Food and Agriculture Organization
of the United Nations

Research on rural women's economic empowerment and social protection

Rwanda Vision 2020 Umurenge: Public Works

Quantitative report

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Nynne Warring & Ana Paula de la O Campos
Food and Agriculture Organization of the United Nations (FAO)

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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FAO, together with its partners, is generating evidence on the impacts of social protection on poverty reduction, food security, nutrition and resilience and is using this to provide related policy, programming and capacity development support to governments and other actors. Countries include Kyrgyzstan, Lebanon, Lesotho, Malawi, Rwanda, Senegal, Zambia, Zimbabwe.

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Abbreviations

FAO	Food and Agriculture Organization of the United Nations
LODA	Local Administrative Entities Development Agency
MINALOC	Ministry of Local Government
MINECOFIN	Ministry of Finance and Economic Planning
PtoP	From Protection to Production Project of the FAO
PW	Public Works
VUP	Vision 2020 Umurenge Programme
WEAI	Women's Empowerment in Agriculture Index

PART 1: CONTEXT

1.1 Background of the PtoP study on rural women's empowerment

The FAO Social Protection and Rural Women's Economic Empowerment research programme falls under FAO Strategic Objective 3 of Reducing Rural Poverty and is delivered through two flagship initiatives: the Rural Women's Economic Empowerment Initiative (RWEE) and the From Protection to Production (PtoP) project. The research aims to gain a better understanding of how social protection policies and programmes can be improved to enhance impacts on rural women's empowerment and identify ways in which social protection schemes or systems can be strengthened towards reducing gender inequalities in agriculture and food security.

The PtoP is a programme based at FAO which includes a multi-country impact evaluation of cash transfers in sub-Saharan Africa as well as qualitative and policy research on social protection and its linkages to agriculture. The project is a collaborative effort between FAO, UNICEF Eastern and Southern Africa Regional Office and the governments of Ethiopia, Ghana, Kenya, Lesotho, Malawi, Rwanda, Zambia and Zimbabwe. The PtoP is funded principally by the UK Department for International Development (DFID), the Food and Agriculture Organization of the UN (FAO) and the European Union. The PtoP programme is also part of the larger Transfer Project in which FAO has joined UNICEF, Save the Children UK and the University of North Carolina in supporting the design, implementation and impact evaluation of cash transfers in sub-Saharan Africa.

PtoP research on women's economic empowerment is conducting a number of case studies – the present study being the first of this series – analysing impacts on women's economic advancement, power and agency. The case studies will also assess the potential empowerment impact of programme design as well as the degree to which gender equality and women's empowerment are mainstreamed in programme implementation. Finally, to a lesser extent, the studies will assess the synergies that social protection programmes have with rural services and other livelihoods interventions.

The case studies use a mixed-method approach that combines qualitative and quantitative methods based on previous methodologies developed by the PtoP, and which will be implemented systematically across country case studies whenever possible. This report summarizes the findings of the quantitative household and individual surveys conducted in the Southern province of Rwanda among beneficiary and eligible households of public works programmes under the Vision 2020 Umurenge Programme (VUP).

1.2 Empowering women through public works: Theory of change and research framework

Public works

Public works programmes are social protection instruments that provide short-term employment to the ultra-poor or the labour-constrained for the development of rural community infrastructure and social services. Usually, public works have a self-targeting mechanism, using intensive tasks and low payments to generate demand from the ultra-poor. The aim of these programmes is to help households cope with crises through temporary employment, while also creating community assets that can help them move out of poverty (e.g. by providing better roads or improving the quality of agricultural land). The use of public works as a safety net mechanism has increased exponentially around the world, from 62 programmes in 2011 to 85 programmes two years later (World Bank, 2014).

This study focuses on the public works component of Rwanda's Vision 2020 Umurenge programme (VUP) further described in the next section. The research aims to test a set of three hypotheses using quantitative information to understand the impact of public works in each in the following three research areas:

1. **Economic advancement hypothesis**: "Social protection programmes [in this case, VUP public works] will promote the economic advancement of women by increasing their productive resources (e.g. incomes, access credit and savings), and improving skills and employment opportunities."
2. **Power and agency hypothesis**: "Social protection [VUP public works] will strengthen women's power and agency by increasing their bargaining power within the household and wider community. This will increase women's self-confidence, their ability to engage in social networks, and participate in decision-making in the public arena."
3. **Operations hypothesis**: "Operational and design features of social protection programmes [VUP public works] will ensure women's equal access to benefits and build linkages with community-based services and livelihood interventions that will promote gender equality and women's economic empowerment."

1.3 Rwanda's Vision 2020 Umurenge Programme and the public works component

The VUP is a large-scale social protection programme that is owned and led by the Rwandan government and considered one of the government's flagship programmes for poverty reduction. Implementation of the VUP started in May 2008 in 30 pilot sectors, the poorest sector[1] in each of Rwanda's 30 districts. Financial year 2013/14 covered 172 sectors and 104 310 beneficiary households (McCord and Shenge, 2014). The VUP is managed by Local Administrative Entities Development Agency (LODA). The programme is jointly financed by the GoR through the Ministry of Finance and Economic Planning (MINECOFIN) and development partners (DFID, EU, SIDA, UNICEF and, World Bank) (Devereux, 2012).

The programme consists of four components: public works, direct support, financial services and sensitization. Public works was the first programme VUP component to be rolled out in May 2008 and receives the largest financial allocation (Devereux, 2012). Through this component the VUP offers temporary employment for building and rehabilitation of community assets to extremely poor households with at least one adult member able to work (MINALOC, 2008). Nationwide, the majority of VUP projects are geared towards support of agricultural livelihoods and land conservation, including radical terracing, anti-erosive ditches, water resource management. Other projects seek to build, upgrade or maintain physical infrastructure such as roads, bridges, schools, water supplies, or health centres (Devereux, 2012).

Targeting and selection of participants

The VUP public works component targets the poorest households (*Ubudehe* categories 1 and 2) with labour capacity. The *Ubudehe* categorization takes place at the village level by the *Ubudehe* committee and the list of beneficiaries is then sent to the cell and sector levels.

Job delivery by the VUP depends on project availability; hence jobs are usually not available for all targeted beneficiaries. The duration of jobs can vary from one to several phases, normally, each phase has a period of 15 days (Pavanello *et al*., 2015a). The average number of

[1] A sector is the next, lower administrative level after districts.

days worked per beneficiary household in financial year 2013-14 was 48 days (McCord and Shenge, 2014).

The qualitative report of this case study (Pavanello *et al*., 2015b) includes further detail on programme planning, targeting and implementation.

1.4 Rwanda's Southern province

The study selected the Southern province as the focus geographic area, based on a set of criteria which included poverty levels, delivery of public work projects, and agro-ecological zone (this is further explained in section 2.3 on sampling design).[2]

The Southern province is one of Rwanda's four provinces and has a population of about 2.5 million, or 23 percent of Rwanda's total population. It was created as a province in 2005 and has eight districts, 101 sectors and 3 502 villages.[3] With 56.5 percent of the provincial population classified as poor, Southern province has the highest poverty incidence in Rwanda (which ranges from 16.8percent in Kigali to 48.4 percent in Western province as the second-poorest). The extremely poor constitute 31.1 percent of the population in Southern province, also higher than all other provinces. Most working adults in the province (70.1 percent) are small-scale farmers, which is comparable to the other provinces. Only about 24 percent of the agricultural output produced in the province is marketed, which is also in line with the rest of country (NISR, 2012).

[2] The study could not cover all provinces of Rwanda due to budget limitations.

[3] Southern province official webpage: http://www.southernprovince.gov.rw/

PART 2: RESEARCH FRAMEWORK & DATA

2.1 Methodological framework

The objective of the quantitative research is to add to the qualitative research in assessing the potential impact of participation in VUP's public works on women's empowerment, along the three key areas of investigation as laid out in the previous section: economic advancement, power and agency and programme operations.[4] The study uses a randomized sample of participant households of the VUP public works component as well as a comparison group, from four districts in Rwanda's Southern Province. For the VUP sample, the study included the cohorts that have been in the programme the longest while still remaining in the programme, i.e. cohorts II and III, which were included in the VUP programme in 2009.[5] As the study expects empowerment impacts to be of a longer-term nature, this was done to look at participants who have potentially been in the programme for more years (bearing in mind that participants are not guaranteed public work jobs). The comparison group is composed of VUP public works eligible households in 'scale-up sectors', e.g. households eligible to participate and receive support under the public works component and who live in sectors that have been selected for the roll-out of VUP public works in the financial year 2014/15. At the time of fieldwork, these household had been identified by the Rwandan authorities to be included in the programme, while public works were still to start. The quantitative survey was limited to one agro-ecological zone – The Central Plateau – in order to enhance accuracy and consistency of measurement as well as statistical power. On the other hand, restricting the study to one district gives a natural limitation in the sense that the findings from the survey apply to this agro-ecological zone within the Southern Province only.

2.1.1 Analysis of VUP and comparison samples

The survey data collection and subsequent analysis and interpretation are challenged by the absence of baseline data and of an experimental design in programme targeting. This restricts us from conducting an impact evaluation of the VUP, and restricts the analysis from attributing any significant differences between participant and comparison households to the programme. At best, we can make strong cases for or against our hypotheses using associations in the data, and conclusions from this analysis should be read with this caveat in mind. For this reason, we are cautious in comparing VUP and comparison households, which leads us to apply slightly different strategies to investigate our three hypotheses.

As our primary analysis strategy, we focus on descriptive analysis comparing key outcome variables between different typologies of households and between male and female adults. We do not directly compare VUP and comparison households/individuals in the descriptive analysis. This way, we are applying gender analysis within VUP and comparison households, respectively, which allows us to comment on gender differences on key outcomes and potentially discover where differences exist in one group but not the other. In order to investigate hypothesis 2 on power and agency, we furthermore employ a regression analysis framework, using indicators of empowerment as independent variables (see section 2.4.2) and

[4] A secondary objective of this quantitative research is to test a methodology that will be mainstreamed and adapted in FAO's overall work on women's empowerment, aiming to influence and guide the way gender-related outcomes of social protection and livelihood interventions, particularly those related to women's empowerment, are monitored and evaluated.

[5] Originally, it was also intended to survey cohort I sectors which started the programme in 2008; however, the VUP was discontinued for these sectors in financial year 2014/15 and was hence not included in the survey. In Ruhango district, the study also includes cohorts V and VII. Details on sampling in Annex 1.

participation in the VUP as our key dependent variable. While a regression framework does not fully solve issues of sample selection, the framework does help qualify the relationship between VUP participation and empowerment outcomes, by controlling for other factors relevant to empowerment beyond the VUP. Hypothesis 3, on programme operations, is investigated with descriptive analysis only using data on VUP participant households, comparing different typologies of households within the participant group.

Lastly, we also use qualitative information to strengthen and better interpret our findings. The quantitative and qualitative findings hence reinforce and support each other to provide a fuller picture of the potential empowerment impacts of the VUP. The qualitative findings are thoroughly analysed in the qualitative field report (Pavanello *et al.*, 2015a). This quantitative report makes reference to the qualitative field report findings throughout, where appropriate.

2.1.2 Questionnaires

The study consists of a household and an individual questionnaire in order to capture both household and individual dynamics.

The individual questionnaire is based on the Women's Empowerment in Agriculture Index (WEAI) methodology. The WEAI methodology emphasizes direct measures of empowerment such as decision-making power and control over assets, related to agriculture. The WEAI individual questionnaire included information on the individual's role in household decision-making around production; income generation; access to and control over productive assets; access to and control over credit; access to agricultural extension or other training; individual leadership and influence in the community; and 24-hour recall time use. The household questionnaire was developed using the WEAI methodology and good practices, in combination with elements from PtoP surveys for impact evaluation of cash transfers in East Africa and adapted to the specificities of the VUP programme. The household survey contained a module specific to the VUP programme design.

2.2 Multi-stage sampling

This section describes the sampling method. For further detail on sampling and challenges encountered in the sampling process, the reader is referred to Annex 1.

The participant **sample frame** is the total population of VUP public works participant households actually employed by the programme, in sectors belonging to VUP cohorts II and III. For the comparison group, the sample frame is VUP targeted participant households for financial year 2014-15 who were not participating in the VUP public works programme at the time of the survey but were eligible to receive support (e.g. belonging to *Ubudehe* categories 1 and 2 and targeted by the VUP programme).

The survey sampling took place in three stages. In the first stage, the province, districts and sectors of focus were chosen. In the second stage, villages were randomly selected as the primary sampling clusters. In the third and last stage, households were randomly selected within the selected villages. The sampling strategy is described in further detail as follows:[6]

In the first stage, the study selected the geographical focus areas of the study. First the province (the highest administrative and geographical unit) was selected, and then districts

[6] Originally, the study intended to use probability proportionate to size sampling; however this was not possible due to lack of accurate information of the total beneficiaries of the VUP; see Annex 1 for details.

