

CHARACTERIZATION OF SMALLHOLDER FARMER HOUSEHOLDS AND FINANCIAL INSTITUTIONS IN THE SOUTHERN PROVINCE OF RWANDA

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ABSTRACT

Improving financial inclusion and access to agricultural credit for smallholder farmers in Africa is vital in meeting the challenges of increasing global food demands. Various international organizations and governments on the continent have increased budgetary allocations to agriculture to encourage private sectors and financial institutions to invest and make agricultural loans available. However, access to credit among smallholder farmers remains sub-optimal, with one of the most significant barriers being information asymmetry. This study aims at better understanding smallholder farmer and financial institution typologies in the southern province of Rwanda to close the gap in the asymmetry of information that may exist between parties. The study utilized a cross-sectional, province-wide random sampling design of farmers and financial institutions, and data collected from structured interviews were analyzed using multivariate techniques. Results show that the largest group of farmers (defining 45% of the clusters) represents smallholder farmers who own less than an acre of land, practice terracing, do not use agricultural inputs, have been in agriculture for at least four years or more, and have two children below five years of age. The largest cluster amongst the financial institutions (defining 82%) have refinancing, rescheduling, or collateral release as measures for managing loan defaults, with loan variable (not fixed) payment periods and targeted credit schemes for farmers. The length of the payment period is the most pronounced defining characteristic for this cluster. Hence, there is need to strengthen and augment efforts to increase agricultural inputs used by smallholder farmers. That will enhance agricultural productivity and enable the farmers to access more significant amounts of credit from institutions with loan ceilings based on farmers' agricultural productivity. Finally, we recommend that financial institutions adopt more refinancing and rescheduling mechanisms for managing loan defaults rather than collateral release or foreclosures for the more resource-constrained farmers. This is particularly relevant as they can be a significant barrier to credit access among farmers for whom a loss of land would be too great of a risk.

Keywords: *Agricultural credit, Information asymmetry, Financial access and use, Smallholder farmers, Financing institutions, Characterization*

1. INTRODUCTION

The role of agribusiness in international development is arguably one of the most critical sectors for developing countries, and its significance cannot be overstated (World Bank, 2020). Its contribution to meeting current and future food demands has global implications (Santpoort, 2020), especially in developing countries where food demand is expected to triple in the next 30 years (FAO, 2020b). However, if current practices within the industry remain unchanged, global food production will fail to meet this growing demand (FAO, 2020a), resulting in hunger and food insecurity in the coming decades (FAO, 2017). For example, the production of cereals (>10 million tons), tubers (>5 million tons), and legumes (>500,000 million tons) in most African countries is higher than it was a decade ago (Ritchie & Roser, 2020), yet most countries are still unable to meet domestic demand and are forced to import more than 50 percent their food supplies (FAO, 2020b; FAO, 2017). The Food and Agricultural Organization (FAO) currently estimates that 34 of the 44 countries that require external food assistance are African countries (FAO, 2020b).

Numerous global efforts have been instated to augment agricultural productivity, especially among smallholder farmers who produce 70 to 80% of the world's food (Ricciardi *et al.*, 2018). Likewise, investment in agriculture (FAO, 2019c; World Bank, 2019) and financial inclusion of smallholder farmers (D'Souza, 2020; World Bank, 2019) is widely promoted. The World Bank, for instance, invested USD5.4 billion in agribusiness in 2019 (World Bank, 2020), and even central governments like Rwanda have increased their budgetary allocations for agriculture in recent years (FAO, 2019a). Part of those allocations is meant to increase access to agriculture credit to farmers, which is one of the most challenging constraints in smallholder agribusiness development (Okoruwa *et al.*, 2020; FAO, 2019b; Akanbi *et al.*, 2020).

Access to credit amongst farmers remains patchy and, when available, sub-optimal in developing countries (D'Souza, 2020). One of the most significant barriers is information asymmetry (Herliana *et al.*, 2018; D'Souza, 2020; Fuglie *et al.*, 2020). Information asymmetry in the context of access to credit refers to

a situation in which both the farmers and financial institutions have little information about each other. That usually results in high-risk perceptions of agribusiness on the part of the financial institutions (Herliana *et al.*, 2018). To correct this bias, providing farmers and financial institutions accurate characterization of each party could help inform their choices and decisions, which in turn could lead to improving access to credit and loan taking (Mitra *et al.*, 2018).

