synthesized by a practical example, are being appraised. Results for alteration of the reduced moment to jib from weights of links of jib system depending on the range of jib with and without useful load are obtained.

Key words: structural synthesis, portal crane, jib system

1. INTRODUCTION

The portal gantry cranes setting its worldwide application for mechanization of loading, unloading and handling processes during treatment of various general and bulk loads within area of ports. The main operational system is crane jib system, which is a combination of guiding and balancing mechanisms that have a shared link – the crane's jib.

Many requirements are set for normal operation of portal cranes. In the case of considering the guide and balance mechanisms of portal crane in geometrical and partially kinethic-static aspects, the essential requirements reduced most frequently to the following [1], [2] and [3]:

- a) Ensuring the minimum s_{min} and maximum s_{max} jib range set – 1 at Fig. 1;
- b) Guaranteed minimum height H for load lifting;
- c) Minimum length of the arm, 2 at Fig. 1;

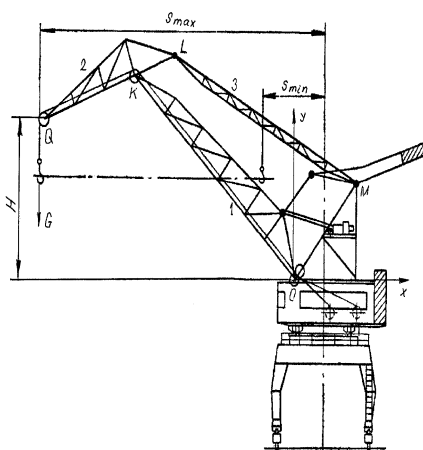


Figure 1. Portal Crane

H – load lifting height; Q – load; G – weight force; S_{min} , S_{max} – minimum and maximum jib range set; 1 – jib; 2 – arm; 3 - hoist

- d) Minimum total length of jib and arm;
- e) Providing a proximity between achieved path of the suspending point of the load and desired horizontal line provided that the deflection to be not greater than the limit (up to 3 % of load path – $s = s_{max} - s_{min}$);
- f) Providing minimum momentum M_G from the carried load weight adjusted to the jib;
- g) Balancing the own weights of the links of guide mechanism for all working path of the jib provided that maximum absolute value of non-balanced momentum must not be greater than the limit value set by the standard (15 % of maximum momentum ($M_{k,max}$) created by the weights of the guide mechanism's links reduced to the jib);
- h) Minimum load of the hinges of the mechanism.

There are many different works in regards to synthesis of jib system mechanism [4], [5], [6] and [7]. The objective of this work is to synthesize new structural schemes of the mechanism for jib system of portal crane through free combinations of the elements of both groups of guide and balance mechanisms.

2. METHODS

The number of the elements of combination of synthesized guide mechanisms is 13 and of the combination of the balance mechanisms is 14 not taking into consideration the variety of “antiparallelgramity”.

To reduce the variants must be set the following limitations: the number of the links of the mechanisms obtained for the jib system must not be greater than ten and the configuration of the mechanism most frequently used in practice saved.

Assume here the same conventional designations. At combination of guide mechanism H_1 with all balance mechanisms Y_i , $i=0,1,\dots,13$ the first group H_1Y_i of 14 mechanisms for jib system is received. The number of the group and the variant, conventional designation, the number of the links and the figure where the received mechanism is displayed, are given in Table 1 (structural schemes of the ten-links and some eight-links mechanisms are not given in this work).

For example, the symbol $4^* \wedge 3$ used in the Figures must be interpreted as follows – the link 4^* of the balance mechanism is fixed to the link 3 of the guide mechanism.

The mechanisms H_2 and H_3 in combination with balance mechanisms Y_i , $i=0, 1, 2, 3$, considering the limitation for the number of the links, give H_2Y_i and H_3Y_i of four mechanisms each, respectively. The guide mechanisms H_i , $i=4, 5,\dots, 13$ are combined with the balancing



variants Y_0 and Y_1 , because the number of their links meets the limitation set as a limiting case. The mechanisms received in such method for jib system are combined in two groups of 10 each.

The number of the mechanisms for jib system of portal crane with no more than ten links, is 42. With the limitation that the number of the links to be not greater than eight, the mechanisms are 18, 10 of which with the balance of Y_0 . With the limitation of six, the mechanisms are only 3, 2 of which are with the balance of Y_0 . In case of combination between guide and balance mechanisms taking into consideration the possibility for matching the varieties of "parallelogramity" and "antiparallelogramity", the number of structural schemes with the first limitation for links is 369, with the second it is 97 and with the third it is 8.

The mechanism of H_1Y_0 from Figure 2 is much simple but despite of this its has not applied in practice because of its poor balance possibilities. With the mechanisms of H_iY_0 , $i=2,3,\dots,13$ (fig. 2 to 6) notwithstanding of simple balance scheme, because of the greater number of the links in relation with the mechanism H_1Y_0 , practically acceptable results may be obtained, but their overall balance parameters gives unsatisfactory results compared to the next structural systems with higher links number.

The H_1Y_1 mechanism (fig.7) is largely widespread in practice and may be accepted for classical type of mechanism for jib system. The mechanisms presented at fig.8 and fig.9 has 8-link structural scheme as H_2Y_1 gives better balance possibilities compared to H_3Y_1 . The mechanisms presented at fig.10 and fig.12 contains 10 links each as H_4Y_1 consists 8 links in guiding unit and 4 links in balance unit, while H_2Y_2 contains 6 links in each of both units which reflects to higher stability of the mechanism.

In the H_1Y_2 mechanism (fig.11), the second couple in Y_2 is proposed firstly as a parallelogram only for lowering the gravity centre with heavy floating portal cranes [8] but later is proposed to use all its parameters as their balance features may be improved 3 to 5 times [9] and [10]. To assess the possibilities of some structural schemes, the variation of the momentum of the gravity force of the elements of jib system reduced to the jib, is determined depending on the range of the crane operated with or without useful load.

Table 1. Description of structural nature of the mechanisms of the jib system of portal crane

№ var.	Conventional Designation	Number links	Note	№ var.	Conventional Designation	Number links	Note	№ var.	Conventional Designation	Number links	Note
1	$H_1Y_i, i=0,1, \dots, 13$			2	$H_2Y_i, i=0, 1, 2, 3$			4.6	H_9Y_0	8	
1.1	H_1Y_0	4	Fig. 2.	2.1	H_2Y_0	6	Fig. 3	4.7	$H_{10}Y_0$	8	
1.2	H_1Y_1	6	Fig. 7	2.2	H_2Y_1	8	Fig. 8	4.8	$H_{11}Y_0$	8	
1.3	H_1Y_2	8	Fig. 11	2.3	H_2Y_2	10	Fig.12	4.9	$H_{12}Y_0$	8	
1.4	H_1Y_3	8		2.4	H_2Y_3	10		4.10	$H_{13}Y_0$	8	
1.5	H_1Y_4	10		3	$H_3Y_i, i=0, 1, 2, 3$			5	$H_iY_1, i=4, 5, \dots, 13$		
1.6	H_1Y_5	10		3.1	H_3Y_0	6	Fig. 4	5.1	H_4Y_1	10	Fig. 10
1.7	H_1Y_6	10		3.2	H_3Y_1	8	Fig.9	5.2	H_5Y_1	10	
1.8	H_1Y_7	10		3.3	H_3Y_2	10		5.3	H_6Y_1	10	
1.9	H_1Y_8	10		3.4	H_3Y_3	10		5.4	H_7Y_1	10	
1.10	H_1Y_9	10		4	$H_iY_0, i=4, \dots, 13$			5.5	H_8Y_1	10	
1.11	H_1Y_{10}	10		4.1	H_4Y_0	8	Fig. 5	5.6	H_9Y_1	10	
1.12	H_1Y_{11}	10		4.2	H_5Y_0	8	Fig.6	5.7	$H_{10}Y_1$	10	
1.13	H_1Y_{12}	10		4.3	H_6Y_0	8		5.8	$H_{11}Y_1$	10	
1.14	H_1Y_{13}	10	1.	4.4	H_7Y_0	8		5.9	$H_{12}Y_1$	10	
				4.5	H_8Y_0	8		5.10	$H_{13}Y_1$	10	