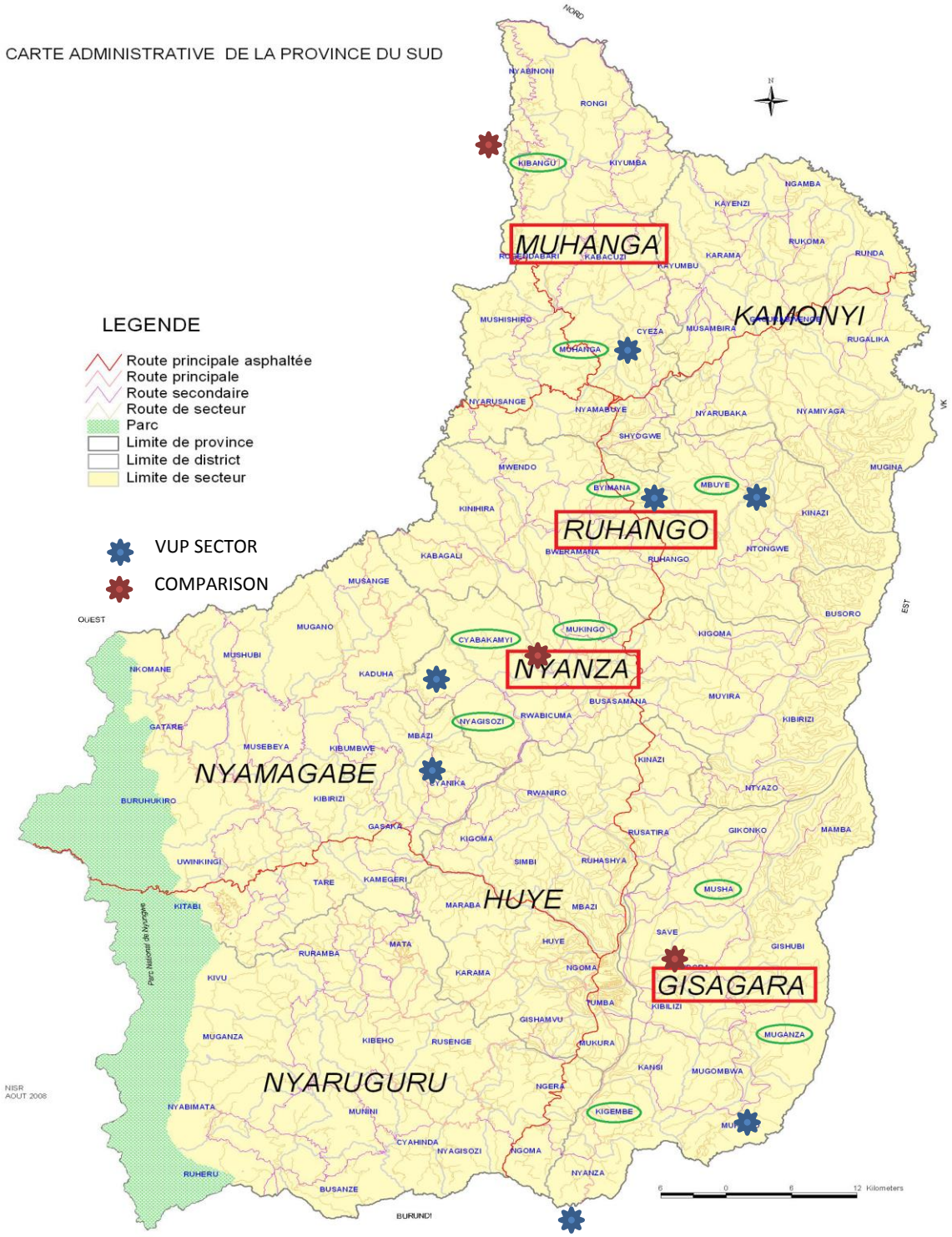
within the province and sectors within the districts (the subsequent administrative and geographical units), based on the same set of criteria:

1. Comparability: Sampling took place in the same agro-ecological zone to enhance comparability across sectors and districts.
2. Poverty: Poorer districts were given priority as the study is interested in the empowerment of the poorest segments of the population. In addition, the participant sample necessarily includes the poorest sectors as earlier VUP cohorts prioritized the poorest sectors.
3. Availability of VUP public works: Districts and sectors where the number of public works projects and public works jobs offered were highest are prioritized. This is to ensure that the study finds participants who have indeed engaged in public works.[7] By choosing locations where the project density is high, the study is more likely to capture participants that have had relatively high exposure to the programme.

Rwanda's Southern Province was chosen as the province of study. Within the Southern province, geographical focus is on the Central Plateau area. The Central Plateau is one of the biggest agro-ecological zones in Rwanda, contains some of the poorest districts in Rwanda (NISR, 2012) and delivery of employment through public works within the sectors selected has been effective. Four districts in Southern province were selected for the survey, while a total of ten sectors were selected in the four districts. The map below shows the selected districts (in red boxes) and the selected sectors (in green circles). Details are also available in Annex 1.

[7] This was decided, having borne in mind that eligible households in VUP sectors are not necessarily entitled to work.

Figure 1 **Map of Rwanda showing VUP sectors targeted by the study**



In the second stage, once the province, districts and sectors were chosen, the survey villages were randomly selected within each sector. A total of 68 villages were visited. Only villages with a minimum of 15 eligible households were used for random selection, in order to ensure that enumerators would be able to interview enough households in each village and allow for the inclusion of replacement households if selected households were unavailable.

In the third stage, after randomly selecting the villages, nine households were randomly selected within each village. In order to assure that the participant households had actually participated in public works, only those had participated in public works for at least ten days in the previous 12 months were considered eligible for interview.

The study conducted three interviews per sample household: the head of household (or: the most knowledgeable person on the specific survey section) was interviewed for the household questionnaire, while the VUP survey module was answered by the VUP worker in the household (only participant households). For the individual questionnaire, the two primary adults of the household were interviewed separately, answering the same questionnaire. To the extent possible, enumerators would interview a male and a female adult respondent, preferably the husband and wife of the household where applicable. In cases where there was not a married male-female pair in the household, the enumerators would interview two adults of opposite sex.[8] In a few cases, pairs of adults of the same sex were interviewed where opposite gender pairs were absent. Furthermore, in some cases there was only one adult living in the household, or the second adult was unavailable at the time of interview. In these households, only one individual survey was conducted.

2.3 Resulting Sample

The household and individual ('primary adult') samples encompass different types of household composition. While some respondents live in households with a male-female adult pair where the male will typically be the head of the household, others live in female adult-only households, where the household head is female. We expect that potential impacts on empowerment will differ depending on the type of household in question. Importantly, key questions such as ownership of assets and decision-making in the household will clearly be dependent on whether respondents belong to households with adult members of both sexes, or with women only. We therefore disaggregate our sample by two types of households: households with both male and female, henceforth referred to as '**double' households**[9] (444 households) versus households with female-only adults, henceforth referred to as **female-only households** (172 households).

The total sample consists of 616 households and 959 individuals. Table 1 shows the final sample size of households and individuals.

[8] This would typically involve interviewing the head and the eldest son/daughter, as long as he/she meets the criteria of 18 years of age; for example, a widowed female primary adult and her 19-year-old son living with her.

[9] A very small proportion of households, 17 out of 444, have two male adults, and they are included in the double household category.

Table 1 **Sample of households and individuals, by programme status, household type and gender**

	TOTAL			VUP			COMPARISON		
	Total	**Double HH**	**Female-only HH**	**Total**	**Double HH**	**Female-only HH**	**Total**	**Double HH**	**Female-only HH**
Households	616	444	272	369	278	91	247	166	81
	Total	**Females**	**Males**	**Total**	**Females**	**Males**	**Total**	**Females**	**Males**
Individual	959	614	345	583	365	218	376	249	127

Table 2 elaborates on the number of surveyed households and individuals, according to household type and programme status.

Table 2 **Total observations – household and individuals, by gender and participation**

	Overall sample			Double households			Female-only households		
	Total	**VUP**	**Comp.**	**Total**	**VUP**	**Comp.**	**Total**	**VUP**	**Comp.**
Households	616	369	**247**	444	278	166	172	91	81
-total individuals in hhs.*	2 741	1 683	1 058	2 148	1 360	788	593	323	270
Individuals	959	583	376	746	471	275	213	112	101
-females	614	365	249	401	253	148	213	112	101
-males	345	218	127	345	218	127	0	0	0

*Reports the number of individuals living in the surveyed households, as captured in the survey household roster.

Gender balance

Gender balance on two dimensions was desired by the outset of the sample design in order to ensure statistical power in gender analysis:

1. at least 30 percent female-headed households (or female-adult only households, as it is explained later) in the household sample; and
2. gender balance in the individual sample.

Without stratifying the sampling further, 172 of 616 households interviewed are female-adult only, or 28 percent of the sample. This is due to the relative large participation of female-headed households in the VUP. For the individual survey, a balanced gender split was not possible because a greater number of households were headed by female adults with no male adults present. The survey obtained 64 percent females and 36 percent male respondents.

2.3.1 Household sample

Table 3 shows household sample characteristics within the VUP and comparison households. In each group, double- and female-only households are compared. Overall, we detect few significant differences between double- and female-only households. The most notable

differences between the types of households appear in the comparison group, where female-only households are significantly smaller, have older household heads, are more likely to belong to the poorest *Ubudehe* category 1, cultivate fewer plots, are less likely to own a cell phone, have walls made of mud bricks and have heads that are less likely to be literate or have any education, as compared to double-households. All this indicates that these households are significantly worse off than double-households. Interestingly, when comparing households within the VUP programme, there are fewer significant differences between female-only and double households; some significant differences exist as female-only households are smaller, less likely to own cell phones, radios and bicycles and to grow sorghum and to have experienced serious illness in the household in the past 12 months. The female-only households also tend to own or cultivate fewer plots and own or cultivate less total plot area, but these differences are only marginally significant. However, these differences are fewer than within the comparison group and seem to suggest a slightly more homogenous group of households within the VUP group.

2.3.2 Individual sample of 'primary' male and female adults

Table 4 compares the primary men and women within VUP and comparison households, respectively. As for the household sample, we detect more significant differences within the comparison sample, where primary women are significantly older than primary men and less likely to be literate and have any education at all. Common for both VUP and comparison groups is that women are less likely to be married than men, which derives from the fact that there is a large portion of female-only households in the sample.

Table 3 **Household survey sample characteristics – households in VUP and comparison samples**

	VUP sample			Comp sample		
	Double	Fem-only	*p-value*	Double	Fem-only	*p-value*
Household composition						
Number of members	**4.89**	**3.55**	***0.000***	**4.75**	**3.33**	***0.001***
Number of children < 16	2.01	1.81	*0.266*	1.99	1.52	*0.153*
HH head is married (=1)	**0.77**	**0.11**	***0.000***	**0.72**	**0.04**	***0.000***
Age of HH head	47.80	47.78	*0.992*	**49.19**	**55.10**	***0.028***
Education of HH head						
Is literate (=1)	0.59	0.51	*0.198*	**0.57**	**0.28**	***0.005***
Primary school (=1)	0.36	0.30	*0.165*	**0.34**	**0.16**	***0.000***
No education (=1)	0.62	0.69	*0.179*	**0.63**	**0.82**	***0.002***
Ubudehe categories						
cat. 1	0.20	0.23	*0.487*	**0.31**	**0.51**	***0.030***
cat. 2	0.73	0.73	*0.856*	**0.69**	**0.48**	***0.034***
cat. 3	0.07	0.04	*0.157*	0.00	0.01	*0.317*
Agriculture						
Number of plots owned/cultivated	2.89	2.39	*0.073*	**2.59**	**2.11**	***0.037***
Total size of all plots (HA)	0.47	0.18	*0.078*	0.32	0.23	*0.202*
Crops grown by HH… (=1)						
sorghum	**0.12**	**0.01**	***0.011***	0.07	0.11	*0.486*
maize	0.20	0.14	*0.131*	0.11	0.15	*0.413*
cassava	0.37	0.35	*0.777*	0.48	0.41	*0.442*
sweet potato	0.22	0.24	*0.445*	0.22	0.21	*0.656*
Irish potato	0.10	0.08	*0.294*	0.06	0.09	*0.182*
beans	0.47	0.35	*0.128*	0.43	0.25	*0.157*
peas	0.68	0.60	*0.371*	0.66	0.69	*0.499*
bananas	0.32	0.25	*0.214*	0.30	0.24	*0.419*
Remoteness						
Distance to and from… (min.)						
health clinic	125.40	119.20	*0.563*	125.16	127.40	*0.823*
food market/shop	86.18	75.70	*0.258*	80.89	80.46	*0.965*
Assets						
Someone in HH owns a…(=1)						
cell phone	**0.46**	**0.30**	***0.022***	**0.44**	**0.27**	***0.003***
lounge suite	0.14	0.09	*0.313*	0.11	0.10	*0.754*
radio	**0.47**	**0.23**	***0.013***	0.44	0.25	*0.084*
bicycle	**0.08**	**0.01**	***0.033***	0.06	0.00	*0.101*
Dwelling						
Number of rooms in house	3.26	2.92	*0.155*	3.20	2.79	*0.095*
Roof material… (=1)						
corrugated iron sheets	0.08	0.15	*0.123*	0.13	0.22	*0.108*
brick/clay tiles	0.92	0.85	*0.142*	0.87	0.78	*0.108*
Wall materials… (=1)						
mud bricks	0.58	0.63	*0.541*	**0.62**	**0.46**	***0.022***
mud bricks with cement	0.06	0.09	*0.278*	0.05	0.07	*0.533*
wooden planks	0.02	0.01	*0.676*	0.02	0.04	*0.708*
tree trunks with mud	0.03	0.02	*0.874*	0.01	0.02	*0.403*
tree trunks with mud and cement	0.31	0.25	*0.434*	0.30	0.38	*0.116*
Shocks in last 12 months						
Number of shocks	0.69	0.55	*0.061*	0.73	0.56	*0.395*
Shock type… (=1)						
serious illness or injury	**0.17**	**0.12**	***0.016***	0.15	0.11	*0.547*
crop failure	0.24	0.25	*0.774*	0.26	0.24	*0.711*

Overall N = 616 [Double 444/Fem 272]. VUP N = 369 [Double 278/Fem 91].Comp N = 247 [Double 166/Fem 81]
Std. errors clustered at sector level. Significant differences at 0.05 level in bold.

Table 4 **Individual survey sample characteristics, primary adults in VUP and comparison samples**

	VUP sample			Comp sample		
	Females	Males	*p-value*	Females	Males	*p-value*
Age	42.66	42.88	*0.901*	**45.72**	**43.97**	***0.003***
Married (=1)	**0.47**	**0.70**	***0.000***	**0.36**	**0.71**	***0.003***
Education						
Is literate (=1)	0.62	0.59	*0.425*	**0.44**	**0.69**	***0.003***
Has some education (=1)	0.36	0.36	*0.950*	**0.33**	**0.45**	***0.001***
Dowry was paid for marriage (1=)	0.07	0.04	*0.293*	0.09	0.04	*0.213*
Primary school (=1)	0.23	0.24	*0.796*	0.26	0.17	*0.278*

Overall N = 959 [Females 614/Males 345].

VUP N =583 [Females 365/Males 218]. Comp N = 376 [Females 249/Males 127].

Std. errors clustered at sector level. Significant differences at 0.05 level in bold.

2.4 Data Analysis

2.4.1 The Women's Empowerment in Agriculture Index

The Women's Empowerment in Agriculture Index is an index launched by IFPRI, the Oxford Poverty and Human Development Initiative and USAID in 2012, and now widely applied across a range of different countries as a means to measure and track women's empowerment and inclusion levels in agriculture. The WEAI is composed as a weighted average of two sub-indices: one measuring five domains of empowerment for women (5DE), and the other measuring gender parity in empowerment within the household (GPI). The WEAI is constructed as follows:

$$WEAI = 0.9 \cdot 5DE + 0.1 \cdot GPI$$

The 5DE, or five domains of empowerment, are production, resources, income, leadership and time. These domains are composed of a total of nine binary indicators, each denoting whether an individual has reached 'adequacy' in that particular area.[10] The five empowerment domains and the indicators comprising the domains are shown in Table 5 below. The individual 5DE empowerment score is calculated as a weighted average of the indicators, with a higher score signifying higher empowerment levels. A person is defined as 'empowered' if her or his score is 0.8 or higher (e.g. reaching adequacy in 80 percent of the domains). The empowerment score is censored at 0.8, meaning that for all empowered individuals (e.g. a score at 0.8 or higher), the score is set to 1 (Alkire *et al*., 2012).

The GPI measures women's empowerment relative to that of men by comparing the 5DE profiles of women and men in the same household (Alkire *et al*., 2012). A woman achieves gender parity if she is empowered according to her censored 5DE empowerment score, or if her censored score is at least as high as that of the primary male adult in the household. While 5DE is calculated using all women in the sample, the GPI can hence only be calculated for women living in a household with both an adult man and woman.