Information asymmetry is one factor holding back the amount of agricultural credit made available and disbursed by commercial banks (D'Souza, 2020). Globally, the rates of agricultural loans disbursed by commercial banks remain low, increasing from 2.4% in 2016 to only 2.9% in 2017 (FAO, 2018). Which is one reason why less than half of the smallholder farmers in sub-Saharan Africa able to access the agricultural credit they need (World Bank, 2018). In Rwanda, of the smallholder farmers who applied for an agricultural loan less than 40% got it (AFR, 2019). Possibly, there are multiple issues such as lack of collaterals by the farmers or fear of perceived risks that could be attributed to this gap, but chief among them is information asymmetry (Zegarra, 2019; Mazeri & Saadouni, 2019; Niinimäki, 2018; Mitra *et al.*, 2018; Hung, 2017). However, only a few studies have attempted to characterize and understand smallholder farmers and their access to financial services in Rwanda (see, for instance, Bidogeza, 2009). Moreover, there is no empirical study that has previously analyzed the smallholder characterizations with that of financial institutions in Rwanda. Therefore, the purpose of this study was to investigate the smallholder farmers' characteristics in partaking of agricultural credit schemes offered by financial institutions in the Southern Province of Rwanda.

2. METHODS

2.1 Study design and setting

The study adopted an analytical cross-sectional, positivist type survey design that enabled the principal investigator to collect a representative sample of smallholder farmers in the Southern Province of Rwanda. Additionally, we collected data on financial institutions headquartered in the city of Kigali. The Southern Province is made up of eight districts that include Kamonyi, Huye, Gisagara, Nyamagabe, Muhanga, Nyanza, Nyaruguru and Ruhango. Within those districts are 101 sectors, 532 cells and 3,501 villages. Kigali is the capital city and home to all financial institutions in Rwanda.

2.2 Sampling

The study population comprises smallholder farmers (n=150) and staff in financial institutions (n=17), from which information was gathered and used to develop respective typologies for analysis. A multistage sampling procedure was used to distinguish the district (stage 1), sector (stage 2), cell (stage 3), village

(stage 4), and household levels (stage 5). Districts were stratified so the smallholder farmer population sampled could be considered representative at the provincial level. Simple random sampling was then conducted in each stratum to sample one sector in each, followed by the stratification of those sectors and a subsequent simple random sample of one cell in each of them. This resulted in a total of 16 cells that were further randomly sampled to select a village from each of them. Thus, at this stage, the sampling frame had 16 villages, where household surveys were conducted using convenience sampling. The study used structured interviews to collect data from smallholder farmers.

As for the financial institutions, a census of all the 17 available institutions in Kigali city was made and administrative staff at each institution were purposively selected.

2.3 Data analyses

Characterization of smallholder farmers and financial institutions was done using principal component analysis and cluster analysis. Both univariate descriptive statistics and multivariate statistical techniques were employed for the analysis of data. Principal Component Analysis (PCA) was first done, so that the most highly correlated variables of smallholder farmer characteristics could be identified and hence considered for cluster analysis. In accordance with Kaiser's criterion, all factors exceeding an eigen value of 1 were retained and considered to be principal components (Kaiser, 1970). For cluster analysis, the number of clusters was determined using the K-means clustering method. Then, the principal components were clustered into four, and the cluster membership of each farmer was identified with respect to the principal components determined. Membership of each cluster was determined, and their typology was assessed according to their definitive characteristics of the farmers and the financial institutions, respectively.

3. RESULTS

3.1 Farmers' socioeconomic characteristics

Almost all the farmers were adults in the ages of 40 to 50 years (Table 1). Almost two thirds of them were male (62.0%), and more than three quarters had received formal education (76.7%). More than a third of them reported that they were residing in households composed of more than five people (39.3%), with one child under five years (38.7%). More than three quarters of the smallholder farmers had been farmers four years and above (88.0%), and almost a quarter of them owned 5 acres of land (22.7%). More than a third of the smallholder farmers practiced intercropping (40.7%), while more than three quarters of them were not practicing shifting cultivation (82.0%). Almost two thirds of them reported that they were not using any irrigation (65.3%). More than three quarters of the farmers reported that they owned the land they were

cultivating on (78.0%), while for those who were not landowners, almost two thirds were renting it (63.6%). The majority of the farmers reported that their household members provided farm labor (73.3%), while for those who did not have household farm labor, it was hired (77.5%). More than a third of the farmers reported that they grew three crop types (43.3%), and spent 100,001–200,000 RWF, an estimate of (100-200 USD) per crop season (34.7%). More than three quarters of the farmers reported that they used chemical inputs during cultivation (82.0%), with more than a third of them using pesticide and organic fertilizer (40.7%). Almost all the farmers

reported that they were not using agricultural inputs (93.3%). In this study, agricultural inputs refer to use of the improved seed, grafting, organic compost, compost tea, manure, and biochar as well as biological pest control bio-stimulants that promote favorable microbial populations and plant growth. For those who used some form of agricultural inputs, most of them used improved seed (80.0%). Half of the farmers reported that they practiced terrace cultivation (50.7%), and the majority practiced crop sequencing (64.7%). More than a quarter of the farmers reported that they earned between 100,001 – 200,000 RWF from a farm each season (30.0%).