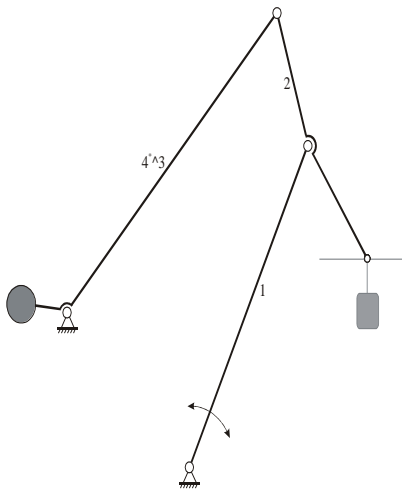


Fig. 2. Mechanism H_1Y_0

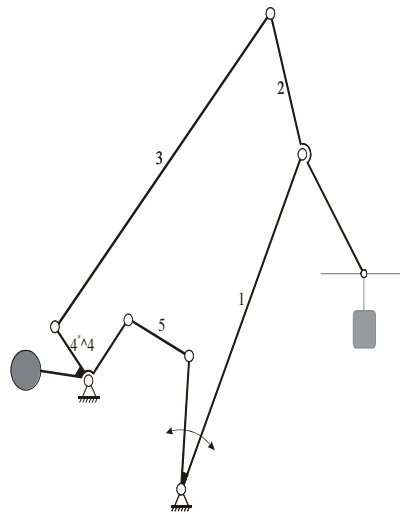


Fig. 3. Mechanism H_2Y_0

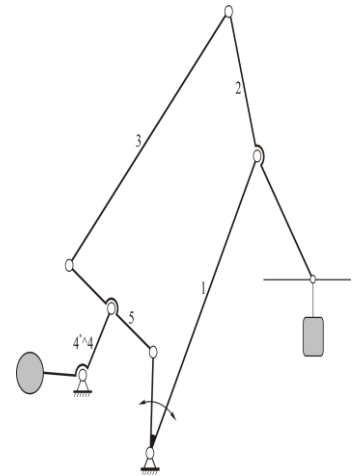


Fig. 4. Mechanism H_3Y_0

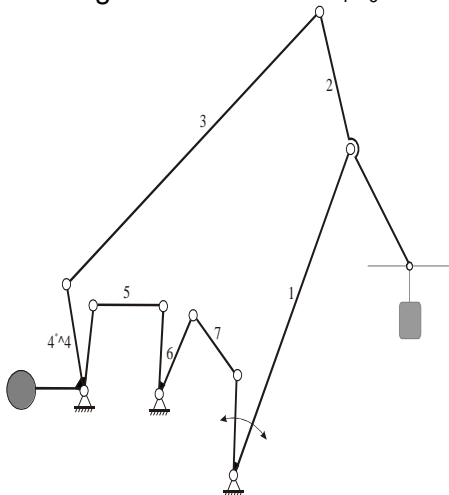


Fig. 5. Mechanism H_4Y_0

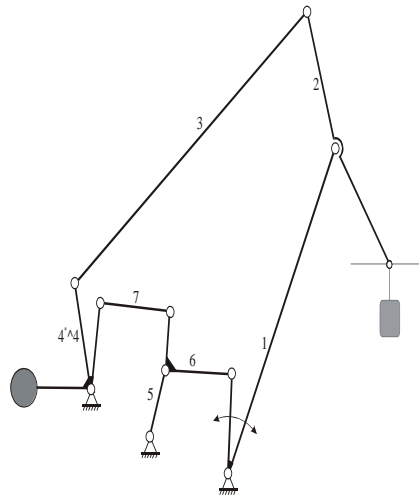


Fig. 6. Mechanism H_5Y_0

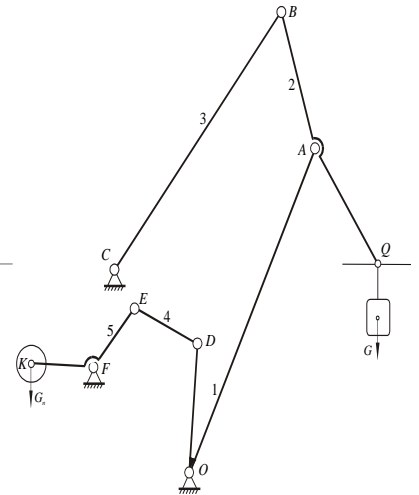


Fig. 7. Classic scheme H_1Y_1

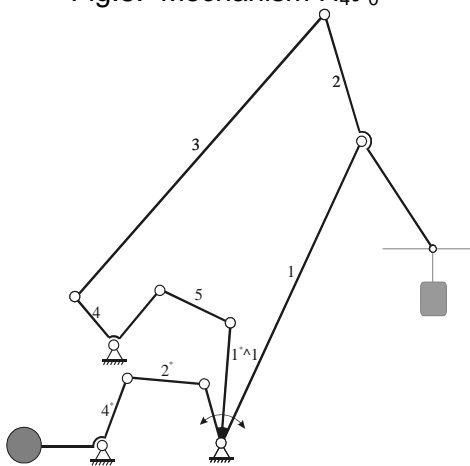


Fig. 8. Mechanism H_2Y_1

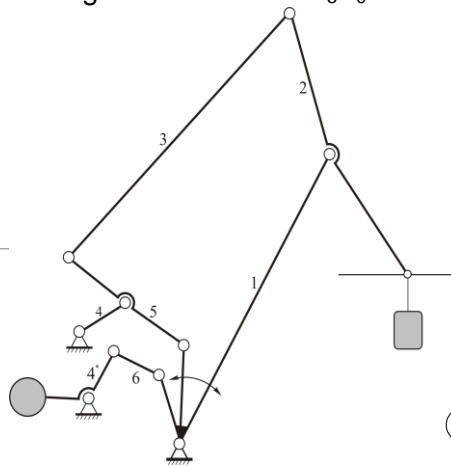


Fig. 9. Mechanism H_3Y_1

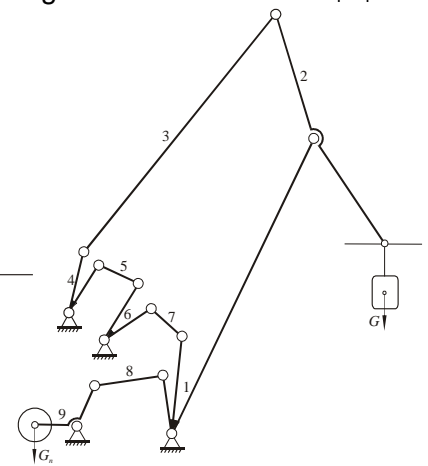


Fig. 10. Mechanism H_4Y_1

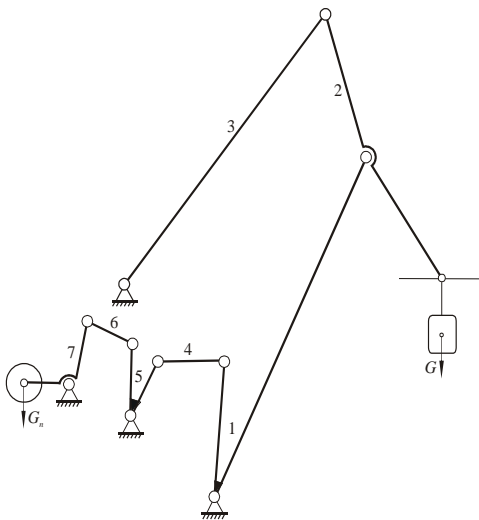


Fig. 11. Mechanism H_1Y_2

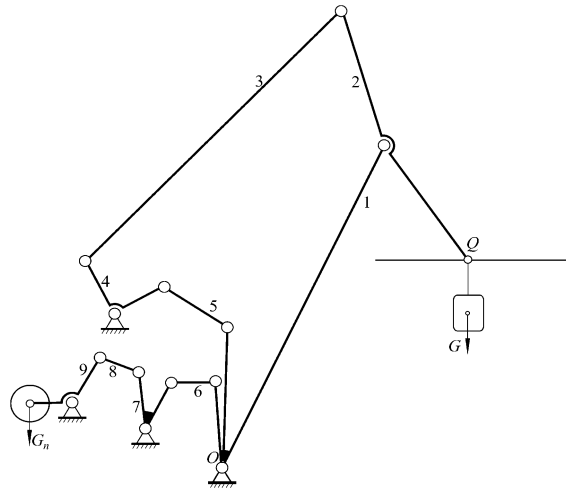


Fig. 12. Ten-links mechanism H_2Y_2 for jib system of portal crane

3. RESULTS

At Fig. 13 are given the obtained graphical functions of the adjusted momentum $M_G=M_G(s)$ and $M_0=M_0(s)$, respectively with or without load for mechanisms H_1Y_1 , H_1Y_2 , H_2Y_1 and H_2Y_2 , synthesized for real crane. Such relationships give indirect assessment for the quality of the mechanism according to the instability of jib system and energy consumption. With the reducing the distance between curves M_G and M_0 instability of the mechanism rises and with reducing the absolute values of the momentums M_G and M_0 the operation of the crane operation is improved according to the energy consumption.