[10] While the WEAI in its original specification has a total of ten indicators, we employ nine of these. The difference between the original WEAI and the one used for this study is further explained in Annex 2.

Table 5 Five domains of empowerment

5DE domains	Indicator	Adequacy when…
Production	Input in productive decisions	Individual participates and has at least some input in decisions regarding agricultural production, or if someone else makes the decisions but the individual feels he or she could.
Resources	Ownership of assets	Individual reports sole or joint ownership over at least one major asset.
	Purchase, sale or transfer of assets	Individual participates (or can participate) in decision to buy, sell or transfer assets owned by the household.
	Access to and decisions about credit	Individual belongs to household that has credit access, and if the household used a credit source, the individual participated in at least one decision about the credit.
Income	Control over use of income	Individual has input in decision-making about income generated from activity he/she participated in.
Leadership	Speaking in public	Individual feels comfortable speaking up in public.
	Group member	Individual participates in at least one economic or social group in his/her community.
Time	Workload	Individual has worked a maximum of 10.5 hours in the last 24 hours.
	Leisure	Individual is satisfied with his/her time available for leisure.

The 5DE, GPI and WEAI have a twofold use. First, the individual measures as described above are calculated for all individuals in our sample. These figures are used to compare the empowerment status of males and females in VUP and comparison groups, as well as in regression analysis (see next section). Second, using the individual figures, the overall 5DE, GPI and WEAI indices for the full sample can be calculated. To construct the overall indices for the full sample, the 5DE index is calculated as 1 minus the average disempowerment score (= 1-5DE score) of disempowered females in the sample, multiplied by the proportion of disempowered women in the sample. The GPI index is calculated as the proportion of households lacking gender parity, multiplied by the average empowerment gap that women experience relative to their male counterparts in the households without gender parity (Malapit *et al.*, 2014). Lastly, the WEAI index is the weighted average of the overall 5DE and the overall GPI. The advantage of constructing the overall indices is that they provide a picture of the overall empowerment status of all surveyed women in our Rwanda sample, and furthermore

allow for comparison of our sample with a WEAI survey previously conducted on Rwandan women by IFPRI.

2.4.2 Regression analysis

In order to respond to the study's hypothesis about the potential impact of the VUP on women's power and agency (hypothesis 2, see section 1.2), we examine the relationship between primary male and female adults' empowerment and participation in VUP public works and other mediating factors. We use binary variables to determine 'empowerment' based on the WEAI methodology described above, using a probit specification:

$$\mathrm{P}(Empowerment = 1|x) = \Phi(x'\beta)$$

-where the probability of *Empowerment* being 1, given *x*, is the Cumulative Distribution Function Φ of:

$$\mathrm{P}\left(Empowerment_{ihj} = 1\middle|x\right) = \Phi(\beta_0 + \beta_1 VUP + X_1 i_{ihj} + X_2 h_{ij} + \mu V_j + \varepsilon_{ihj})$$

Empowerment is a binary response variable for an individual i in household h and in village j. β_1 is the coefficient to be estimated for household (or alternatively, individual) participation in the *VUP* (dummy); X_2 is a vector of individual characteristics of individual i in household h in village j, including female (dummy), age and age squared, educational level (dummy), marital status (dummy), illness (dummy) and whether dowry has been paid for marriage (dummy); X_2 is a vector of household characteristics of household h in village j, including household size, and whether the household experienced any shocks in the last 12 months (dummy); μ_j is a vector of district dummy variables that control for all fixed characteristics of district j, and ε_{ihj} is the error term.

Outcome variable: Empowerment

We use different measures of empowerment as our outcome variable in alternative specifications, based on the work of Sraboni *et al*. (2013) and Malapit *et al*. (2013).

<u>WEAI sub-indices</u>

1. **5DE score**. The 5DE score is the censored individual empowerment score which is the weighted average of the individual's achievements in the nine indicators that comprise the five empowerment domains (see above section). The 5DE score is a discrete variable ranging between 0-1, therefore we transform 5DE score to a binary variable, with a value of 0 if the score is lower than 0.8 (e.g. the individual is disempowered) and a value of 1 if the score is equal to or higher than 0.80 (e.g. the individual is empowered).

2. **GPI**. The GPI is a measure of relative empowerment within the household and is available for the subsample of 'double households' only. The GPI is a discrete variable, with values ranging from 0 to 1; therefore, we transform the GPI to a binary variable, with a value of 1 if there is no gap in the censored empowerment scores between the male and the female of the household (e.g. there is empowerment equality), and a value of 0 for households with any gap in the censored scores.

<u>Adequacy indicators</u>

In addition to the WEAI subindices, we use select adequacy indicators as measures of empowerment in specific areas (see previous section for details on the indicators): ownership

of assets, access to and decisions about credit, control over use of income, speaking in public, group membership and workload.

Key independent variables

Our key independent variable of interest is VUP participation. We employ two different measures of VUP participation across the different specifications:

1. household level: the household is a beneficiary of VUP public works;
2. individual participation: the individual performs public work at VUP site.

Both measures are binary with 1 denoting participation. For the first measure, the status will be the same for both individuals belonging to the same household (in the cases where two individuals were interviewed from the same household). The second measure can be either 1 or 0 for individuals living in a VUP participant household (depending on who carried out the public work for the household; each household can list several persons as their public workers, but not everyone interviewed in the individual survey necessarily performed the public works for the household, so their individual participation status would be 0). The second measure is always 0 for individuals in non-VUP households.

It is of interest to consider both household and individual participation in the programme, since the two may have different impacts on empowerment. Belonging to a participant household may increase the disposable income of the household and shift household responsibilities among members, for instance, individual participation could mean higher bargaining power for the participating individual while also signifying an increased time burden. These consequences of participation could affect empowerment differently.

PART 3: RESULTS

3.1 Economic Advancement

3.1.1 Household survey findings

Table 6 summarizes the findings on economic advancement for double compared to female-only households, within VUP and comparison households, respectively. Table 7 summarizes economic advancement indicators by males and females within double households only.

Household income

Table 6 shows that household cash income differs significantly between double and female-only households.[11] The difference seems to originate from significantly higher incomes in double households from salaried jobs, livestock sales and higher profits accrued from business. In terms of VUP transfers, we detect no difference between double and female-only households, although female-only households receive more support through the direct support components; however, this difference is only marginally statistically significant as it corresponds to a small number of observations.

While we cannot comment on causality, we also note that households in the VUP sample tend to have more income sources as compared to their counterparts in the comparison sample. Also, a larger fraction of comparison households report having no source of cash income, compared to VUP households.

Employment

The study finds some significant inequalities in wage employment between household types. Table 6 shows that in both VUP and comparison households, double households hold more jobs than female-only households. This can very well in part be explained by the larger household size of double-households, but also shows the greater income-earning potential of double-households. Females' total job income is higher in absolute numbers in female-only households compared to double households in both VUP and comparison samples, but the difference is only marginally significant for the VUP sample.

Table 7 compares employment indicators for males and females within double households only, revealing significant gender differences in wage employment. In both samples, men earn overall a higher income than women, about 60 percent of the income in the household. Men also have a higher average income than women. Finally, within the VUP sample, a higher share of the men in the household has a job, about 50 percent compared to 40 percent of women.

In the qualitative fieldwork undertaken by FAO (Pavanello *et al*., 2015a), wage labour was mentioned as an important consumption-smoothing strategy mostly deployed by young and adult men. This is somewhat consistent with the portrayal of men as the main job income earners in the household; however, exploring VUP programme operations in the following sections will show that VUP public works are in fact typically performed by women.

Ownership, decision-making and control over household resources

An important element of economic advancement is the degree to which women own or manage household resources. Table 6 shows the extent to which women own and work in household

[11] Household income is composed of income from business profits, livestock sales, salaried jobs, rent and transfers outside the VUP.

plots,[12] and the extent to which women own livestock or retain control over livestock sales. Women's land and livestock ownership seem to have the same proportions in both VUP and comparison groups, although we do not test this.

In Table 7, we see that within double households in the VUP sample, men own a significantly larger proportion of the household plots and are significantly more likely to own cattle than women. For the remaining ownership variables, men and women appear to own small livestock (goats, sheep, pigs) and chickens to the same extent.

These findings are an interesting contrast to that of responsibilities in agriculture, showing that women tend to have greater responsibilities: women work on a larger share of plots than men and are responsible for marketing crops from a larger share of plots than men. Also, in the VUP sample, a larger share of women than men takes care of household goats, sheep and pigs. This is in tune with qualitative findings by FAO (Pavanello *et al*., 2015a) that women tend to be more engaged in crop farming than men, particularly in planting. When it comes to controlling money from sales of different livestock, we detect no differences between men and women, although men in the VUP sample are marginally more likely to control the money from sales of goats, sheep and pigs.

Household resilience and food security

All households, double and female-only, in both VUP and comparison samples report high levels of food insecurity, particularly on being worried about the household running out of food and household members eating less than they should. Hence, while we cannot make any claims regarding the VUP's impact on food security (the research design would not allow us to make attributions to the programme in any case), we do see that food availability is a real concern for the majority of households in our sample. Comparing double and female-only households within the VUP sample, we observe that female-only households are significantly more likely to report experiencing the more severe forms of food insecurity: having to skip meals, being hungry and not eating, marginally significant running out of food and going without eating the whole day.

[12] As a fraction of the total plots owned or cultivated by the household, and the fraction of plots from which women take crops to market and negotiate prices for, out of all household plots that the household sell crops from. Note, that the survey is designed in a way so that up to three household members can be listed per plot, so a plot can be owned/worked on/marketed by both a female and a male household member. Other options are: household jointly, outside household male, outside household female, government or other institution, clan/family; these categories are not included here as we want to consider only individual owners/workers/marketers.

Table 6 Rwanda: economic advancement indicators, households in VUP and comparison samples

PART 1	VUP sample			Comp sample		
	Double	Fem-only	*p-value*	Double	Fem-only	*p-value*
Income						
HH cash income (RWF)	**67,756.00**	**36,842.00**	***0.008***	**60,454.00**	**31,261.00**	***0.009***
Cash income from… (RFW)						
business profit	**6,696.00**	**1,187.00**	***0.052***	**7,062.00**	**1,938.00**	***0.003***
livestock sales	7,326.00	5,226.00	*0.613*	**9,248.00**	**4,321.00**	***0.058***
salaried jobs	**51,531.00**	**27,067.00**	***0.028***	**42,219.00**	**21,619.00**	***0.070***
rent	0.00	76.92	*0.273*	6.02	0.00	*0.384*
non-VUP transfers	2,230.00	3,286.00	*0.594*	2,172.00	3,383.00	*0.378*
VUP transfers/services … (RWF)						
VUP public works	29,197.00	24,795.00	*0.210*	…	…	…
VUP direct support	**428.00**	**4,357.00**	***0.100***	…	…	…
VUP financial services	5,577.50	5,321.00	*0.889*	…	…	…
Number of HH income sources	1.43	1.32	*0.317*	**1.20**	**1.16**	***0.061***
HH income source… (=1)						
wage	0.78	0.73	*0.112*	0.39	0.30	*0.110*
self-employment in agriculture	0.42	0.34	*0.362*	**0.42**	**0.35**	***0.053***
self-employment, non-ag.	0.10	0.03	*0.169*	0.06	0.09	*0.108*
transfers	0.04	0.04	*0.885*	0.02	0.01	*0.802*
Has no cash income	0.08	0.17	*0.116*	0.30	0.41	*0.058*
Wage employment						
Number of jobs held by HH members	**1.31**	**0.93**	***0.010***	**1.12**	**0.70**	***0.017***
Females total income from jobs	**14,254.00**	**26,902.00**	***0.069***	16,885.00	21,283.00	*0.565*
Males total income from jobs	37,275.80	…	…	25,232.40	…	…
Average job income per female	12,955.00	21,653.00	*0.166*	15,620.90	14,931.00	*0.834*
Average job income per male	32,921.00	…	…	24,101.00	…	…
Share of females in HH that has a job	0.40	0.55	*0.120*	0.38	0.35	*0.589*
Share of males in HH that has a job	0.49	…	…	0.44	…	…
Share of job income earned by females	**0.39**	**0.98**	***0.000***	**0.41**	**0.97**	***0.011***
Share of job income earned by males	0.61	…	…	0.59	…	…
Hired labour						
Days HH hired labour for farming (past 12 months)	7.81	1.11	*0.201*	8.34	1.68	*0.303*
Days HH hired labour for care work or other (past 12 months)	2.46	1.17	*0.417*	0.27	4.57	*0.343*
Ownership of productive resources						
Share of HH plots owned by females	**0.33**	**0.84**	***0.000***	**0.38**	**0.84**	***0.000***
Share of HH plots owned by males	0.54	…	…	0.46	…	…
Female(s) own HH cattle (=1)	0.08	0.12	*0.158*	0.10	0.09	*0.610*
Male(s) own HH cattle (=1)	0.08	…	…	0.10	…	…
Female(s) own HH goat/sheep/pig (=1)	**0.18**	**0.35**	***0.073***	**0.13**	**0.24**	***0.078***
Male(s) own HH goat/sheep/pig (=1)	0.18	…	…	0.16	…	…
Female(s) own HH chicken (=1)	0.08	0.10	*0.531*	**0.12**	**0.02**	***0.023***
Male(s) own HH chicken (=1)	0.11	…	…	0.11	…	…

PART 2	**VUP sample**			**Comp sample**		
	Double	Fem-only	*p-value*	Double	Fem-only	*p-value*
Responsibilities in agriculture						
Share of plots worked on by females	**0.66**	**0.88**	***0.000***	**0.66**	**0.84**	***0.081***
Share of plots worked on by males	0.45	…	…	0.47	…	…
Share of plots with crops marketed by females	**0.65**	**0.85**	***0.062***	**0.61**	**0.89**	***0.055***
Share of plots with crops marketed by males	0.44	…	…	0.51	…	…
Female(s) take care of HH cattle (=1)	0.23	0.20	*0.135*	0.20	0.15	*0.152*
Male(s) take care of HH cattle (=1)	0.27	…	…	0.26	…	…
Female(s) take care of HH chicken (=1)	0.22	0.25	*0.573*	**0.16**	**0.33**	***0.054***
Male(s) take care of HH chicken (=1)	0.18	…	…	0.14	…	…
Female(s) take care of HH goat/sheep/pig (=1)	0.10	0.07	*0.242*	0.08	0.01	*0.197*
Male(s) take care of HH goat/sheep/pig (=1)	0.08	…	…	0.07	…	…
Control over money						
Female(s) control money from sale of HH cattle (=1)	0.04	0.03	*0.905*	**0.04**	**0.02**	***0.028***
Male(s) control money from sale of HH cattle (=1)	0.04	…	…	0.05	…	…
Female(s)control money from sale of HH goat/sheep/pig (=1)	**0.09**	**0.00**	***0.004***	**0.04**	**0.00**	***0.040***
Male(s) control money from sale of HH goat/sheep/pig (=1)	0.09	…	…	0.04	…	…
Shocks						
During the last 12 months, someone in HH… (=1)						
worried that HH would run out of food	0.89	0.93	*0.257*	0.93	0.86	*0.156*
had to skip a meal	**0.69**	**0.80**	***0.014***	0.69	0.78	*0.157*
ate less than they should	0.94	0.92	*0.660*	0.95	0.90	*0.323*
ran out of food	**0.77**	**0.87**	***0.054***	0.77	0.80	*0.717*
were hungry but did not eat	**0.65**	**0.80**	***0.041***	0.67	0.72	*0.424*
went without eating a whole day	**0.72**	**0.84**	***0.062***	0.73	0.74	*0.775*
Number of shock coping measures taken in 12 months (0-10)	1.04	1.07	*0.802*	1.10	0.86	*0.158*

Overall N = 616 [Double 444/Fem 272]. VUP N = 369 [Double 278/Fem 91]. Comp N = 247 [Double 166/Fem 81].