As a relation base, the classical six-links mechanism H_1Y_1 has been selected for the jib system designed in Ruse Shipyard with load capacity of $G=10t$ and range variations $s=4 \dots 29$ m.

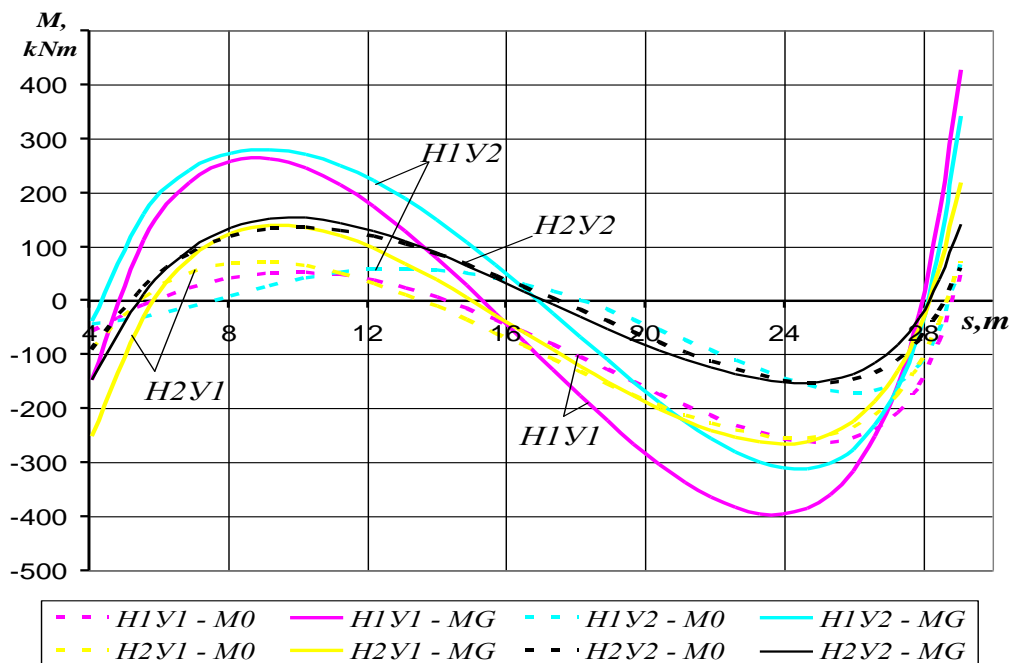


Fig.13. Graphical function $M=M(s)$

As shown on the diagrams all synthesized mechanisms have three intersection points with the abscissa axis each, both ends of which are centres of stable equilibrium. This means that in case of emergency situations when the mechanism of the jib system is out of control it would strive for occupying one of such centres.

Note that with the increasing of the number of links of the mechanism – eight with H_2Y_1 (fig.8), ten with H_2Y_2 (fig.12), the absolute value of the momentums M_G and M_0 decreases as well as the distance between them in relation with six-links H_1Y_1 .

The great proximity of the two curves M_G and M_0 in mechanism H_2Y_2 , in considerable part of range variation interval s is an indicator for high stability of the mechanism not considering the weight of the load carried.

With eight-links mechanism H_1Y_2 (fig.11), a deterioration of the results is found and the maximum adjusted momentum is almost two times greater and the distance between the curves M_G and M_0 remains considerable in relation with eight-links H_2Y_1 . This may be explained with the fact that guide mechanism of the H_1Y_2 structure has four links and has more limited optimisation possibilities in relation with the six-links guide mechanism of the H_2Y_1 structure.

4. CONCLUSIONS

Structural schemes of mechanisms for portal crane meeting the set limitations are synthesized among which are the known schemes.

It is found that using mechanisms with more complicated structure for the jib system of portal crane is advisable. Particular attention have to be paid to H_2Y_1 mechanism where in relation with classical mechanism H_1Y_1 there are only two more small links.

The point of interest is also the H_2Y_0 mechanism that has the same number of links as classical H_1Y_1 but one less rotating couple and not used in practice yet. It is to be studied and related with the classical one.

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BIO-ENERGY FROM PHOTOSYNTHETIC ALLOYS FOR USE IN BIOQUALS AND BIOPRODUCTS

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Abstract: Significant technical progress has been made in recent years in the development of algae-based bioenergy, and much of industrial and academic R&D projects have diverged from the biofuels strategy. This report summarizes the conclusions of a recently concluded symposium analyzing the prospects for using micro- and macroalgae as a feedstock for biofuels and bioenergy.

It discusses international activities for the development of bio-energy and non-energy algae bioproducts, advances in the use of macroalgae (both non-cultivated and cultivated algae). Applications for various biochemical and thermochemical uses, bio-refining capabilities for various products, as well as an in-depth review of the process from the point of view of economy and energy sustainability are also given.

Keywords: algae, bioenergy, biorefinery

1. INTRODUCTION

In light of the continued low fossil fuel prices, the algae-based industry is being forced to shift its focus from lower value to higher-value (non-energy) biofuels and bioenergy. It is envisaged that algae (biomass) -based bioproducts will be required by industry to provide the additional revenue needed to reduce the cost of algae-based biofuel production. Such an approach to biorefinery, which generates a number of high quality algae products, should be essential for the full use of algae biomass and to enable economically viable bioenergy production. In order to accelerate the implementation of algae-based production, minimizing energy, water, nutrients and the use of integrated algae-based operations, it should become a key objective of future R&D. The International Energy Agency (IEA) Bioenergy Technology Collaboration Program (TCP) has commissioned and published a report showing the state of the seaweed-based bioenergy technology [1]. The report was prepared by a team of 20 authors in terms of processing experiment, biorefinery, macroalgae and overall technical and economic sustainability. The international status and prospects for the use of micro- and macroalgae as a report of IEA Bioenergy Task No.39 / 2010 [2] are addressed.

2. EXHIBITION

The report shows the potential for the production of liquid and gaseous biofuels derived from algae and therefore algae-based bioenergy in the more general context of integrated biorefineries. Although there is considerable potential for using the high photosynthetic efficiency of algae for bioenergy and biofuels production, inherent biological cellular constraints on the production capacity of the strains are associated with large differences in the predictions of microalgae and macroalgae. The report highlights the significant

challenges of extrapolating the performance cited in the literature. There are also significant advantages over the development and production of algae-based bioenergy. Biofuels and bioproducts in the context of multi-product biorefineries should achieve the maximum valorisation of algae. The analysis presented in the report aims to further explore the biofuels and bioenergy technologies that will be used in the future for the supply of liquid and gaseous fuels for transportation.

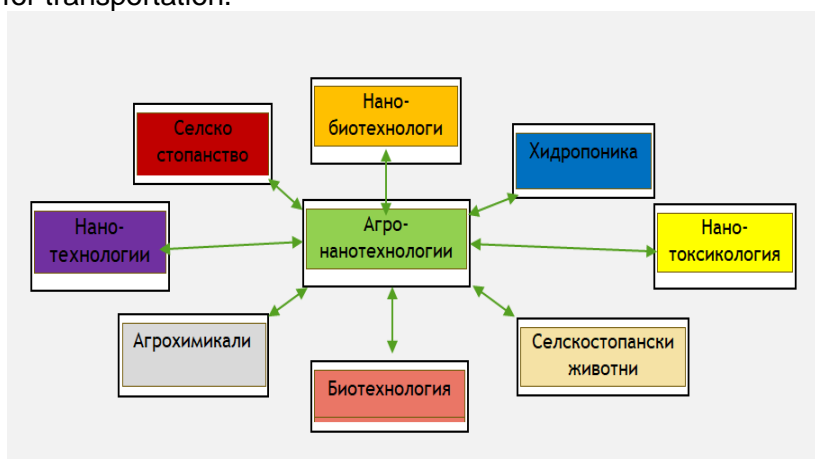


Figure 1. Scheme of the development of agro-technology

Regardless of technical progress, the prospects for producing bioenergy or algae-based biofuels are significantly higher (Figure 1).

This is the result of the significant fall in oil prices since August 2014. A lot

Algae-based biofuel producers are increasingly shifting their commercial interest to them.

Until oil prices return to pre-August 2014 levels, or reducing the carbon footprint of a small group of companies becomes an approach where co-production of higher value products is linked to the economic viability of co-production of biofuels from algae [3-6].

The structure of the report follows different fields of research and development (R&D) for algae and bioproducts bioenergy applications. The main focus is on the relationship between microalgae and biofuels and bioproducts, in line with the majority of literature and scientific reports that have public and private funding compared to macroalgae. Thus, the state of macro-algae-based bioenergy production is reviewed and the finding that the prospective use of low-cost algae for biogas production could be a potential commercial short-term bioenergy opportunity in some regions. The annexes of the report include a unique overview of commercialized technologies and a comprehensive list of commercial algae-based research projects and production facilities worldwide. One of the challenges facing algae oil production is the development of effective methods for collecting algae for processing. Most existing methods require expensive equipment, consume large amounts of energy, or are difficult to put into industrial practice (Figure 2) [15].



Figure 2. Seaweed oil

In recent years, research has been conducted to create production systems for the production of biofuels from oil-bearing algae. Aquatic plants have a high fat content, which is why they can displace rapeseed and soybeans as raw materials for biofuels.

Microalgae exceed 8 to 25 times the energy potential derived from palm oil and 40 to 120 times rapeseed oil, which are typical representatives of vegetable oilseeds [14].

The benefits of algae biodiesel production are its rapid growth; the high yield per unit (ha) of area; the biofuel obtained from algae contains no sulfur; it is non-toxic and biodegradable very well. Some algae species are ideal for biodiesel production due to their high oil content, which is more than 50%.

Energy considerations for algae production provide a framework for considering the maximum productivity limits of real algae and the absolute potential for biofuels / bioproducts production under physical and geographical constraints. As already emphasized, there is clear economic sustainability. There are still challenges to developing large-scale biomass based biofuels. Although complete economic considerations about algae, the cost of growing biomass and producing biofuels is a complex operation. It is different from where there is production with physical, geographical and socio-economic conditions for the production of biomass in the context of the use of bio-refineries to extract additional value from products co-produced with gaseous or liquid biofuels.

The problem with algae production remains the high cost of cultivating and harvesting the raw material for land biomass. Despite recent research and technology, the main promise of using algae-based systems for bioenergy production, as well as chemicals and nutrients for products, remains the challenge of meeting the cost and sustainability targets. Algae, as a class of photosynthetic microorganisms, exhibit great biodiversity and metabolic plasticity compared to terrestrial plants (Figure 3).



Figure 3. Algae bioenergy production

Besides not being widely used for food, they have many other advantages over traditional sources of biofuels [16]:

1. Can be grown in places that are not suitable for growing other crops;
2. They produce biofuel through photosynthesis - ie. they just need sun, water and carbon dioxide. Of course, some other nutrients are also needed;
3. In photosynthesis, oxygen is released and carbon dioxide absorbed reduces the emissions of harmful gases into the atmosphere.

For some geographic locations, algae can be cultivated on arable land. In addition, the rapid growth and extremely high photosynthetic efficiency of algae feedstocks allow for higher yields of real biomass (and thus product yield). In this context, algae remain promising renewable sources.

Significant economic barriers to sustainability in the production of cheap energy and fuel are market relations. Future research and commercial deployment of algae as feedstock should provide global, economic and sustainable solutions on a larger scale to current infrastructure. Among these reasons, the inverse relationship between productivity and lipid content can be a particularly difficult challenge for overall process optimization and cost-effectiveness [7]. Although many algae-based technologies have been demonstrated in laboratory settings, these are often isolated cases and therefore remain a challenge to validate the effectiveness of different technologies to work together effectively and in an integrated and effective manner. Reducing the sources of energy, water and land from joint exploitation should be one of the key objectives for future large-scale demonstrations [8]. A common potential challenge for production and process is specific production strains and their cultural characteristics.

The reasons for improving future applications of algae-based systems can be categorized into the following profitability and sustainable use of algae for bioenergy [7]:

a) the productivity of algae biomass, energy, water, nutrients (fertilizers), greenhouse gas (GHG) emissions and the use of all types of algae in the country must be sustainable throughout the production chain and data must be collected in a consistent and scale-based way to support reliable techno-economic assessments (TECs) and life-cycle analyzes (AWCs);

(b) for the environmental, genetic and biochemical development of algae species, it is necessary to improve the productivity and resistance of algae strains to influences such as temperature, seasonality, inefficiency and competition;

(c) the use of physical, chemical, biological and other algae strains to be investigated and integrated with biorefinery operations;

(d) integration of co-located inoculation, cultivation, primary harvesting. Concentration and pre-treatment systems must be designed to maximize cost-effectiveness;

(e) complete valorisation of the algae biomass in situ, its processing from the algae into its lipids, carbohydrates and / or growth inhibition, but at low salinity, such as wastewater, organic inhibitors and biological factors that limit the rate of water recycling.

There are many and varied opportunities to cultivate microalgae and maximize the use of dual-use bioenergy products. They contain biochemical elements - lipids, carbohydrates and proteins. This presents the possibility of treating different components of algae biomass individually, using biorefinery for this purpose, ie. alternative products from each component creates an integrated flow of algal fractional biomass. This approach allows the algae-based product to be increased, leading to significant use of the lipid fraction [9,5]. The production of biofuels from biomass from whole algae using the bio-refining method may even exceed the quantities used from plant raw material [10].

By all means, the anaerobic digestion (AD) approach of algae residual cell mass should be used to co-produce biogas to aid plant emergence. The report also examines the possibilities of generating biogas from biomass for the supply of natural gas [11]. In particular, the use of AD is crucial for both the economy and the sustainability of the conversion process, since AD provides the primary pathway for nutrient recycling to the cultivation process [12].

Alternative algae conversion technology is based on hydrothermal liquefaction (NLT) and as a way of increasing algae-based biomass production. A number of research groups value NLT seriously, and there are companies that commercialize it [13]. NLT provides a reliable approach for upgrading biomass from algae to liquid bio-intermediate, which can then be catalytically upgraded to renewable diesel. Algae species and cell masses with their biochemical composition have been found to have only minimal impact on fuel / bioproduct yields. However, modern HTL-based technology for algae biomass is currently at an early stage of development and further testing is required in continuous flow systems, as well as

more biomass characterization, such as product composition and in particular its hydroprocessing efficiency so that it can be mixed with the fuel.

Regardless of the fuel or energy production process, the isolation of by-products can provide the necessary additional revenue, reducing the net costs of algae-based biofuel production. As such, the biorefinery approach is based on realizing the full value of algae biomass, i.e. each component of biomass is used for its most advantageous application in order to maximize the overall economic performance of bio-refineries [5,4]. This integration of various components will only be feasible when the products and their respective market applications are commensurate.

The most complex and specific nature of the multiple division of products should be prioritized as research topics in order to maximize value for current and future work. For each of the major biochemical fractions of algae biomass (i.e., lipids, carbohydrates, and proteins), there is a subgroup to experimentally demonstrate valorization approaches. The closest to the maximum value of the product area experimentally demonstrated in rock with those of the fuels is the production of oleochemical products (eg surfactants, lubricants, additives and biopolymers) from algae oils.

The technical and economic analysis (TEA) literature on various algae-based production methods continues to account for large differences in process economics, and it is difficult to draw definitive conclusions about the "true" or "most likely" production costs. In addition, differences in financial modeling of assumptions that the broad variability of algae cost estimates are different from assumptions about growth characteristics and cultivation productivity. Therefore, most TEA and LCA studies are based on data extrapolated from smaller scale pilot and laboratory experiments, as well as larger and larger algae demonstration data and retrofitting remains a key need. In general, the reliability of TEA and LCA in a future algae-based production is an extrapolation of an industrial one, taking laboratory results.