Std. errors clustered at sector level. Significant differences at 10% level in bold.

Table 7 Rwanda: economic advancement indicators – male and female shares, double households, in VUP and comparison samples

	VUP sample			Comp sample		
	Females in the HH	Males in the HH	*p-value*	Females in the HH	Males in the HH	*p-value*
Wage employment						
Total job income earned by (…)	**14,254.24**	**37,276.01**	***0.000***	16,986.64	25,232.73	*0.082*
Average job income per individual	**12,954.84**	**32,920.58**	***0.000***	**15,621.36**	**24,100.60**	***0.059***
Share of (…) that has a job	**0.40**	**0.49**	***0.011***	0.38	0.44	*0.198*
Share of job income earned by (…)	**0.39**	**0.61**	***0.000***	**0.41**	**0.59**	***0.022***
Ownership of productive resources						
Share of household plots owned by (…)	**0.33**	**0.54**	***0.000***	0.38	0.46	*0.157*
Share of (…) that owns any household cattle	**0.08**	**0.13**	***0.016***	0.10	0.09	*0.671*
Share of (…) that owns any household goat/sheep/pig	0.18	0.18	*1.000*	0.13	0.16	*0.371*
Share of (…) that owns any household chicken	0.08	0.11	*0.139*	0.12	0.11	*0.848*
Responsibilities in agriculture						
Share of household plots worked on by (…)	**0.66**	**0.45**	***0.000***	**0.66**	**0.47**	***0.000***
Share of household plots marketed by (…)	**0.65**	**0.44**	***0.008***	0.61	0.51	*0.340*
Share of (…) that takes care of any household cattle	0.23	0.27	*0.096*	0.20	0.26	*0.129*
Share of (…) that take care of any household goat/sheep/pig	**0.22**	**0.18**	***0.034***	0.16	0.14	*0.493*
Share of (…) that takes care of any household chicken	0.10	0.08	*0.103*	0.08	0.07	*0.782*
Control over money						
Share of (…) that controls money from sale of any household cattle	0.04	0.04	*1.000*	0.04	0.05	*0.416*
Share of (…) that controls money from sale of any household goat/sheep/pig	0.06	0.09	*0.071*	0.07	0.04	*0.158*

Overall N = 444. VUP N = Double 278. Comp N = 166. Simple t-test of means between variables.
The table compares the means of the same household level variables computed for males and females, respectively, in double-households. Shares of plots do not always sum to 100% as not all plots are owned by HH members and one plot can have several owners, workers and marketers. Control over money does not include chickens due to very low sales of chicken in the sample.

3.1.2 Individual survey findings

Table 8 show findings from the individual survey on indicators of economic advancement for primary males and females.

Access to Credit

VUP public works wages are paid to participants through SACCO accounts, meaning that previously unbanked participants in many cases opened new financial accounts to receive payments. In parallel to the VUP, the GoR has increased the availability of SACCO branches in all sectors of the country in addition to expanding mobile banking (Pavanello *et al.*, 2015a), meaning that credit is now more accessible also for non-beneficiaries of the VUP.

The study detects no significant differences between the samples of reporting primary males and females – within VUP and comparison groups – in terms of whether or not the household accessed any credit in the past 12 months, the number of credit sources accessed by the household and the value of the total credit obtained by the household.[13] This is reassuring insofar the question was asked to the individual respondent but regarding household access, so results seem to suggest that males and females agree on how much credit their households are accessing.

The study detects no significant difference between primary males and female in terms of average number of credit decisions made, although the results suggest that VUP individuals have made on average more credit decisions than their counterparts in the comparison group – for both males and females.

[13] As reported by female respondents; questions regarding access to credit at household level were asked to primary females and males separately in the individual survey.

Primary women and men decide mostly to use relatives and friends as their main source of credit (about 30 percent borrowed from this source), followed by VSLAs and SACCOs (about 20 percent).

Asset ownership

Primary men report a higher incidence of ownership (solely or jointly with another person) than women across all assets, but with some differences between VUP and comparison samples. Men in the VUP sample are significantly more likely to own agricultural land, large livestock and poultry, and marginally more likely to own farm equipment and small durables than are women. In the comparison sample, males are more likely to own small livestock, farm equipment and the house, and marginally more likely to own agricultural land and poultry than women. These findings are consistent with previous findings at household level in section 3.1.1.

Time use

Each individual participant is asked about his/her time use in the past 24 hours, noting when the reported day was a workday or a rest day (holiday). While public works provide an additional cash income source, they potentially place time constraints on the household as one or several members need to put in work time on the public work sites. The magnitude of this additional demand on time and whether it leads to changes in female household members' other work burdens, such as domestic tasks, is important for empowerment if it eventually leads to women in public works being less able to undertake other productive activities or have adequate time for leisure and rest, while domestic time demands remain unchanged.

Table 8 compares time use between males and females, within VUP and comparison households, respectively. Men in both VUP and comparison households spend significantly longer hours working; significantly less time on domestic chores (by a factor of 2.3 and 2.7, respectively) and report having between 50-75 percent more leisure time than the females. Results are consistent when looking at workdays only (no holidays).

In the qualitative research, a number of male and female respondents explained that husbands would look after children while their wives worked in VUP public works sites. In most VUP villages however, no changes as a result of VUP works in time allocation for domestic activities between spouses were mentioned (Pavanello *et al*., 2015a). Nevertheless, the quantitative findings suggest that males in the VUP sample put more hours in care work than men in the comparison group. This cannot be confirmed with our study but it is an interesting result for future research.

Table 8 Rwanda: economic advancement indicators, primary adults in VUP and comparison samples

PANEL A: Household-level	VUP sample			Comp sample		
	Females	Males	*p-value*	Females	Males	*p-value*
Credit						
Number of HH credit sources (0-6)	0.79	0.78	*0.866*	0.63	0.65	*0.385*
HH took credit from any source	0.61	0.63	*0.616*	0.54	0.54	*0.937*
Total credit, last 12 months	20,182.00	21,925.00	*0.631*	13,061.70	14,060.00	*0.437*

PANEL B: Individual-level	VUP sample			Comp sample		
	Females	Males	*p-value*	Females	Males	*p-value*
Credit						
Average number of credit decisions alone or jointly	1.02	1.06	*0.660*	0.91	0.92	*0.699*
Individual decided alone or jointly to borrow from... (=1)						
formal lender	0.02	0.02	*0.900*	0.02	0.03	*0.273*
friends/relatives	0.30	0.31	*0.795*	0.32	0.31	*0.489*
credit/microfinance group (incl. SACCO, VSLA, merry-go-round)	0.21	0.19	*0.718*	0.17	0.17	*0.835*
Asset ownership						
Number of assets individual owns alone or jointly	2.77	3.28	*0.067*	**2.45**	**3.24**	***0.000***
Individual owns... alone or jointly (=1)						
agricultural land	**0.62**	**0.75**	***0.019***	0.64	0.74	*0.071*
large livestock	**0.13**	**0.21**	***0.030***	0.14	0.20	*0.210*
small livestock	0.26	0.24	*0.643*	**0.18**	**0.24**	***0.046***
chickens, ducks, turkeys, pigeons	**0.09**	**0.06**	***0.047***	0.06	0.13	*0.069*
farm equipment (non-mech.)	0.58	0.67	*0.076*	**0.47**	**0.55**	***0.025***
house	0.58	0.66	*0.264*	**0.51**	**0.66**	***0.002***
small consumer durable	0.30	0.37	*0.077*	0.24	0.32	*0.118*
Time use						
Minutes spent on... in last 24 hours, all						
working	**271.22**	**332.40**	***0.009***	278.30	379.70	*0.059*
domestic work/care	**290.80**	**128.20**	***0.000***	**261.36**	**96.26**	***0.001***
leisure	**101.94**	**150.80**	***0.008***	82.39	146.30	*0.054*
sleep, eating, personal care	783.50	807.90	*0.157*	809.57	807.20	*0.922*
Minutes spent on... in last 24 hours, day not a holiday						
working	314.06	366.60	*0.051*	**309.83**	**401.80**	***0.049***
domestic work/care	**289.10**	**133.50**	***0.000***	**266.86**	**85.96**	***0.001***
leisure	**64.55**	**122.20**	***0.006***	**63.23**	**146.80**	***0.014***
sleep, eating, personal care	775.84	795.20	*0.279*	793.34	799.30	*0.733*

Overall N = 959 [Females 614/Males 345]. VUP N =583 [Females 365/Males 218]. Comp N = 376 [Females 249/Males 127].
Std. errors clustered at sector level. Significant differences at 0.05 level in bold.
Panel A reports individual responses but about household-level information;
Panel B reports individual responses about indivial-level information

3.2 Power and Agency

3.2.1 Individual survey findings

The power and agency hypothesis is investigated with data from the individual survey of male and female primary adults. This survey asked questions on different domains of power and agency, including decision-making in the household and in agriculture, as well as on their engagement in social networks and the extent to which they felt comfortable speaking up in public and reclaiming their rights. Results are shown in Table 9.

Social networks

An important aspect of power and agency is the extent to which women are comfortable with and able to participate in social and public life. We investigate whether women and men in VUP and comparison households have a higher probability of participating in the public sphere and feel more confident engaging in social networks.

The study observes some differences between men and women's participation in public life. Men are more likely to be members of agricultural producers' groups (VUP sample) while women are unsurprisingly more likely to participate in women's groups. Another interesting finding is the extent to which women in VUP households belong to credit or microfinance groups (including SACCOs, merry-go-rounds and VSLAs) compared to those in the comparison group – while about 28 percent of women in the comparison sample are in these groups, the figure is of 48 percent for females in the VUP sample. While we cannot ascribe this difference to the VUP programme as such, the programme does appear to expose beneficiaries to formal banking through its requirement of payment through SACCO accounts.

Speaking in public

About 12 percent of women in VUP households speak up with little or no difficulty to ensure proper payment for work, much smaller than 23 percent as is the case when it comes to the men (the difference is marginally significant). These figures are higher than in the comparison group, which is likely due to VUP participants' larger exposure to situations where protesting over work payment issues is relevant.

The study also shows that men speak up significantly more than women in conveying needs and priorities to authorities, protesting against misbehaviour of authorities and taking part in decision-making in the community. The same pattern is observed in both VUP and comparison households.

Input in decision making in the household and perceptions of decision-making

Comparing men and women's responses shows that men and women report about the same levels of input into decision-making in the household. Only in decisions regarding food crop farming are women in the VUP sample more likely to report having input than men, although the difference is marginally significant.

Interestingly, disagreements on female decision-making between reporting males and females is highly significant: women, to a significantly larger extent than men, declare that it is the female who makes decisions about different aspects of household productive activities, particularly in agricultural and crop production, taking crops to market and on VUP income. Identifying who actually makes the final decisions is of course very difficult to capture; however, it is interesting to note that significant differences persist in male and female perceptions of who decides on what within the household.

Security of assets

Considering the individuals with a spouse, the study finds that men in the VUP sample are significantly more likely than women to respond that they get to keep agricultural land, non-mechanized farm-equipment and the household's house when their spouse dies. In the comparison sample, this holds true for small livestock. The overall level of security of assets is low for both men and women.

Table 9 Rwanda: Power and Agency indicators. Primary adults in VUP and comparison samples

	VUP sample			Comp sample		
	Females	Males	*pvalue*	Females	Males	*pvalue*
Social networks						
Number of groups individual is active member of	1.23	1.33	*0.582*	0.89	0.95	*0.679*
Active member of… (=1)						
agricultural producers' group	**0.12**	**0.23**	***0.004***	0.10	0.11	*0.640*
credit/microfinance group (incl. SACCO, VSLA, merry-go-round)	0.48	0.47	*0.856*	0.28	0.30	*0.554*
mutual help/insurance group/burial society	0.08	0.12	*0.235*	0.08	0.11	*0.339*
other womens' group	**0.16**	**0.04**	***0.004***	**0.09**	**0.01**	***0.011***
Speaking up in public						
Individual speaks up with little or no difficulty to… (=1)						
ensure proper payment for work	0.12	0.23	*0.052*	0.02	0.02	*0.987*
convey needs and priorities to authorities	**0.25**	**0.44**	***0.002***	**0.25**	**0.52**	***0.001***
protest misbehaviour of authorities	**0.18**	**0.25**	***0.012***	**0.17**	**0.38**	***0.018***
take part in decision-making in community	**0.26**	**0.56**	***0.002***	**0.26**	**0.61**	***0.011***
Input into HH decision making						
Individual has input into some or all HH decision re activity… (=1)						
food crop farming	0.86	0.78	*0.090*	0.82	0.82	*0.901*
cash crop farming	0.06	0.10	*0.213*	0.06	0.04	*0.206*
livestock	0.58	0.57	*0.854*	0.41	0.50	*0.245*
non-farm activities	0.07	0.06	*0.568*	0.05	0.04	*0.755*
wage employment	0.54	0.61	*0.140*	0.34	0.34	*0.957*
Perception about decision making						
Individual thinks main female normally makes the decision re… (=1)						
agricultural production	**0.38**	**0.15**	***0.000***	**0.40**	**0.09**	***0.043***
crop production	**0.39**	**0.13**	***0.000***	**0.42**	**0.09**	***0.011***
when or who to take crops to market	**0.14**	**0.05**	***0.040***	**0.13**	**0.03**	***0.017***
non-farm business	0.07	0.03	*0.224*	0.06	0.02	*0.154*
VUP income	**0.34**	**0.08**	***0.000***	0.01	0.01	*0.983*
Security of assets						
Individual keeps asset if spouse dies… (=1)						
agricultural land	**0.17**	**0.24**	***0.007***	0.11	0.21	*0.139*
large livestock	0.11	0.12	*0.863*	0.07	0.16	*0.264*
small livestock	0.12	0.12	*0.872*	**0.08**	**0.17**	***0.042***
chickens, ducks, turkeys, pigeons	0.12	0.08	*0.237*	0.13	0.18	*0.473*
farm equipment (non-mech.)	**0.18**	**0.26**	***0.008***	0.13	0.19	*0.323*
farm equipment (mech.)	0.33	0.33	*1.000*	0.25	0.00	*0.509*
house	**0.15**	**0.22**	***0.044***	0.14	0.23	*0.109*
small consumer durable	0.17	0.21	*0.117*	0.15	0.21	*0.211*

Overall N = 959 [Females 614/Males 345]. VUP N =583 [Females 365/Males 218]. Comp N = 376 [Females 249/Males 127].
Std. errors clustered at sector level. Significant differences at 0.05 level in bold.
Keeping assets in case of death only calculated for individuals with a spouse.

3.2.1 WEAI results

Table 10 shows the WEAI results for primary females and males. The individual WEAI for women is 0.80 and for men 0.84 in VUP households, while in the comparison sample the score is 0.78 for women and 0.83 for men. While men score higher than women on overall empowerment, as determined by the individual WEAI index and the individual 5DE score, the difference is only significant in the comparison group. For both males and females,

empowerment measures are fairly high, suggesting that the individuals in our sample on average relatively empowered.

Looking at the 5DE adequacy indicators, where 1 signifies that adequacy is reached in the indicator and 0 means adequacy is not reached, we observe that in the VUP sample men are significantly more likely to experience adequacy than women in terms of ownership of assets, speaking in public and time poverty; whereas in the comparison group men also display higher likelihood than women to achieve adequacy in asset transactions. Interestingly, the women in our sample are more likely to achieve adequacy in input in productive decisions than men; however, this difference is only significant in the comparison group.

Table 10 **Rwanda: Women's Empowerment Index, primary adults in VUP and comparison samples**

	VUP sample			Comp sample		
	Females	Males	*pvalue*	Females	Males	*pvalue*
Individual WEAI index	0.80	0.84	*0.140*	**0.78**	**0.83**	***0.010***
Individual GPI index	0.27	0.27	*1.000*	0.29	0.29	...
Individual Empowerment score	0.86	0.91	*0.057*	**0.83**	**0.88**	***0.029***
5DE indicators, adequacy (=1)						
input in productive decisions	0.95	0.90	*0.185*	**0.95**	**0.89**	***0.025***
ownership of assets	**0.85**	**0.92**	***0.047***	**0.84**	**0.91**	***0.028***
purchase, sale or transfer of assets	0.85	0.87	*0.577*	**0.84**	**0.86**	***0.002***
access to and decisions on credit	0.54	0.56	*0.654*	0.47	0.48	*0.769*
control over use of income	0.98	0.98	*0.965*	0.97	0.96	*0.716*
member of at least one group	0.71	0.71	*0.936*	0.61	0.59	*0.506*
feels comfortable speaking in public	**0.40**	**0.68**	***0.002***	**0.36**	**0.72**	***0.002***
not time poor	**0.58**	**0.77**	***0.001***	0.61	0.70	*0.182*
satisfied with leisure time	0.74	0.78	*0.146*	0.75	0.79	*0.362*

Overall N = 959 [Females 614/Males 345]. VUP N =583 [Fem. 365/Males 218]. Comp N = 376 [Fem. 249/Males 127]. Std. errors clustered at sector level. Significant differences at 0.05 level in bold.

In addition to the individual empowerment figures, the WEAI data has also been used to construct the overall 5DE, GPI and WEAI indices for our sample, as described in section 2.4.1. Table 11 below shows the overall WEAI, 5DE and GPI for the women in our sample (combining VUP and comparison), while Figures 2 and 3 show the contribution of each of the five domains and nine indicators to the disempowerment of women and men in the sample.

The overall WEAI for the full sample of primary female adults is 0.86, comprised of a 5DE of 0.85 and a GPI of 0.93. This shows that the women in our sample are generally quite empowered along the measured dimensions.[14]

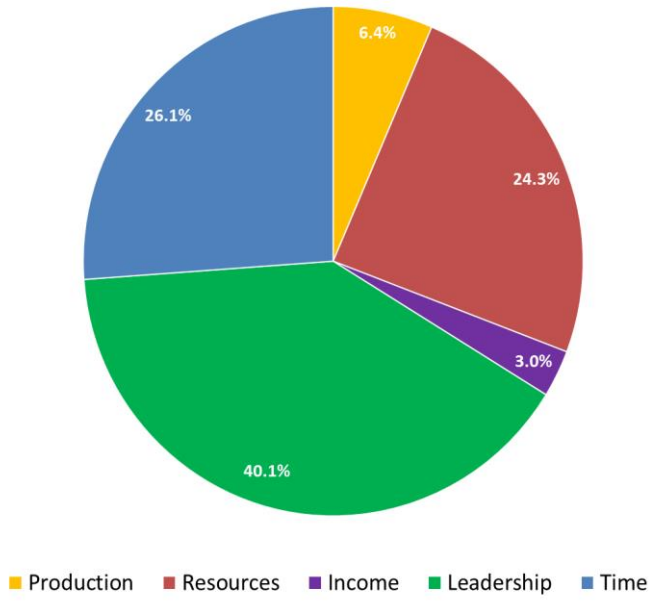
[14] Although not entirely comparable and used only as a reference, the national WEAI figures from 2013 are higher: national WEAI = 0.91, 5DE = 0.90 and GPI = 0.96 (Malapit *et al.*, 2014).

Table 11 Rwanda: WEAI, 5DE & GPI

5DE score	0.85
Disempowerment score (1-5DE)	0.15
N (number of observations, females)	570
% of women achieving empowerment	56.14
% of women not achieving empowerment	43.86
Mean 5DE score for not yet empowered women	0.65
Mean disempowerment score (1 – 5DE) for not yet empowered women	0.35
GPI score	0.93
N (number of dual-adult households)	246
% of women achieving gender parity	65.45
% of women not achieving gender parity	34.55
Average empowerment gap	0.19
WEAI score	0.86

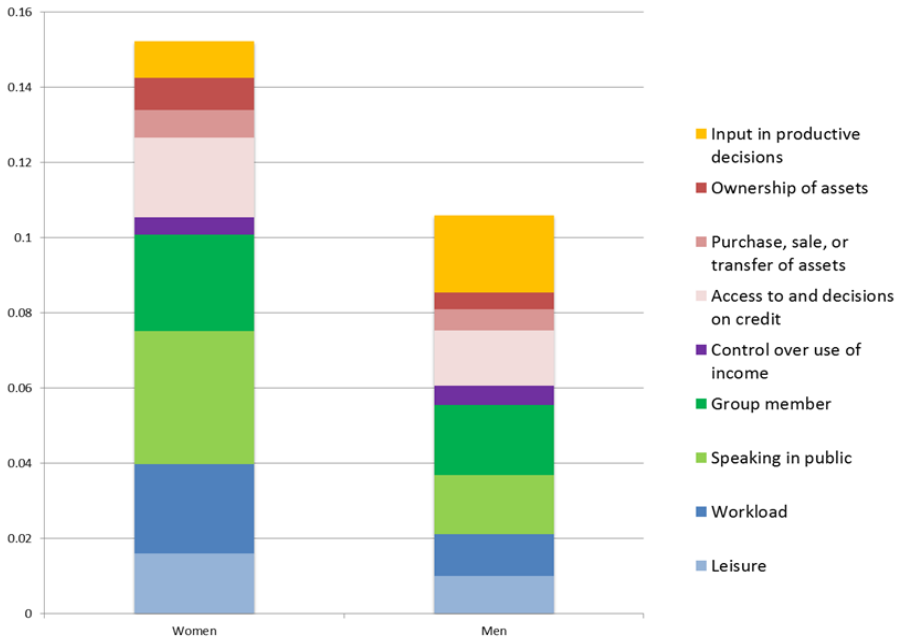
Figures calculated using the full sample of all female primary adults. Censoring is at 80 percent. 5DE N = number of females for whom score could be calculated. A total of 44 females do not have a 5DE score due to missing information for one or more indicators. GPI N = number of dual adult households where empowerment scores are calculated for both the male and the female.

Figure 2 Rwanda: Contributions to female disempowerment from 5 domains



Figures calculated using the full sample of all female primary adults. Censoring at 80%. Contributions are calculated as each domain's share of the total disempowerment score for women. The disempowerment score is 1 minus the empowerment score.

Figure 3 **Rwanda: Contribution to male and female disempowerment from 9 indicators**



Figures calculated using the full sample of all female and male primary adults. Columns show the average disempowerment score for women and men, and the contributions to the scores from each indicator. The disempowerment score is 1 minus the empowerment score.

As seen in Figure 2, the main contributors to female disempowerment in our sample is community leadership accounting for 40 percent of disempowerment, followed by time allocation (26 percent) and access to productive resources including credit (25 percent).

Figure 3 illustrates how the indicators contribute to male and female disempowerment showing, first of all, the extent to which women are less empowered than men (their disempowerment is larger); and second, that men are disempowered to a smaller extent than women in all indicators, except inputs in productive decisions. With respect to this indicator, qualitative findings among VUP beneficiaries and non-beneficiaries found that women make most decisions in planting; however, the study highlighted that it was mostly men who decide on the quality and type of crops to plant (Pavanello *et al*., 2015a). Women's disempowerment comes mainly from inadequacy in speaking in public, followed by workload and group membership and access to and decisions on credit. Disempowerment for men comes mostly from inadequacy in input in productive decisions and group membership, followed by speaking in public and access to and decisions on credit.

3.2.2 Results from regression analysis

Table 12 reports average marginal effects of the probit regression analysis. We follow the specification described in section 2.5.2, employ the individual sample of primary males and females and use two alternative definitions of VUP participation: a dummy variable for whether the individual belongs to a VUP public works beneficiary household; and a dummy variable for whether the individual himself/herself worked at a public works sites. Tables 13 shows the average marginal effects using the same probit specification, but the effects are estimated on the female and male primary adult individual samples separately. Table 14 shows the average

marginal effects using the subsample of men and women from households where both a primary adult man and women was interviewed, and using household fixed effects instead of sector fixed effects.

Results in Table 12 show no marginal effect on the probability of being empowered (as measured by the 5DE and the GPI indices) from VUP participation on either individual or household level. Table 13 confirms these findings when the regression is run by male and female samples separately. However, when using household fixed effects for the subsample of male-female pairs living in the same household (Table 14), results show a significant positive association between individual participation in VUP and the empowerment 5DE index. One explanation could be that women in female-headed households were already the key decision makers in their households, regardless of the VUP, so when we exclude them from this specification, we find a stronger empowerment effect from the VUP. However, Table 14 also shows that from that subsample of men and women from the same household, the VUP mostly empowered men as opposed to women, indicated by the negative average marginal effect of the interaction of VUP participation and the female dummy.

Turning to WEAI adequacy indicators, the analysis detects a highly significant average marginal effect on the probability of achieving adequacy in group membership and access to and decision-making about credit from VUP individual participation, when using the full sample of individuals (Table 12). Control over use of income is also positive but only significant at the 10 percent level. Adequacy in the control over use of income is also highly significant when using the VUP participation variable at household level; however, the average marginal effect from VUP participation at household level is negative for adequacy in group membership, but significant only at the 10 percent level. While the separate probit regressions for males and females (Table 13) found no effect on the probability of empowerment from individual participation in VUP public works, participation does increase the probability of achieving adequacy in access to and decisions about credit and control over use of income for women for both men and women.

Examining other determinants of empowerment and adequacy, Tables 12 and 14 show that women tend to have a significantly lower probability of being empowered (measured by 5DE) as opposed to men; and are less likely to achieve adequacy in speaking in public, in their ownership of assets and in achieving adequate workloads as opposed to men. An increase in age also increases the likelihood of being empowered as measured by the 5DE and the likelihood of achieving adequacy in all indicators except workload. In separate regressions by the female and male samples we find that age increases the likelihood of being empowered for both men and women (5DE), and for women, older age increases the probability of living in a household with no empowerment gap while for men this probability decreases (GPI). Finally, Tables 12 and 13 show that having some education (primary degree or higher) matters for empowerment in some instances; on the full sample (Table 12) we find positive effects on the probability of living in a household without an empowerment gap, in achieving adequacy in speaking in public, as well as in ownership of assets. For females, education also increases the probability of empowerment (5DE) and achieving adequacy in speaking in public, in credit decision and asset ownership (Table 13). Table 14, however, controlling for household fixed effects, results do not show a significant association between education and the outcome variables for the subsample of pairs from the same household.

Given the limitations of this study in obtaining a randomized sample of VUP beneficiaries and the lack of baseline data, the probit analysis does suffer from the caveat that direct attribution to the VUP programme is challenging and the above analysis should be read keeping this in mind. However, the findings provide some indication of the VUP's impact potential in certain

areas of empowerment. In addition, qualitative evidence found that when payments and number of workdays are more accessible and available, beneficiaries tend to associate and form groups for business generation, increasing their access and control over use of income (Pavanello *et al*., 2015a). Also, the fact that VUP payments are made through formal accounts (e.g. SACCOs), facilitating beneficiaries' access to financial services, explains how the VUP may increase beneficiaries' adequacy on access to and decisions about credit. That is, despite challenges in establishing causality in the regression analysis, findings are indeed backed up by qualitative evidence, lending more credibility to the conclusions.