3. CONCLUSION

Until the values of bioproducts return to pre-August 2014 levels or carbon reductions are paid at higher prices than in 2006, then global climate change policy and primary bioenergy strategies from algae will be able to rely on a multifunctional biorefinery. One of the drawbacks in the production of such products is that they produce bioproducts of higher value than a conventional refinery. The main purpose of algae-based bioenergy applications is not yet in competition with existing food and feed, since algae have the potential to be cultivated on arable land and therefore have the potential to use wastewater as a medium for growing and recovering nutrients. each step of the integrated process. However, on the other hand, there are significant current and future barriers to the commercialization and economic production of algae at a relatively low market value for energy and fuels, in particular to support the demand for large-scale deployment resources.

Due to incomplete knowledge of algae biology, many laboratories that study algae are looking for the full range of algae-based processes by examining them over an extended multi-season period. Progress in minimizing the residues of energy, water and land from integrated algae-based operations should be a major goal of future large-scale research.

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IMPACT OF ENVIRONMENTAL FACTORS ON THE PRODUCTIVITY OF SPRING FODDER PEAS (*PISUM SATIVUM*, VAR. *ARVENSE*, L.) CULTIVAR "BOGATIR" GROWN FOR GREEN FERTILIZATION

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Abstract: Among the innovative environmental ways of maintaining soil fertility, green fertilization is the most appropriate and effective way. This type of fertilization can be done with the green vegetative mass of different plants, but the most significant effect is obtained from legumes.

The present experiment was conducted with spring fodder peas (*Pisum sativum*, var. *Arvense*, L.) Bogatir variety. The aim is to determine the influence of the main groups of factors on the productivity of green vegetative pea mass. The morphological analysis of the green vegetative mass in beginning of flowering was made. The participation of weeds in the green vegetative mass has been reported. The density of the aboveground vegetative mass before plowing was monitored. The yield of green mass at the beginning of flowering of peas was established.

The results show that, from spring forage peas, the Bogatir variety grown under environmental conditions yields 2467kg / dka of green vegetative mass. The participation of weeds in green biomass is minimal, averaging only 3.73%. The share of stalks, leaves and generative organs is as follows, 51: 38: 11%., leaves and generative organs is in ratio 44%: 39%: 17%.

The analysis of the results give us reason to recommend the use of Bogatir spring fodder pea as an effective crop for green fertilizin.

Keywords: Organic farming; Fertility of the soil; Green fertilization; Spring fodder peas; Yield green biomass

1. INTRODUCTION

Organic farming is a model of agriculture whose main purpose is to preserve soil fertility and produce organic agricultural produce. In this regard green fertilization, also known as "sideration", plays an essential role. It is an inexhaustible, constantly renewable source of organic matter [8]; [12]; [15]. It is a reliable tool for maintaining and enhancing soil fertility and improving soil performance [14]; [19]; [20].

Green fertilizing improve the physical and chemical properties of the soil and increase its biological activity. The impact of green vegetable matter is not only after incorporation into the soil, but also during their growing season itself. In the absence of mineral fertilization, green fertilization is an effective way of adding nutrients to the soil. The crops for green manure contain a wide range of nutrients needed for plant development and are more effective than manure [21]; [10].

Green fertilizer has the greatest effect when legumes are included in crop rotations [3]; [4]; [5]; [6]. Green vegetative parts of legumes enrich the soil with nitrogen [1]; [11]; [13]; [16]; [17].

Peas is one of the most grown legumes both nationally and globally. As a legume plant, peas enrich the soil with nitrogen and leave 2 - 3 kg/dka of nitrogen after harvest [9]. It is one of the most widely used legumes for green manure [2]; [7]; [18].

Following a detailed literature review, it has been found that there are no studies regarding the use of spring fodder peas of the Bogatir variety for green manure. This led us to conduct an experiment in this direction.

2. MATERIAL AND METHODS

In the experimental field of the Faculty of Technics and Technologies, Yambol (Thracian University, Stara Zagora), an experiment with fodder peas of the Bogatir variety (subspecies *Pisum sativum* subssp. *Arvense*) was conducted under field conditions. It is grown to make with him green manure.

The area on which the experiment was conducted for many years was maintained in a state of "black fallow", the area being plowed once a year deep and then disking.

The soil is a leached vertisol (*Haplic vertisol*), with a slightly alkaline reaction and a humus content in humus-accumulative horizon the of 2.3%. Soil samples were taken before and after the experiment was completed and are was made analysis of the nutrient content.

At the end of February, two disking were held consecutively. The sowing of the peas was carried out with a sowing rate of 24 kg / dka. By principles of organic pea cultivation mineral fertilizers and plant protection products were not used to comply. The plowing of the peas was done in the beginning of flowering phase.

The main purpose of the experiment is to investigate the influence of environmental factors on the productivity from vegetative mass of „Bogatir“ forage peas. The accompanying goals of the experiment are; to determine the morphological composition of the components of the green vegetative mass in the beginning of flowering phase and to determine the share of weeds in the green vegetative mass.

3. RESULTS AND DISCUSSION

The pea is a valuable legume with high nutritional value. It is relatively cold resistant and not very demanding on soil conditions. The vegetative development of the peas grown under organic farming depends very much on the climatic conditions. The area in which the experiment takes place is in southeastern Bulgaria, in the lowland parts of the Middle Tundian basin. The climate is typical of the transitional continental climate climatic sub-region of the continental-European climate area. It is characterized by mild winters, dry and hot summers, warm and humid spring and autumn warmer than spring. The climatic characteristics during the vegetative period are presented in figure 1, and a detailed description of the manifestation of the climatic parameters by months during the experiment period and changes in their parameters relative to the area norm are presented in table 1.

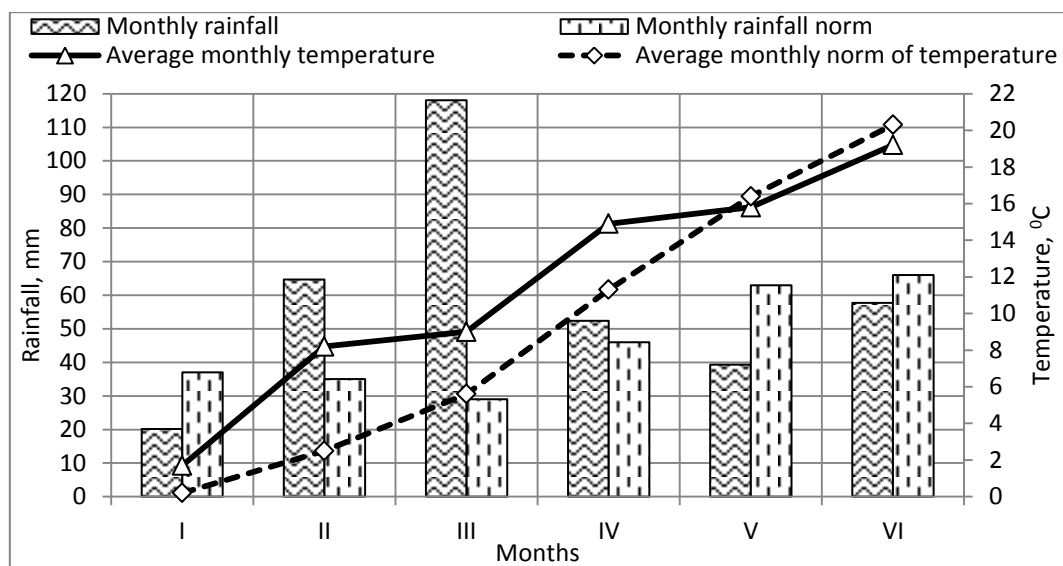


Figure 1. Monthly rainfall (mm) and average monthly temperatures (°C) for the study period and area norm

Table 1. Characteristics of meteorological conditions for the study period and the norm for the area

Month	Climatic parameters	Climatic manifestation	
		During the study period	Deviations from the norm for the region
January	Rainfall	Insufficient quantities. Snowless.	17 mm less than the norm for the area.
	Temperature	High average daily temperatures.	Increase compared to the norm with 1,5 °C.
February	Rainfall	Frequent showers with high rainfall. Snowless.	Double higher rainfall compared to norm.
	Temperature	Daily atypical for the month warm days.	Increase compared to the norm with 5,7 °C.
March	Rainfall	Frequent showers with high rainfall.	Precipitation by 89 mm in excess of the norm.
	Temperature	High average daily temperatures.	Nearly twice as high compared to normal.
April	Rainfall	Normal precipitation amounts.	Just above the area standard.
	Temperature	High average daily temperatures.	Increase from norm with 3,6 °C.
May	Rainfall	Less rainfall.	Less than normal with 23,7 mm.
	Temperature	Short periods with colder days.	Lower than norm with 0,6 °C
June	Rainfall	Periodic rainfall with periodic droughts.	Quantity slightly lower than norm with 8,7 mm.
	Temperature	Periods with colder days.	Lower than from the norm with 1,1 °C.

Higher rainfall in the months of February and March are the reason the sowing to be carried out a little later than the scheduled calendar dates. A good moisture supply is an important

prerequisite for the sprouting and normally vegetative development of peas. The following months have relatively good conditions for the vegetative development of the peas, which contributes to the normal flow of phenophases from germination to the onset of flowering.

The high participation of the main crop is of particular importance for the formation of vegetative biomass with good nutritional value. Opportunities for development and on other plant species are great, and this can significantly impair the condition of the crop and its nutritional and economic value. Weed species multiply especially when to them is not held chemical struggle. Weed participation ranged from 2.98 to 5.17%. This presence of weed species in the crop is within the acceptable range, given that no chemical protection against weeds with herbicides has been applied. If the participation of other plant species is large, this would affect the nutritional value of the crop.

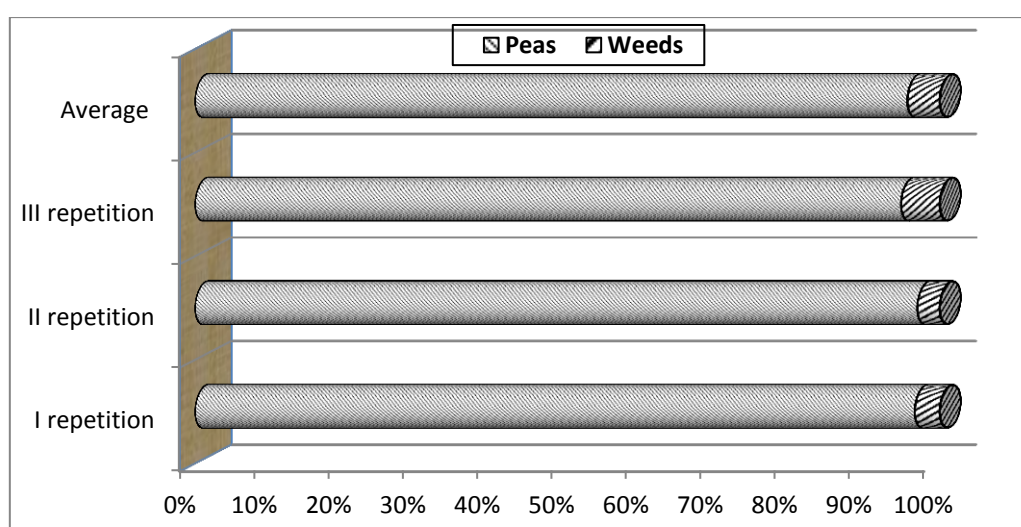


Figure 2. Botanical composition of the crop from the feed peas variety "Bogatir"

The amount of green biomass depends on the development of the plants during the growing season. Previous ours studies have shown that during the 65-day growing season peas form a well-developed above-ground vegetative mass and in flowering beginning phase is with height from 66.6 to 72.2 cm [18]. In the composition of this biomass includes stems with numerous branches, leaves and generative organs (flowers). As a botanical species of the legume family (*Fabaceae*) field pea variety "Bogatir" develop central stem with numerous branches. Unlike some other subspecies, the stem of this pea, although thin, stands steadily upright with branches tucked to the stem. The first branches of the stem start on 5 - 6 cm from the surface of the soil, and the next offshoot are through 2 - 3 cm.

The results of the morphological analysis of the aboveground vegetative mass of the peas in the flowering onset phase are presented in figure 3. The share of stalks, leaves and generative organs is as follows, 51: 38: 11%. The figure shows, that the highest proportion of vegetative pea biomass has the stems - 51%. In total, the stalks and leaves of peas have a share of 89%. By the end of the growing season of the peas, most nitrogen accumulates in the stems, leaves and seeds and at in the roots (Kirilov, A. 2016). Therefore, in our studies, the total vegetative mass that will be incorporated into the soil will bring in sufficient nitrogen.

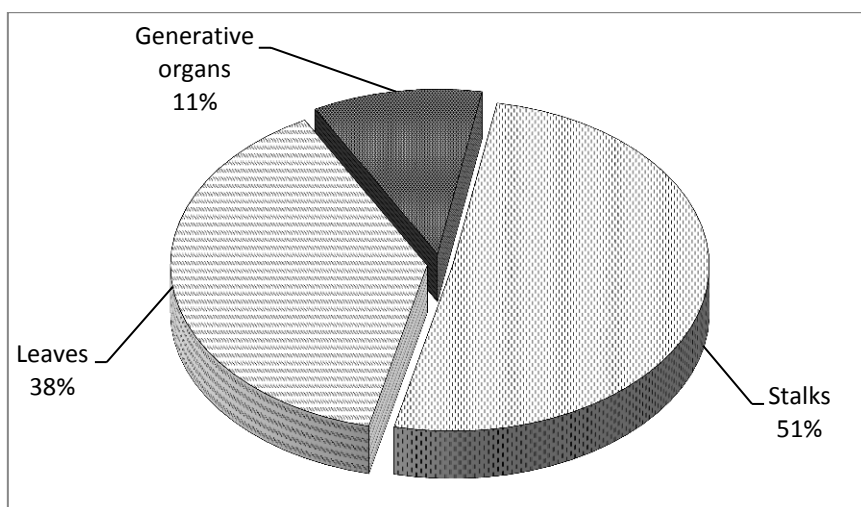


Figure 3. Correlation of the components of the vegetative mass of peas in phase beginning of flowering, %

In order to get good effect from green fertilization it is important what amount of green biomass will be incorporated into the soil. Good indication of this is the yield of green biomass obtained in phase beginning of flowering. Under the climatic conditions of the Yambol agro-region, from the ecologically grown spring forage peas variety “Bogatir” the yield is 2400 to 2680 kg/dka of fresh vegetative biomass (fig. 4). These quantities are high and are a consequence of the favorable combination of climatic indicators during the study period. In the case of drought during the growing season, the actual yields will be are lower.

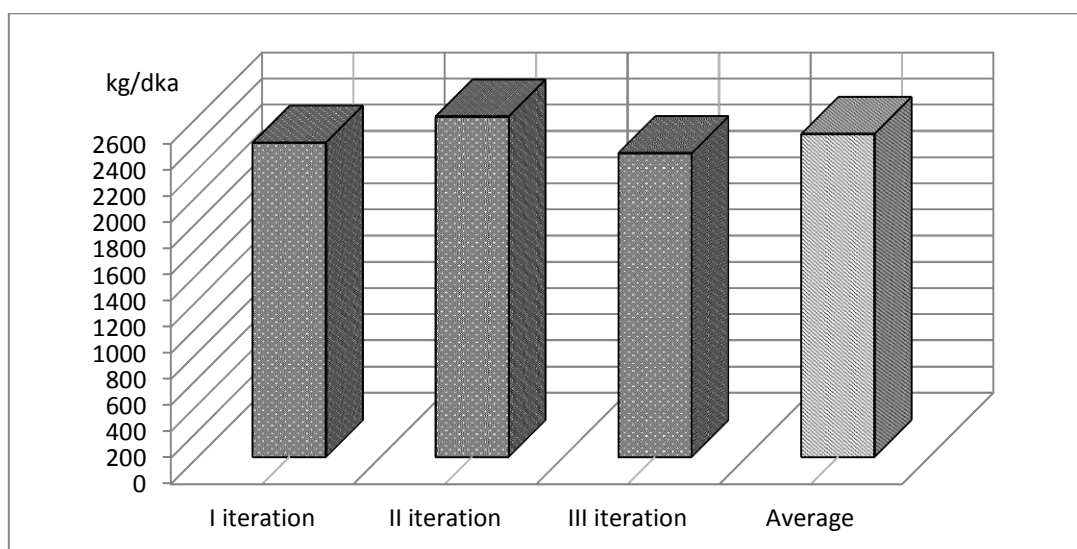


Figure 4. Yield of fresh vegetative biomass in the beginning phase of flowering of peas, kg/dka