Table 12 Rwanda: Probit regression on empowerment measures using individual primary adult sample: two definitions of participation in VUP public works (sector fixed effects)

	WEAI				*Adequacy indicators*											
	5DE		GPI		Speaking in public		Group membership		Access to and decisions about credit		Ownership of assets		Control over use of income		Workload	
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part	HH Part	Ind Part
VUP PWs ?	-0.072	0.092	-0.261	-0.065	-0.052	0.001	-0.054	**0.102***	0.046	**0.194*****	-0.112	0.043	0.041	**0.048***	-0.012	0.026
	(0.127)	(0.060)	(0.197)	(0.069)	(0.117)	(0.057)	(0.110)	**(0.058)**	(0.115)	**(0.058)**	(0.072)	(0.044)	(0.027)	**(0.026)**	(0.110)	(0.057)
(VUP PW)*(Female) ?	-0.018	-0.012	-0.006	0.082	0.062	0.070	-0.027	-0.068	-0.022	-0.054	-0.017	-0.017	0.005	-0.003	-0.059	-0.074
	(0.066)	(0.066)	(0.087)	(0.090)	(0.066)	(0.064)	(0.064)	(0.065)	(0.067)	(0.067)	(0.046)	(0.048)	(0.023)	(0.030)	(0.064)	(0.064)
Female ?	**-0.144*****	**-0.144*****	0.011	-0.025	**-0.331*****	**-0.318*****	0.037	0.050	0.017	0.031	**-0.078****	**-0.077*****	-0.014	-0.009	**-0.149*****	**-0.156*****
	(0.053)	**(0.042)**	(0.069)	(0.054)	**(0.050)**	**(0.039)**	(0.051)	(0.041)	(0.054)	(0.043)	**(0.037)**	**(0.029)**	(0.018)	(0.012)	**(0.050)**	**(0.040)**
Age	**0.039*****	**0.037*****	0.002	0.003	**0.021*****	**0.020*****	**0.019*****	**0.018*****	**0.029*****	**0.027*****	**0.016*****	**0.015*****	**0.007*****	**0.006*****	-0.003	-0.003
	(0.005)	**(0.005)**	(0.008)	(0.008)	**(0.005)**	**(0.005)**	**(0.005)**	**(0.005)**	**(0.006)**	**(0.006)**	**(0.003)**	**(0.003)**	**(0.002)**	**(0.002)**	(0.006)	(0.006)
Age squared	**-0.000*****	**-0.000*****	-0.000	-0.000	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	**-0.000*****	0.000*	0.000
	(0.000)	**(0.000)**	(0.000)	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.000)	(0.000)
Has some education ?	0.032	0.030	**0.110****	**0.109****	**0.100*****	**0.098*****	**0.054***	**0.053***	0.043	0.043	**0.041***	**0.038***	-0.011	-0.010	0.010	0.011
	(0.033)	(0.033)	**(0.045)**	**(0.046)**	**(0.032)**	**(0.032)**	**(0.032)**	**(0.032)**	(0.033)	(0.033)	**(0.022)**	**(0.022)**	(0.012)	(0.011)	(0.032)	(0.032)
Married ?	**0.063***	**0.066***	-0.040	-0.030	**0.095*****	**0.101*****	**0.088*****	**0.088*****	**0.105*****	**0.112*****	-0.007	-0.005	0.007	0.006	**-0.114*****	**-0.119*****
	(0.034)	**(0.034)**	(0.053)	(0.053)	(0.034)	(0.034)	**(0.034)**	**(0.034)**	**(0.035)**	**(0.035)**	(0.023)	(0.023)	(0.012)	(0.011)	**(0.033)**	**(0.033)**
Illness ?	0.025	0.025	0.046	0.044	0.011	0.012	**0.071***	**0.070***	**0.072***	**0.075****	-0.024	-0.026	-0.007	-0.005	0.042	0.041
	(0.037)	(0.037)	(0.055)	(0.055)	(0.036)	(0.036)	**(0.037)**	**(0.037)**	**(0.037)**	**(0.037)**	(0.024)	(0.024)	(0.012)	(0.012)	(0.036)	(0.036)
Dowry was paid for marriage ?	0.021	0.029	-0.034	-0.030	0.093	0.095	-0.044	-0.039	0.068	0.082	0.022	0.025	0.005	0.009	0.068	0.067
	(0.068)	(0.067)	(0.078)	(0.079)	(0.062)	(0.062)	(0.063)	(0.063)	(0.067)	(0.065)	(0.048)	(0.047)	(0.029)	(0.030)	(0.063)	(0.062)
Number of household members	-0.009	-0.007	-0.004	-0.006	-0.007	-0.006	0.003	0.004	0.002	0.005	0.001	0.002	-0.003	-0.003	0.006	0.005
	(0.009)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.006)	(0.006)	(0.003)	(0.003)	(0.009)	(0.009)
Number of shocks ?	-0.021	-0.020	-0.002	-0.003	-0.024	-0.023	-0.012	-0.012	0.032	0.032	0.002	0.002	**-0.023*****	**-0.022*****	-0.010	-0.011
	(0.021)	(0.021)	(0.026)	(0.026)	(0.020)	(0.020)	(0.020)	(0.020)	(0.021)	(0.021)	(0.013)	(0.013)	**(0.008)**	**(0.007)**	(0.020)	(0.019)
Number of observations	890	890	492	492	959	959	917	917	959	959	959	959	846	846	959	959
Adjusted R2	0.102	0.105	0.038	0.037	0.112	0.113	0.060	0.063	0.065	0.077	0.110	0.107	0.171	0.201	0.088	0.089

Average marginal effects reported; std errors clustered at village level, *** p<0.01, ** p<0.05, * p<0.1; ? denotes dummy variable;

Ind Part means that VUP PWs refers to individual participation in VUP public works, Ben HH means that VUP PWs refers to household participation in VUP public works.

Table 13 Rwanda: Separate probit regression on empowerment measures using individual primary adult male and female samples: individual participation in VUP (sector fixed effects)

	WEAI				*Adequacy indicators*											
	5DE		GPI		Speaking in public		Group membership		Access to and decisions about credit		Ownership of assets		Control over use of income		Workload (no time poor)	
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
VUP IND ?	0.080	0.072	0.039	-0.084	0.056	0.004	0.032	0.071	**0.134****	**0.191*****	0.028	0.048	**0.053****	**0.080***	-0.063	0.007
	(0.054)	(0.060)	(0.077)	(0.076)	(0.052)	(0.060)	(0.052)	(0.065)	**(0.052)**	**(0.067)**	(0.037)	(0.046)	**(0.026)**	**(0.042)**	(0.050)	(0.058)
Age	**0.042*****	**0.020*****	**0.043*****	**-0.036*****	**0.019****	**0.019****	**0.029*****	-0.001	**0.037*****	0.010	**0.022*****	0.006	**0.009*****	**0.009****	-0.007	-0.006
	(0.007)	**(0.007)**	**(0.011)**	**(0.011)**	**(0.008)**	**(0.008)**	**(0.007)**	(0.008)	**(0.007)**	(0.009)	**(0.004)**	(0.005)	**(0.003)**	**(0.004)**	(0.008)	(0.009)
Age squared	**-0.000*****	**-0.000*****	**-0.000*****	**0.000*****	**-0.000****	**-0.000****	**-0.000*****	-0.000	**-0.000*****	-0.000	**-0.000*****	-0.000	**-0.000*****	**-0.000*****	**0.000****	0.000
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	(0.000)	**(0.000)**	(0.000)	**(0.000)**	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	(0.000)
Has some education ?	**0.102****	-0.054	0.103	**0.119***	**0.133*****	0.043	0.059	0.057	**0.076***	-0.002	**0.064****	0.029	-0.003	**-0.076****	0.056	-0.052
	(0.043)	(0.045)	(0.064)	**(0.062)**	**(0.041)**	(0.048)	(0.041)	(0.049)	**(0.042)**	(0.053)	**(0.030)**	(0.035)	(0.020)	**(0.033)**	(0.042)	(0.046)
Married ?	0.025	**0.197*****	-0.016	0.060	**0.077***	**0.139****	0.032	**0.228*****	**0.082***	**0.192*****	-0.031	0.077**	-0.018	0.003	**-0.142*****	-0.017
	(0.045)	**(0.052)**	(0.070)	(0.082)	**(0.044)**	**(0.056)**	(0.042)	**(0.058)**	**(0.044)**	**(0.064)**	(0.031)	(0.036)	(0.019)	(0.021)	**(0.042)**	(0.060)
Illness ?	0.038	0.007	0.042	0.035	0.025	-0.008	0.067	0.087	**0.091****	0.057	0.004	-0.064	-0.012	0.037	0.026	0.078
	(0.047)	(0.057)	(0.076)	(0.077)	(0.045)	(0.058)	(0.045)	(0.064)	**(0.045)**	(0.065)	(0.032)	(0.041)	(0.018)	(0.039)	(0.045)	(0.060)
Dowry was paid for marriage ?	0.080	-0.123	0.013	-0.151	0.093	0.156	0.041	**-0.219***	0.118	-0.002	0.029	(dropped)	0.033	(dropped)	0.057	0.097
	(0.081)	(0.111)	(0.097)	(0.134)	(0.074)	(0.159)	(0.075)	**(0.117)**	(0.076)	(0.136)	(0.057)		(0.041)		(0.072)	(0.141)
Number of household members	-0.014	0.008	-0.022	0.020	-0.014	0.004	0.006	0.008	0.003	0.009	-0.009	**0.026****	-0.001	**-0.016***	0.005	0.009
	(0.011)	(0.013)	(0.017)	(0.018)	(0.011)	(0.014)	(0.011)	(0.014)	(0.011)	(0.015)	(0.008)	**(0.011)**	(0.004)	**(0.009)**	(0.011)	(0.013)
Number of shocks ?	0.000	**-0.049***	-0.017	-0.003	-0.010	-0.038	0.004	-0.037	**0.067****	-0.019	0.009	-0.006	**-0.028****	**-0.021***	-0.035	0.034
	(0.028)	**(0.029)**	(0.035)	(0.036)	(0.026)	(0.031)	(0.026)	(0.030)	**(0.026)**	(0.035)	(0.019)	(0.019)	**(0.012)**	**(0.012)**	(0.026)	(0.030)
Number of observations	570	320	246	246	614	345	586	331	614	345	614	270	427	165	614	345
Adjusted R2	0.086	0.191	0.083	0.075	0.047	0.113	0.064	0.114	0.086	0.098	0.101	0.200	0.202	0.324	0.096	0.071

Average marginal effects reported; std errors clustered at village level, *** p<0.01, ** p<0.05, * p<0.1; ? denotes dummy variable;

VUP PW IND denotes individual participation in VUP public works, F denotes regression run only on female sample, M only on male sample.

Table 14 **Rwanda: Probit regression on empowerment measures using sub-sample of individual primary adults in same household: individual participation in VUP public works (household fixed effects)**

	WEAI	*Adequacy*			
	5DE	Speaking in public	Group membership	Access to and decisions about credit	Ownership of assets
	(1)	(2)	(3)	(4)	(5)
VUP IND ?	**0.220****	-0.045	0.158	0.089	-0.053
	(0.092)	(0.093)	(0.160)	(0.131)	(0.102)
(VUP PW)*(Female) ?	**-0.257****	0.198	-0.033	**0.393****	0.061
	(0.112)	(0.121)	(0.204)	**(0.176)**	(0.124)
Female ?	**-0.160*****	**-0.588*****	0.072	-0.141	**-0.350*****
	(0.057)	**(0.056)**	(0.093)	(0.093)	**(0.066)**
Age	**0.098*****	**0.059*****	**0.086*****	**0.090*****	**0.077*****
	(0.009)	**(0.012)**	**(0.011)**	**(0.016)**	**(0.008)**
Age squared	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001*****	**-0.001*****
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Has some education ?	-0.041	0.081	-0.048	-0.088	0.116
	(0.078)	(0.063)	(0.110)	(0.096)	(0.077)
Married ?	**-0.338*****	-0.145	**-0.903*****	0.033	-0.149
	(0.128)	(0.210)	**(0.205)**	(0.199)	(0.185)
Illness ?	0.048	0.138	-0.069	0.123	-0.135
	(0.070)	(0.089)	(0.131)	(0.115)	(0.092)
Dowry was paid for marriage ?	-0.018	0.057	-0.263	-0.059	-0.005
	(0.123)	(0.092)	(0.192)	(0.180)	(0.090)
Number of household members	0.020	-0.033	**0.775****	**-0.328***	-0.062
	(0.040)	(0.049)	**(0.381)**	**(0.193)**	(0.050)
Number of shocks ?	-0.078	-0.044	**1.954*****	0.551	**-0.106****
	(0.053)	(0.304)	**(0.737)**	(0.498)	**(0.049)**
Number of observations	306	296	200	208	156
Adjusted R2	0.442	0.396	0.208	0.272	0.600

Average marginal effects reported; std errors clustered at village level, *** p<0.01, ** p<0.05, * p<0.1;
, ? denotes dummy variable; VUP PW IND denotes individual participation in VUP public works,

3.3 Programme Operations

Table 15 describes the operational aspects of the VUP and allows us to investigate the public works participation among our participant sample, by household type (double and female-only).

Participation in public works and income

Beneficiaries participated on average 45 and 42 days a year in public works, for double and female-only households respectively. However, it is important to remember that by sampling design, the survey omitted beneficiaries who participated in public works less than 10 days in the last twelve months. Figure 4 complements the picture by showing that the majority of beneficiary households worked between 1 and 3 cycles (of 15 days each). The results are consistent with the reported average days in financial year 2013-14 (Pavanello *et al*., 2015a).

In our sample, women form the majority of public works workers, when we consider double and female-only households together. In double households, women participate by 41 percent, and for 20 percent of these households, men and women alternate work at public works. Add to this the female-only households where only females participate in the public works, and it is clear that women make up the majority of public works performers. This is also consistent with the qualitative fieldwork by Pavanello *et al*. (2015a).

Average annual income from the VUP between double and female-only households is not significantly different, being on average about RWF 29 800 (39.80 USD) and RWF 24 900 (33.30 USD). Dividing the income reported by beneficiary households by the number of reported days of VUP work reveals that households did not receive their full entitlement of 1 000 RWF/day (1.34 USD/day), but rather received between 742 (female-only households) and 828 (double households) RWF/day. It is likely this is caused by delays in payments, meaning that households have not been paid for the total number of days worked in the last 12 months.

Only a small share of 8 percent in double households reported having obtained a similar job outside the VUP and only 1 percent in female-only households.

Distance to public works sites and payment points

PW sites are significantly closer (in time) to female-only households. On average, public works sites are 2.9 and 2.4 hours away from double and female-only beneficiary homes respectively. Collection sites are generally closer, but still remotely located from beneficiary households, about 2.4 hours distance from overall VUP households.

Public works projects

The majority of public works beneficiaries in our sample engage in road and bridge construction, followed by anti-erosive ditches and radical terraces. There are no observed differences between the type of work double and female-only households engage in.

Spending of last VUP payment

Most of the VUP income is spent on food, followed by the purchasing of assets and shoes or clothes for children. There are no differences observed between the way double and female-only households spend the VUP income.

Operational issues

Overall, in our sample, it is mostly women who collect VUP payments. In almost half of the double households, women collect the payments. About a half of VUP double households and a third of female-only households reported payments not being easily accessible. Most households that reported difficulty in accessing payment stated that waiting time at the collection site (e.g. SACCO office) is long, followed by delays in payment and not knowing when payments will be available.

Over half of VUP households stated that work at VUP sites is not easy, primarily because of to the high physical work that it involves, as well as the sites being too far, lacking means of transport to reach them more easily. Also, about half of the double household sample, and about 60 percent of female-only households, do not know where to go to file complaints about the programme.

Finally, we see that only about a fourth received training to perform their job. The qualitative fieldwork by Pavanello *et al*. (2015a) found that training courses are only provided to a minority of beneficiaries who worked in higher positions for the VUP public works, such as captains or supervisors, and not to all public works beneficiaries. This is despite the VUP manual stating that participants should receive on the job training (MINALOC, 2009:15). Whether this reflects lack of appropriate resources to undertake the trainings, or a realization that not all public works jobs require prior training, is not possible to answer in this analysis.