4. CONCLUSIONS

As a result of the researches carried out and the analyzes made on the productivity of spring fodder peas "Bogatir" cultivated for green fertilization under ecological conditions and according to the principles of organic farming in Yambol agro-region, the following conclusions can be drawn:

1. The soil and climatic conditions of the Yambol agro-region are favorable for the cultivation of spring fodder peas Bogatir for green fertilization.
2. The participation of the weeds in the green vegetative mass is minimal. It ranges from 2.98 to 5.17 % and could not adversely affect the nutritional value of green biomass.
3. For short growing season peas form stalks, leaves and generative organs, which are in the ratio 51: 38: 11%. The total proportion of leaves and stalks is 89%. This indicates that sufficient nitrogen will be incorporated into the soil.
4. The yields of fresh vegetative biomass in the beginning blooming phase of Bogatir spring peas range from 2400 to 2680 kg/dka.
5. The good vegetative development the Bogatir spring fodder pea and the high yields of fresh vegetative mass make us recommend to the Bio-producers in the Yambol region to use this variety peas for green fertilization.
6. We recommend that the Bogatir spring fodder peas be widely used in the practice for green fertilization in all agricultural regions in Bulgaria with soil and climatic conditions similar to the Yambol region.

The experiment was conducted in connection with the implementation of the FTT 2 project "Environmental protection through technological solutions for organic farming in Yambol region".

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ANALYSIS OF THE FACTORS OF ROAD ACCIDENTS IN BULGARIA IN LIGHT OF THE PRIORITIES OF EUROPEAN DIRECTIVES

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Abstract: Road safety in the European Union has improved significantly in recent decades (EU roads are the safest in the world), but the number of fatalities and injuries is still too high. This is very much true for Bulgaria because, within the European area, it is in the group with the highest number of road accident victims who bear not only material losses.

Bulgaria, as a member state of the European Union, implements European policies in its legislation and constantly updates its legal framework. In recent years, a number of new initiatives have been taken to reduce trauma and victims on Bulgaria's roads. However, the results achieved are not satisfactory and they are far from what was planned in the previous planning documents.

This report classifies the major factors and their elements affecting road accidents in Bulgaria according to the current legal framework in the European Union. A SWOT analysis of the strengths and weaknesses of BSP provision was made, taking into account the impact of these factors. Finally, proposals have been made to prioritize the factors most influential in a national plan to improve road conditions, reduce road accidents, and ensure road safety.

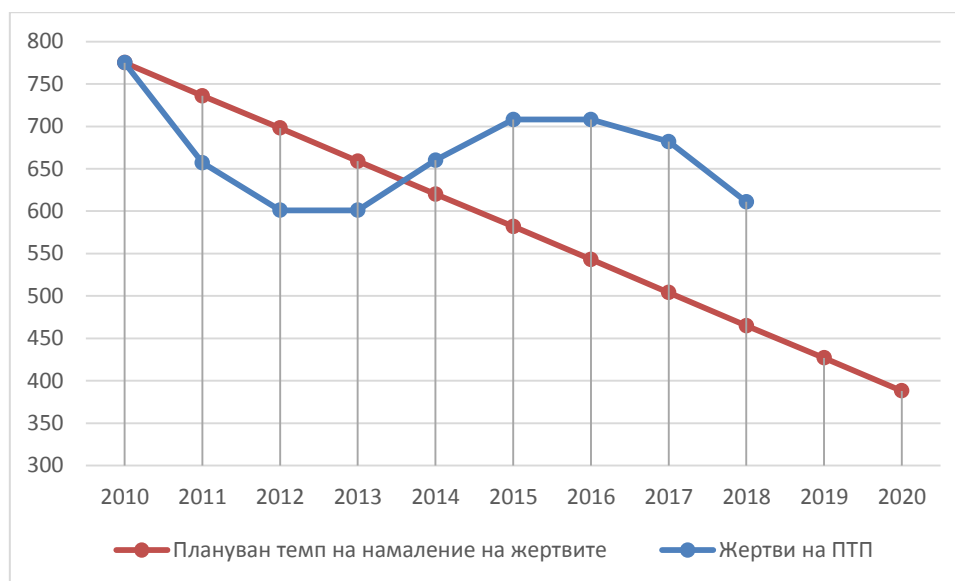
Keywords: European and National Policies, road accidents, Safety traffic, Road safety

6. ВЪВЕДЕНИЕ

Въпреки целенасочената политика в международен и национален план за намаляване броя на пътнотранспортните произшествия, жертвите и щетите, които те нанасят, до сега получените резултати са далеч от желаните [2, 8].

Съгласно Национална стратегия за подобряване безопасността на движението по пътищата на Р. България за периода 2011 - 2020 г. темпът на намаляване на броя на убитите, средно годишно, трябваше да намалее с 50% до 2020г. На фиг.1 е представен планираният темп на намаляване на жертвите от ПТП за периода 2010-2020г., който е съпоставен с реално отчетените жертви за периода от статистиката. Очевидно е, че действията, които се предприемат на национално ниво не само не довеждат до тенденция на намаление, а в периода 2013-2016г. се наблюдава дори увеличение на загиналите при ПТП [2, 4]. За 2018г. има 1% намаление на жертвите в сравнение с предходната година. Необходимо е да се преосмислят предприетите мерки, да се оцени тяхното въздействие като се отчитат реалните условия.

Като държава-член на Европейския съюз, Р.България транспонира европейското законодателство в областта на безопасността на движението по пътищата (БДП). През последните години непрекъснато се актуализира действащото законодателство - Това, обаче се оказва недостатъчно, за да се постигнат поставените цели през 2010г.[7]



Фиг.1. Плануван темп на намаляване на жертвите от ПТП и реално отчетените жертви за периода 2010-2018г.

В настоящия доклад е направена класификация на основните фактори и техните елементи, оказващи влияние върху пътнотранспортните произшествия (ПТП) в България, съгласно действащата нормативна база в Европейския съюз. Направен е SWOT анализ на силните и слабите страни при осигуряването на БДП, отчитайки влиянието на тези фактори.

7. СТРУКТУРИРАНЕ НА ОСНОВНИТЕ ФАКТОРИ, ОКАЗВАЩИ ВЛИЯНИЕ ВЪРХУ ПЪТНОТРАНСПОРТНИТЕ ПРОИЗШЕСТВИЯ

Прецизирането на значимите фактори, които влияят върху появата на ПТП е важен момент в определяне на политиките в областта на БДП. Въпреки, че тенденциите в световен и национален план са сходни, необходимо е те да бъдат разгледани и обсъдени на ниво конкретен регион, тъй като влияние биха могли да окажат и фактори, свързани с определената националност [1, 6, 9].

В резултат на извършено проучване на международните практики беше направен анализ и структуриране факторите и техните елементи, които трябва да бъдат изследвани и да бъде оценено въздействието върху тях, за да се получат положителни тенденции [5, 10].

Резултатите са представени в фиг.2. Според анализирания източници основните моменти, на които трябва да се обърне сериозно внимание при анализиране на БДП са:

- Институционалната организация на пътната безопасност;
- Пътната инфраструктура;
- Превозни средства и устройства за безопасност;
- Предотвратяване на поведение, застрашаващо пътната безопасност;
- Контрол на движението по пътищата.



Фиг.2. Основни фактори, влияещи върху БДП и структура на техните елементи

8. АНАЛИЗ НА ОСНОВНИТЕ ФАКТОРИ ЗА ОСИГУРЯВАНЕ БЕЗОПАСНОСТ НА ДВИЖЕНИЕТО ПО ПЪТИЩАТА В БЪЛГАРИЯ

През месец януари, 2019г. беше създадена Държавна агенция „Безопасност на движението по пътищата“, с цел координиране на действията на органите, ангажирани с осигуряване на БДП. Тя публикува доклад, в който на база приведена статистика и анализ на представените данни е предложен Обобщен План за действие за подобряване на състоянието на БДП.