Table 15 **Rwanda: Programme operations, double vs female-only households**

	VUP sample		
	Double	Fem	*p-value*
Participation			
Number of days in PW	45.29	41.74	*0.223*
Worked min 10 days in PW	0.97	0.94	*0.305*
VUP worker is female (=1)	**0.41**	**0.99**	***0.000***
VUP worker is male (=1)	**0.39**	**0.00**	***0.000***
VUP workers are male and female (=1)	**0.20**	**0.01**	***0.000***
PW income			
Female collects VUP pay (=1)	**0.46**	**1.00**	***0.000***
Income from PW	29,786.00	24,887.00	*0.166*
Average daily renumeration	827.75	742.00	*0.296*
Distances to sites (to and from)			
VUP payment collection (min)	136.55	141.20	*0.721*
VUP PW site (min)	171.31	143.20	*0.285*
PW projects			
Anti-errosive ditches (=1)	0.40	0.40	*0.988*
Radical terraces (=1)	0.31	0.23	*0.276*
Roads and bridges (=1)	0.47	0.52	*0.521*
Spending of last VUP payment			
Food for HH or children (=1)	0.71	0.72	*0.872*
Shoes or clothes for children (=1)	0.23	0.31	*0.220*
Paying back loan (=1)	0.09	0.14	*0.192*
Savings (=1)	0.02	0.02	*0.996*
Education (=1)	0.10	0.07	*0.213*
Health expenses for HH or children (=1)	0.14	0.09	*0.259*
Assets (=1)	0.42	0.40	*0.725*
Investments for HH business (=1)	0.01	0.02	*0.493*
Operation issues			
Payment is not easy to access (=1)	0.47	0.33	*0.068*
Access to payment is not easy because… (=1)			
collection site is far	0.06	0.17	*0.175*
long waiting time at collection site	0.58	0.57	*0.918*
don't know when available/delays	0.45	0.53	*0.406*
unsatisfied with renumeration and deductions	0.05	0.10	*0.340*
PW work is not easy (=1)	0.52	0.54	*0.773*
PW is not easy because… (=1)			
hard physical work	0.89	0.88	*0.768*
do not have necessary skills	**0.02**	**0.00**	***0.049***
have children/dependants to care for	**0.01**	**0.04**	***0.048***
time conflict	0.01	0.00	*0.135*
site too far/no transportation	0.10	0.08	*0.620*
other reasons	0.13	0.14	*0.804*
Knows where to go with complaints (=1)	0.50	0.39	*0.130*
Received training for PW (=1)	0.26	0.21	*0.405*
Someone in HH has obtained similar job outside VUP	**0.08**	**0.01**	***0.041***

Double HH N = 271. Female HH N = 90

Std. errors clustered at sector level. Significant differences at 0.05 level in bold.

Figure 4 **Rwanda: VUP days worked in last one year**

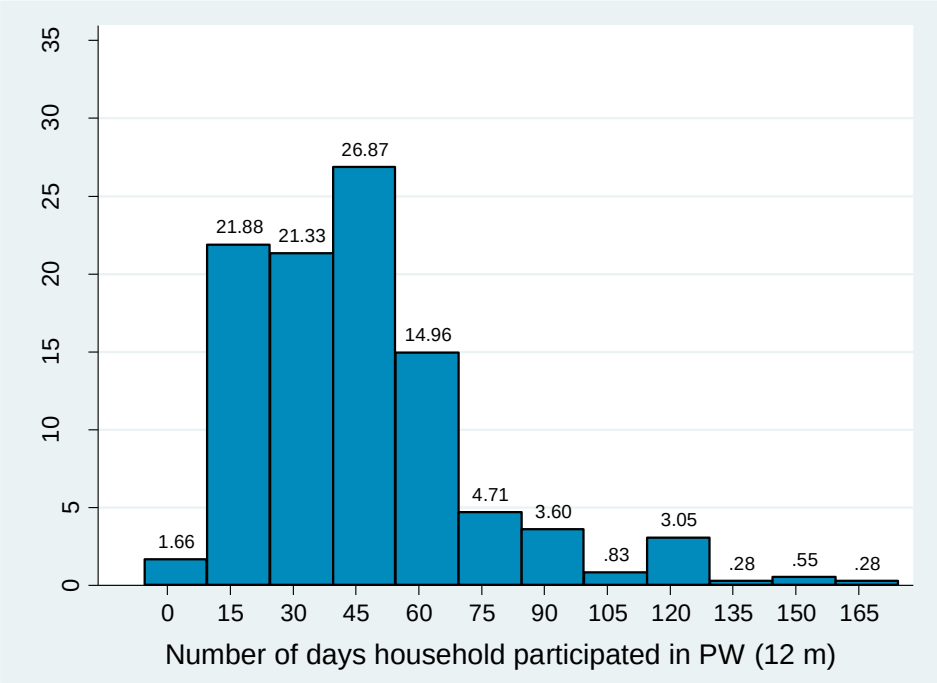
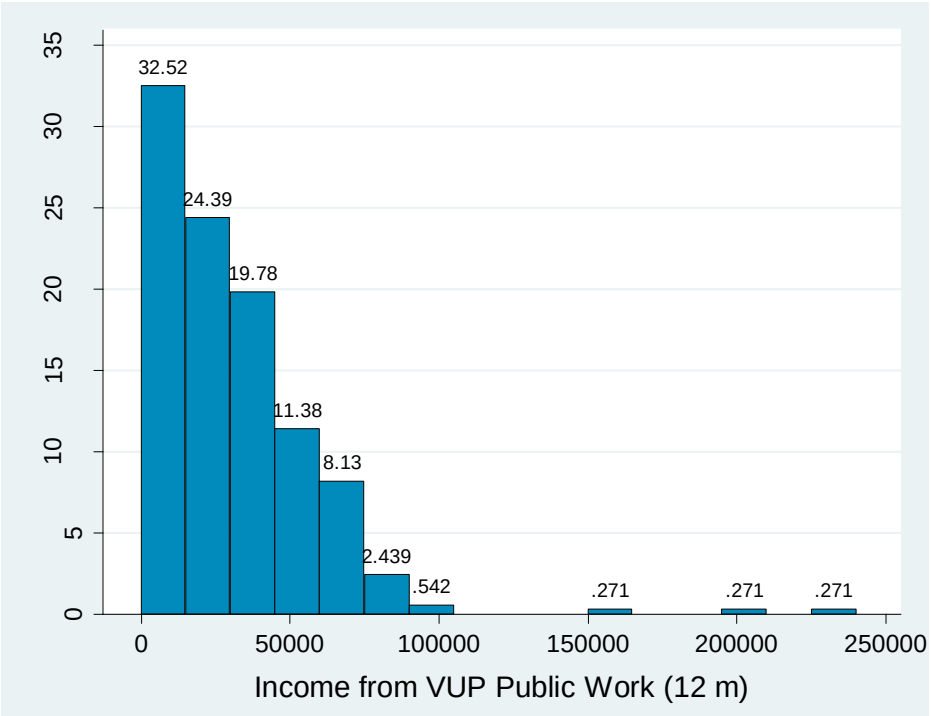


Figure 5 **Rwanda: VUP annual income (household)**



PART 4: CONCLUSIONS AND RECOMMENDATIONS

4.1 Economic advancement

The analysis suggests that the programme partially promoted women's economic advancement through increasing household cash incomes and by promoting their financial inclusion via access to SACCO accounts and VSLGs; however, gender imbalances in wage incomes and intra-household decision-making persist, which may decrease the ability of female beneficiaries to advance economically. More specifically:

- While **gender differences in cash incomes persist** with cash income in female-only households significantly lower than in double households, we do observe that VUP households report higher cash incomes and more income sources than comparison households, although we cannot attribute this impact to VUP in this study.
- VUP public works wage transfers functioned mainly for **smoothing household consumption,** particularly of food, and followed by the purchase of small assets, shoes and clothing.
- The study found gender inequalities in employment status and income generation, particularly in **wage employment**. Within the VUP sample, men are more likely to hold wage-paid jobs and earn significantly more income from paid jobs than women. In this light, the VUP is in a strategic position to help balance gender inequalities by facilitating women's access to paid employment, and particularly of female heads of households. The majority of public works workers are women and are also likely to retain – full or partial – control over their own incomes through SACCO accounts. Indeed, probit regressions results show correlation between VUP public works participation and achieving adequate control over use of income.
- The VUP only marginally promoted **employment outside public works** via new acquired skills. A small share of 8 percent in double households reported having obtained a similar job outside the VUP and only 1 percent in female-only households. **Training on activities related to public works** was only provided to a quarter of beneficiaries.
- The VUP may facilitate women's (and men's) **financial inclusion through SACCOs and VSLAs,** although borrowing from relatives and friends remains the main source of credit for both beneficiary and non-beneficiary households. The probit regression results suggests that individuals working in VUP public works are more likely to achieve **adequacy in access to and decisions about credit**, and this effect is particularly pronounced for women.

The study found that gender inequalities exist in the control over household assets and income, and workloads, with implications for women's economic empowerment:

- Despite women having high levels of responsibility in agricultural production, **women own fewer of agricultural assets than men**. This may suggest a division between day-to-day decision-making and managerial responsibilities *vis-à-vis* ownership control over assets and income for men and women. In fact, the data suggests that men experience more security of control over assets as they report to retain – to a higher extent than women – agricultural land, livestock and other assets (house, non-mechanized farm-equipment) after a spouse dies.

- **Women's overall work burden** may be of concern as women spend significantly more time on domestic tasks and have less leisure time for personal care and rest than men. This is found in both VUP and comparison samples. These imbalances have implications for women's ability to engage in other income-generating activities or to find time to rest.

Finally, the study also suggests that VUP public works may have not functioned as a safety net to serve as a buffer in times of stress and shocks among beneficiary households:

- The study observed both in VUP and comparison samples a high level of **food insecurity and vulnerability to shocks**. This assumption is supported by the fact that more than half of beneficiary households obtained less than RWF 25 000 in the last 12 months.

4.2 Power and Agency

Women in our sample, in both VUP and comparison households, showed on average a higher level of empowerment than the comparison group, however, the probit regression suggests that within double households, men are mainly empowered by the VUP, as defined by the 5DE Index. Some areas of empowerment leaving room for improvement are described as follows:

- Descriptive analysis found that men are more empowered in the public arena: **men speak up significantly more than women** to convey needs and priorities to authorities, protest misbehaviour of authorities and take part in decision-making in the community.
- Within the household, women report to be **participating in household decision-making to a high extent**, including in agricultural production and with regard to spending VUP income. However, men report women's participation in decision-making in a lower degree than that reported by women, signalling differences in the perceptions of men and women about their decision-making roles.
- Using the individual 5DE score as a measure of empowerment, data show that on average, the majority of women in our sample – both beneficiaries and non-beneficiaries – have a high level of empowerment, and on average, **high adequacy in most WEAI indicators of empowerment**. However, the probit regression shows no correlation between VUP public works participation and overall empowerment (5DE) in our sample, and suggests that overall empowerment (defined as per WEAI) is concentrated within the male participants in double households.
- Despite overall relatively high empowerment levels for the women in our sample, **major areas contributing to disempowerment for women** include: (1) access to and decision-making on credit, (2) ability to speak in public and (3) time poverty. In line with this, probit regressions on the full individual sample suggest that women are less likely than men to achieve adequacy in speaking in public and in ownership of assets, and are more likely to be time poor.
- Overall, results suggests that **VUP public works can play a strategic role** in increasing women's empowerment, but also that full potential is yet to be reached: while empowerment appears to be lagging behind in terms of credit, speaking in public and time use, these are indeed also areas that the VUP is promoting through, for instance, increased credit access and exposure to new social groups and public spheres (seen in the qualitative fieldwork). This provides some obvious entry points for the VUP to promote women's empowerment and decrease gender inequalities, particularly if the VUP is implemented as per design.

4.3 Operations

The study finds that the design and implementation of VUP public works need to be improved to allow for the promotion of female (and male) beneficiaries' empowerment. Low number of days available, delays in payment, distance to work sites and hard working conditions risk increasing gender inequalities in economic and social terms, particularly as women are the majority of public works labourers.

- Beneficiaries in our sample worked on average 45 and 42 days a year in public works, for double and female-only households respectively, which is **lower than the national VUP average**. Number of days worked is also lower than the required number of days in the Social Protection Strategy (71 days), with only about 13 percent of the surveyed VUP beneficiary households accessing more than 75 days of work.
- Calculations based on the reported data suggest that about 32 percent of household beneficiary wages had not being paid by the time the survey was conducted, lack of payments being more pervasive in female-headed beneficiary households. This is likely explained by **payment delays**, as reported in the qualitative study.
- Also, between a third and half the beneficiaries reported **payments not being easily accessible**. The most commonly reported reasons were waiting time at the collection site followed by delays in payment and not knowing when payments will be available.
- **Distance to public works sites** is considerable, being on average 2.5 hours away (return trip) from beneficiary homes. Just above half the beneficiaries stated that work at VUP sites is not easy, mainly due to the hard physical work that it involves, but also because the sites are too far and beneficiaries have no means of transport to reach them.
- Communication issues related to payments and complaints mechanisms need improvement. The majority of beneficiary households reported **not knowing** where to go to file complaints about the programme.

4.4 Additional remarks on the limitations of the study

This study encountered difficulties in establishing **attribution to the VUP**, posing a major limitation to the analysis and interpretation of results. This was the result of challenges encountered in the design of the study and the data collection:

- **Inability to construct a counterfactual for impact evaluation** was due to lack of randomization of sample selection of both VUP participants and a control group, a lack of baseline data with information on income, employment participation and wages, as well as empowerment indicators related to intra-household decision-making – representative of VUP beneficiaries – in one or more districts or sectors.
- Difficulties in tracking VUP beneficiaries as per official targeting guidelines. The **public works payroll lists and targeting lists** obtained from the Rwanda Ministry of Local Government (MINALOC) and National Institute of Statistics (NISR) were often incomplete and had several inclusion and exclusion errors of beneficiary households, which was discovered and confirmed during fieldwork. These inconsistencies had implications for the sampling strategy that had to proceed without probability sampling, further impacting **representativeness** and causing **potential bias** in our results.

Nevertheless, the study attempts to address potential bias by **triangulating study results** with qualitative research information. In fact, our findings are largely consistent with the qualitative work undertaken in southern and eastern parts of Rwanda by FAO (Pavanello, Pozarny and De la O Campos, 2015) and with reports available about VUP public works. In addition, the study tried to limit unobservable variation and address potential bias by sampling sectors in one agro-ecological zone (potentially decreasing sample variation), and by introducing econometric analysis.

4.5. Recommendations

Although women's empowerment is not the main objective of the VUP public works programme, this analysis highlights how the programme has the potential to act as a catalyst for economic advancement and poverty reduction through contributing to women's economic advancement, decision-making power and agency.

To capitalize on the potential of the VUP to advance women's empowerment, attention should be given to:

- Ensuring that **wage payments are delivered on time** and that VUP public works beneficiaries **work a minimum of days** in each financial year (e.g. at least 71 days as outlined in the Social Protection Strategy). Beyond gender-sensitive design, reducing the gap between design and implementation should be a priority.
- Strengthening the programme **targeting mechanism** to ensure compliance and consistency in implementation.
- Programme design should take into account **existing gender inequalities**, particularly related to women's disadvantages in accessing cash wage employment. The VUP is in a strategic position to increasing women's wage employment opportunities by offering secure and capacity-enhancing job opportunities; however, to reap their full potential public works jobs need improvement from their current implementation.
- Sensitize VUP female beneficiaries who are opening accounts with a financial institution for the first time on the importance of **holding their own bank accounts** as a way of promoting economic decision-making their economic advancement, power and agency and can ultimately be a way to enhance females' control over their own incomes.
- In view of the potential impact of the VUP on group membership, establish or extend support to **local community spaces**, including public works sites, where female beneficiaries can come together to discuss problems, find support and strengthen social relations. Such spaces could also be used to facilitate exchange of information on the VUP between programme staff and beneficiaries and to provide **sensitization activities** focusing on group formation, economic and livelihoods development.
- Developing a **monitoring system** that enables regular tracking of public works beneficiary households and individuals directly working at public works sites, including the cumulative number of days that households/individuals have worked in different projects, number of projects participated in and trainings attended.

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ANNEX 1: Sampling design

The study employs a multistage sampling of beneficiary households and comparison (eligible non-participant) households. This section describes the sampling method and the challenges encountered in the sampling.

Sample frame

The participant sample frame is the total population of VUP public works participant households actually employed by the programme, in sectors belonging to VUP cohorts II and III. For the comparison group, the sample frame is VUP targeted participant households for financial year 2014-15 who were not participating in the VUP public works programme at the time of the survey but were eligible to receive support (e.g. belonging to *Ubudehe* categories 1 and 2 and targeted by the VUP programme).

Multistage sampling without Probability Proportionate to Size (PPS)

The survey sampling was carried out in three stages. In the first stage, the province, districts and sectors of focus were chosen. In the second stage, villages were randomly selected as the primary sampling clusters. In the third and last stage, households were randomly selected within the selected villages.

Originally, the study intended to use a probability sampling approach, with cells or villages as the primary sampling unit (PSU). Clusters were intended to be randomly selected with replacement, using the cumulative PPS. The public works payroll lists (current and future) obtained from the Rwanda Ministry of Local Government (MINALOC) and National Institute of Statistics (NISR) constitute our only tracking mechanism of targeted and actual participant households in public works. However, while generally available and with the necessary tracking information included (e.g. full names, locations, days worked, etc.), these lists were often 'patchy' and had several inclusion and exclusion errors. For example, a number of participants' (VUP) lists at village level included households from *Ubudehe* category 3, which is not officially VUP eligible. In other cases, enumerators would find that eligible households from eligible lists had already begun working on public works sites, or households that were listed as participants had not actually participated in public works in the past year. In summary, although lists of targeted and actual public works beneficiaries do exist for each sector, the lists turned out not to be a complete reflection of reality, so it was not possible to establish the total number of public works participants from these lists. Without the total number of beneficiary and eligible households, PPS was not possible. Despite this obvious shortcoming, the lists still provided the best available picture of the public works participants, and we relied on the information they provide as the basis for our sampling, but proceeded without PPS. The three-stage sampling strategy employed in the absence of probability sampling is described in further detail below.

Stage 1: Sampling the province, districts and sectors

As a first step, the study selected the geographical focus areas of the study. Our overarching selection criteria are related to comparability, poverty levels and availability of the VUP public works. We first select the province (the highest administrative and geographical unit) and then districts within the province and sectors within the districts (the subsequent administrative and geographical units) based on the same set of criteria:

1. Comparability: Sampling took place in the same agro-ecological zone to enhance comparability across sectors and districts.
2. Poverty: Poorer districts are given priority as the study is interested in the empowerment impacts of the VUP on the poorest segments of the population. In addition, the participant sample will necessarily include the poorest sectors as earlier VUP cohorts prioritized the poorest sectors by design.
3. Availability of VUP public works: Districts and sectors where the number of public works projects and public works jobs offered were highest are prioritized. This is to ensure that the study finds participants who have indeed engaged in public works, bearing in mind that eligible households in VUP sectors are not necessarily entitled to work. By choosing locations where the project density is high, the study is more likely to capture participants that have had relatively high exposure to the programme.

Rwanda's Southern province was chosen as the province of study. Within the Southern province, geographical focus is on the Central Plateau area. The Central Plateau is an appropriate area as not only is it one of the most expanded agro-ecological zones in Rwanda, but it also contains some of the poorest districts in Rwanda (NISR, 2012) and the delivery of employment through public works within the sectors selected has been effective.

Districts and sectors in Southern province that best fulfil the above criteria were then chosen for conducting the survey. Four out of a total of six districts in Southern province in the same agro-ecological zone were selected for the survey, while a total of ten sectors were selected in the four districts. The selection was based on information provided by LODA on the implementation of the programme; as well as on information of poverty levels (ECIV3) and agro-ecological zones (FEWS NET). Table 1 below shows the final districts and sectors for the beneficiary and comparison subsamples.

Table 1 **Districts and sectors in the study sample - Southern province**

District	Sector	Type of sector	Entry year	# of villages
Gisagara	Kigembe	PW beneficiary - cohort II	2009	5
	Muganza	PW beneficiary - cohort III	2010	5
	Musha	Comparison	2015	11
Muhanga	Muhanga	PW beneficiary - cohort III	2010	7
	Kibangu	Comparison	2015	8
Nyanza	Nyagisozi	PW beneficiary - cohort II	2009	5
	Cyabakamyi	PW beneficiary - cohort III	2010	5
	Mukingo	Comparison	2015	10
Ruhango	Byimana	PW beneficiary - cohort V	2012	7
	Mbuye	PW beneficiary - cohort VII	2014	5

Source: Laterite, 2015.

Originally, it was planned to undertake the survey in 12 sectors (three per district); however, the field team encountered problems in Muhanga district as the VUP lists of Kabacuzi sector were not available. This sector was eventually dropped, and in order to compensate, the number of surveyed villages in sectors Byimana and Muhanga were slightly increased (two villages were added in each of those sectors) (Laterite, 2015). Furthermore, the team also faced difficulties in Ruhango district, which stands out as different from the others: no comparison group is surveyed, and public works cohorts are V and VII, respectively. This selection was due to particular difficulties in obtaining the participant and eligible lists from this district. Finally, it was not possible to obtain any lists for either the comparison sectors or for the preselected public works cohort II and II sectors, so a choice was made to survey two sectors in cohorts V and VII instead, since those were feasible to survey given the available information and the timeframe (Laterite, 2015).

Stage 2: Sampling of villages

Once the province, districts and sectors were chosen, the survey villages were randomly selected within each sector. A total of 68 villages were visited. For the participant sample, only villages with 15 or more participant households were kept in the list prior to the random selection.[15] In order to assure that the participant households had actually participated in public works, only those that according to the participant list had participated in public works for **at least ten days in the previous 12 months** were considered eligible for interview and kept in the lists prior to selecting the villages. The household questionnaire also included a question on number of days worked in the start of the survey to verify this information.

For the comparison sectors, the procedure of selecting villages with a minimum number of eligible households was the same, using the list of households in sectors where the VUP public works will be introduced in the financial year 2014-2015. However, the number of randomly selected villages per sector was generally higher as we had fewer sectors to select from, and so a minimum of 12 eligible households in each village was used as the cut-off number.

Stage 3: Sampling of households and individuals

After randomly selecting the villages, nine households were randomly selected within each village. Replacement households would be contacted, in case the households selected for survey were unavailable at the time of survey or did not meet the requirement of minimum public works participation. Generally, an enumerator would go back to the same household a maximum of three times in order to conduct the survey, and only thereafter move on to a replacement household.

The study conducted three interviews per household: The head of household (or the most knowledgeable person on the specific survey section) was interviewed for the household questionnaire, while the VUP survey module was answered by the VUP worker in the household (only asked to participant households). Following the household questionnaire, the two primary adults of the household were interviewed separately, answering the same individual questionnaire. To the extent possible, enumerators would interview a male and a female adult respondent, preferably the husband and wife of the household where applicable. In cases where there was not an obvious male-female pair of adults in the household, the enumerators were instructed as much

[15] This was in order to accommodate survey logistics, as enumerators would need to interview nine households in each village to make survey scheduling work within a reasonable timeframe. Using 15 as a cut-off allowed for a number of replacement households present in the same village in case some of the nine households were not available for interview.

as possible to interview two adults of the opposite sex, by typically interviewing the head and the eldest son/daughter, as long as he/she meets the criteria of being no less than18 years of age (a widowed female primary adult and her 19-year-old son living with her, for example). In a few cases, pairs of adults of the same sex were interviewed where opposite-sex pairs were non-existing. Furthermore, it was not possible to undertake two individual interviews in all survey households, in cases where there was only one adult living in the household, or the second adult was unavailable at the time of interview. In these households, only one individual survey was conducted. Tables 2 and 3 show the distribution of households and individuals surveyed by district.

Table 2 **Households surveyed, by district and participation**

	All households			Female-only households		
District	**Total**	**VUP**	**Comp.**	**Total**	**VUP**	**Comp.**
Gisagara	189	104	85	55	21	34
Muhanga	139	67	72	37	16	21
Nyanza	180	90	90	47	21	26
Ruhango	108	108	0	33	33	0
TOTAL	**616**	**369**	**247**	**172**	**91**	**81**

Table 3 **Individuals surveyed, by district and participation**

	All individuals			Individuals in female-only households		
District	**Total**	**VUP**	**Comp.**	**Total**	**VUP**	**Comp.**
Gisagara	292	169	123	69	26	43
Muhanga	222	107	115	48	21	27
Nyanza	277	139	138	56	25	31
Ruhango	168	168	0	40	40	0
TOTAL	959	583	376	213	112	101

ANNEX 2: Modifications to original WEAI undertaken for the study

The WEAI, the 5DE and the GPI are designed as national figures based on data at individual level. We can hence employ the WEAI methodology to calculate these indices for our total sample, e.g. we construct our sample WEAI, sample 5DE and sample GPI, representing all women in our data. However, we are also interested in comparing empowerment measures between individuals in and outside the VUP programme. Hence, we need to adapt the methodology to allow for meaningful individual-level variables that can be used in comparative analysis.

For the 5DE, this is straightforward. The individual disempowerment score used to construct the 5DE is calculated as:

$$c_i = w_1 I_1 + w_2 I_2 + \dots w_d I_d$$

We can then easily calculate the **individual 5DE$_i$ empowerment** score as:

$$5DE_i = 1 - c_i(k)$$

with *k* denoting a censoring of the variables.

The **individual gender parity gap GPI$_i$** is calculated as the normalized gap between the male and the female disempowerment score in dual households (with both a male and female adult) where the female is disempowered relative to the man (her score being less than the male's):

$$GPI_i = 1 - \frac{c'_i(k)^W - c'_i(k)^M}{1 - c'_i(k)^M}$$

In dual households were no gap exists, the individual parity index is set to 0.
Lastly, based on the individual 5DE empowerment score and the individual GPI, we can calculate the individual WEAI as a weighted average of the two:

$$WEAI_i = 0.9 \cdot 5DE_i + 0.1 \cdot GPI_i$$

Adaptation of the WEAI Survey

The WEAI individual survey is administered to the main male and main female of the household and is used to construct the 5DE score for the two individuals. This study employs adapted versions of the two surveys in order construct the 5DE score, the GPI and the WEAI for our sample. In addition, the surveys allow for in-depth analysis of certain empowerment domains, for instance, they contain elaborate modules on decision-making, ownership of assets and participation in social networks. That is, we can use the data collected to construct the empowerment score and indices, but also to unpack specific elements of empowerment related to our three areas of enquiry.

5DE Domains	Indicator	Original weight	FAO weight	Indicator changed from original?
Production	Input in productive decisions	1/10	1/5	No
	Autonomy in production	1/10	0	Not included
Resources	Ownership of assets	1/15	1/15	No
	Purchase, sale or transfer of assets	1/15	1/15	Two questions replaced with two others
	Access to and decisions about credit	1/15	1/15	VUP added as credit source
Income	Control over use of income	1/5	1/5	Definition of ownership slightly different
Leadership	Speaking in public	1/10	1/10	One context added
	Group member	1/10	1/10	No
Time	Workload	1/10	1/10	Survey codification modified
	Leisure	1/10	1/10	No

ANNEX 3. Power Calculations

Other studies have investigated rural women's empowerment in Rwanda and data on empowerment is available, including similar data to construct the WEAI. We conducted this exercise using data available from USAID/IFPRI in Rwanda from 2013. The data is similar to that collected in our study with the purpose of constructing the WEAI.

The power calculations are based on three 'effects of interest' for which the study needs to ensure sufficient statistical power:

- Expected impact of empowerment (as defined by WEAI)
- Expected impact of participation in non-agricultural wage employment
- Expected impact of active membership in producer organizations or other associations

The study uses the following formula for computing power calculations. It assumes that the sample is equally divided between beneficiary and comparison observations and that both groups have the same standard deviations:

$$N = \left[\frac{4\sigma^2(z_{\frac{a}{2}} + z_\beta)^2}{D^2}\right][1 + \rho(H-1)]$$

Where:

N= total sample size

D= the difference in means of effect of interest (or effect size)

σ = the standard deviation of the outcome metric

$z_{a/2}$ = alfa confidence level of .05 (95%) = 1.960

z_β= beta of statistical power .80 = 0.842

ρ= intra-cluster correlation coefficient

H= number of observations sampled in each cluster (15/19)

The intra-cluster correlation coefficient ρ (Rho) is calculated based on available data on empowerment, participation in wage employment and participation in associations respectively in the selected clusters, using the following formula:

$$\rho = \frac{s_b^2}{s_b^2 + s_w^2}$$

Where: s_b^2 is the variance between clusters and s_w^2 is the variance within clusters.

Therefore, with: α=1.96, β=0.842, p=0.5 and H=15/19, the required sample size for achieving sufficient statistical power to test H_0 based on the effects of interest is shown below.

The table below shows the required sample size for each indicator of interest in the Southern province. The expected impact on empowerment indicators reflects a hypothetical impact as a

result of the VUP which in our view would be a minimum to indicate that the programme empowers women. The table confirms that the proposed sample size has sufficient statistical power to measure the expected impacts within the geographical area of interest.

Table A1 Required sample size, by effects of interest

Impact on outcome:	Expected (desired) impact as a result of VUP public works	Difference in means (D)	Individual sample (beneficiary and comparison groups)	Household sample (beneficiary and comparison groups)
Decreased disempowerment (WEAI)	28%	0.030	874	437
Participation in wage employment	30%	10.6%	1 187	594
Membership in associations (producers)	30%	10.9%	1 113	557

Food and Agriculture Organization of the United Nations (FAO)

Viale delle Terme di Caracalla

00153 Rome, Italy

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