След задълбочен анализ на представената информация в този доклад, тук се предлага SWOT анализ на силните и слабите страни в държавната политика за осигуряване на БДП по фактори, определени като силно значими за намаляване на ПТП.

Резултатите са представени в табличен вид.

Фактори	Силни страни	Слаби страни
Институционална и правна регулационна рамка	Наличие на голям брой държавни органи с правомощия в областта на БДП	В българската нормативна уредба липсва дефиниция на понятието „безопасност на движението по пътищата“, включваща всички фактори с влияние върху безопасността.
	Наличие на нормативна база в съответствие с Европейското законодателство	Съществуват противоречия между различните нормативни документи и актуализиране на законодателството в съответствие с съвременния подход, възприет на ниво ЕС, по отношение на взаимоотношенията между пътнотранспортната система, нейното развитие и поддръжане, както и участниците в движението
	Понастоящем приложение намират голям брой	

	подзаконовите нормативни актове към действащите ЗДвП, ЗП и ЗАП	Твърде големият брой подзаконовни нормативни актове и честата актуализация създава трудности при прилагането на нормативната уредба, както от страна на държавните органи, така и от страна на адресатите на правните норми.
	Наличие на голям брой изследвания и анализи на функционалността на действащата нормативна база	<p>Липса на механизъм за прилагането на приетия като БДС международен стандарт за пътна безопасност ISO39001:2014 „Системи за управление на безопасността на движението“.</p> <p>Наличие на несъответствие между законовите и подзаконовите норми</p> <p>Базите данни между различните институции не са синхронизирани и се използват фрагментарно от гледна точка на целите и правомощията на отделните структури</p> <p>Научно-изследователският капацитет в страната не се използва ефективно. Внедряването на положителните световни практики по БДП все още не е оформено като целенасочен процес.</p>
Поведение на участниците в движението	В системата за обучение и изпити за придобиване на правоспособност за управление на МПС се работи по непрекъснатото подобряване с цел подобряване на качеството	<p>Сред водачите, пешеходците, пътниците и работниците на пътя все още липсва култура на поведение в посока дисциплинираност, отговорност и самоконтрол на поведението по време на участие в движението по пътищата.</p> <p>Наличие на рискови групи сред участниците в движението, с които е необходимо да се работи допълнително</p> <p>Всички категории участници в движението имат необходимост от информиране и ефективно обучение по проблемите на БДП с цел ефективно предпазване от пътни произшествия. Съществуват дефицити по отношение на системно и адекватно въздействие върху човешкото съзнание.</p> <p>Има необходимост от ясно и точно регламентиране на задълженията на компетентните органи по прилагане политиката на БДП.</p> <p>Необходимост от прецизиране и стандартизиране на изискванията към специалистите, подготвящи бъдещите шофьори - усъвършенстване на системата за обучение на преподавателите</p> <p>Необходимост от кампании за разясняване на ролята на човешкия фактор за БДП и за промяна на обществените нагласи към изследванията за психологическа годност на кандидатите - информираност на обществото за реалния принос и потенциалните възможности на транспортната психология за подобряване на БДП</p>
	От страна на МОН са изготвени и се прилагат редица концепции, стратегии и методики за организираност и управление на дейностите по възпитанието и обучение по БДП в системата на предучилищното и училищното образование	
	Наличие на голям брой научни изследвания за поведението на водачите на превозни средства по време на управлението	

Пътна инфраструктура	Наличие на стратегия за развитие на транспортната система на Република България до 2020 г.	Незадоволително качество на транспортна инфраструктура на страната.
	Наличие на Интегрирана транспортна стратегия в периода до 2030 г.	Подобренията се извършват поетапно, приоритетно и в условията на разходване на ограничен финансов ресурс, което обуславя все още незадоволителното техническо състояние на определени елементи от системата и териториалните различия.
	Приета Стратегия за развитие на пътната инфраструктура в Република България 2016 - 2022 г.	Неефективност на областните и общинските програми за рехабилитация на републиканската пътна инфраструктура.
	Стремеж към непрекъснато актуализиране на нормативната база по отношение изискванията за проектиране на пътища	Липсва информация за състоянието на банкетите и отводнителните съоръжения.
	Налична статистика за пътните участъци с концентрация на ПТП	Пътеуказателната система, разглеждана от гледна точка на организация на движението – маркировка и сигнализация, е в незадоволително състояние. Липсва интегриран подход при управление на този елемент.
		Липсва цялостно изградена интелигентна транспортна система за управление на трафика.
		Липсва задълбочена координация между службите на Пътна полиция и АПИ по отношение на изграждането на контролно-технически средства.
		Липсва на анализ за въздействието на вече предприетите действия чрез ЗДВП.
Автомобилен парк	Налични нормативни изисквания за техническото състояние на автотранспортната техника на Европейско ниво	Липсата на законодателство и технически ограничения за внос на употребявани автомобили.
	Наличие на активен контрол по отношение на техническото състояние, изисквания за задължителен годишен технически преглед	България значително изостава по отношение на използването на екологични, сигурни и икономични автомобили.
		Регламентиране на изисквания към качеството на извършваните ремонти и техническо обслужване на пътните превозни средства.
		Липсва анализ по отношение на състоянието на автомобилния парк като цяло.
Контролна дейност	Съгласно действащото законодателство контролната дейност по осигуряване на БДП е възложена на службите за контрол на МВР.	Констатира се дефицит на данни за ПТП, настъпили по причини, свързани с автомобила.
	При разработване на политиката по контрол на безопасността на	Липсата на ефективен контрол по изпълнение на задълженията, които органите на изпълнителната власт имат.
		Неефективност на действащата система за установяване на извършените нарушения на правилата за движение по пътищата
		Ниска ефективност на административно-наказателните процедури при установяване на нарушения при изискване на голям ресурс

	<p>движението министърът на вътрешните работи се подпомага от служители на Главна дирекция "Национална полиция", които участват в разработването на нормативни актове и други документи.</p>	<p>Необходимост от прецизиране на нормативните документи по отношение взаимодействието на различните органи, ангажирани по осигуряване на БДП при регистриране и анализ на ПТП и осигуряване на временна организация на движение.</p>
	<p>Изградена информационна система към МВР</p>	<p>Изследването и разкриването на причините за настъпване на пътнотранспортни произшествия се нуждае от прецизиране както с оглед коректност на поддържаните статистика и база данни, така и с оглед възможност за извършване на обективен анализ, целящ ефективно въздействие върху факторите, влияещи на настъпването на ПТП.</p>

9. ЗАКЛЮЧЕНИЕ

На базата на проведените проучвания на европейските политики и практики, на състоянието по осигуряване на БВП, в доклада са систематизирани и структурирани основните фактори, влияещи значимо върху вероятността за поява на ПТП.

На база SWOT анализа на състоянието на тези фактори в България могат да се формулират следните спешни необходими дейности за намаляване на ПТП:

- актуализация на организацията на движение в населените места;
- оптимизиране на пътната безопасност в границите на населените места;
- извършване на цялостен и задълбочен анализ за безопасността на пътната мрежа;
- приоритетно обезпечаване на идентифицираните рискови участъци с технически средства за контрол на скоростта;
- промяна на правилата за обезопасяване на неподвижните препятствия в крайпътното пространство и др.
- промяна на нормативната база, уреждаща материята, свързана с обучението на водачите, закона за движение по пътищата и превозните средства;
- прецизиране на разследването и разкриването на всички причини за настъпване на ПТП с оглед както коректност на поддържаните статистически данни, така и с оглед възможност за извършване на обективен анализ, целящ ефективно въздействие върху факторите, влияещи за настъпването на ПТП;
- обезпечаване на основните пътни артерии с технически средства за контрол на скоростта;
- поставяне на акцент върху превенцията, а не установяване на нарушенията;
- разработване на интерактивна информационна карта с за всички участъци с концентрация на ПТП в България;
- активизиране на кампаниите за публична информираност на населението от всички възрасти;
- организиране на атрактивни мероприятия с децата и учениците за приучаване към безопасно поведение на пътя;
- създаване на единен център за обработка на пътнотранспортните нарушения, събиране на данни, които да са достъпни за заинтересованите органи и др.

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