Table 1: Socioeconomic characteristics of the smallholder farmers

Variable	N	%	Variable	N	%
Age			Own land cultivated on		
18 - 28 years	16	10.7	Yes	117	78.0
29 - 39 years	52	45.3	No	33	22.0
40 - 50 years	74	94.7	Land use agreement if not owned		
> 50 years	8	100.0	Lease hold	12	36.4
Gender			Rental	21	63.6
Female	57	38.0	Household members provide labor		
Male	93	62.0	Yes	110	73.3
Formal education			No	40	26.7
Yes	115	76.7	Labor source on farm if not members		
No	35	23.3	Hired labor	31	77.5
Household size			Machinery	9	22.5
One	5	3.3	Crop types grown		
Two	17	11.3	One	8	5.3
Three	24	16.0	Two	14	9.3
Four	32	21.3	Three	65	43.3
Five	13	8.7	Four	46	30.7
More than five	59	39.3	Five	13	8.7
Number of children under five years in household			More than five	4	2.7
One	58	38.7	Cost per crop season (In RWF)		
Two	51	34.0	< 100,000	23	15.3
Three	28	18.7	100,001 - 200,000	52	34.7
Four	12	8.0	200,001 - 300,000	54	36.0
Five and more	1	.7	300,001 - 400,000	18	12.0
Duration as a smallholder farmer			400,000 - 500,000	1	.7
Less than 1 year	4	2.7	More than 500,000	2	1.3
One year	5	3.3	Use any chemical inputs during cultivation		
Two years	5	3.3	Yes	123	82.0
Three years	4	2.7	No	27	18.0
Four years and more	132	88.0	Agricultural inputs used		
Size of land owned			Organic fertilizer	22	14.7
Less than 1 acre	35	23.3	Inorganic fertilizer	21	14.0
1 acre	32	21.3	Pesticide and inorganic fertilizer	36	24.0
2 acres	15	10.0	Pesticide and organic fertilizer	61	40.7
3 acres	27	18.0	Inorganic and organic fertilizer	10	6.7
4 acres	7	4.7	Use any agricultural inputs		
5 acres and more	34	22.7	Yes	10	6.7
Cropping systems usually practiced			No	140	93.3
Intercropping	61	40.7	Agricultural inputs used		
Mixed cropping	54	36.0	Improved livestock	2	20.0
Mono cropping	35	23.3	Improved seeds	8	80.0
			Practice Terrace Cultivation		

Practice shifting cultivation			Yes	76	50.7
Yes	27	18.0	No	74	49.3
No	123	82.0	Practice crop sequencing		
Use any irrigation			Yes	97	64.7
Yes	52	34.7	No	53	35.3
No	98	65.3	Income from farm each season		
			< 100,000	32	21.3
			100,001 - 200,000	45	30.0
			200,001 - 300,000	24	16.0
			300,001 - 400,000	27	18.0
			400,000 - 500,000	12	8.0
			More than 500,000	10	6.7

3.2. Characteristics of the financial institutions included in this study

Almost all the financial institutions we sampled were privately owned (94.1%) (Table 2) and reported to be providing targeted agricultural credit to smallholder farmers producing maize and rice (70.6%). Additionally, the majority of institutions provide agricultural input premiums (64.7%). Close to two thirds of the institutions sampled were reported to be providing agricultural credit to about 10,000 – 15,000 smallholder farmers annually (64.7%). More than

three quarters of the institutions reported that they had no established ceiling rates for lending to smallholder farmers (82.4%). For those which had ceilings (17.6%), they were all reported to have a ceiling of 70% of the expected production. Of the institutions sampled, 82.4% require collateral from smallholder farmers to give them credit, with 64.3% requiring land titles. More than three quarters of the staff reported that at the institutions they worked in, agriculture was not institutionally perceived to be risky (82.4%) (Table 2).

Table 2: Descriptive characteristics of the financial institutions

Variable	Indicator	n	%	Variable	Indicator	n	%
Ownership status of financial institution	Government owned	1	5.9	Require collateral	Yes	14	82.4
	Privately owned	16	94.1		No	3	17.6
Category of finance institution	Formal	17	100.0	Collateral required	Houses	2	14.3
					Guarantee funds	3	21.4
Type of financing institution if formal	Commercial Bank	8	47.1	Mechanisms in case farmers default	Land titles, Agricultural machinery and houses	9	64.3
	Micro-Finance Bank	6	35.3		Yes	17	100.0
	Co-operative Bank	3	17.6				
Duration of provision of financial services to Rwandans	More than four years	17	100.0	Mechanisms established	Refinancing, rescheduling, foreclosure	11	64.7
	Opening an account and collateral	6	35.3		Sell out collateral	3	17.6
Credit access requirements	Collateral and company documentation	8	47.1	Interest rate provided	Refinance and insurance use	3	17.6
	Business plan and collateral	3	17.6		15%	8	47.1
Provide targeted agricultural credit to smallholder farmers	Yes	12	70.6	Payment period for agricultural credit from financial institution	More than 15%	6	35.3
	No	5	29.4		One year	3	17.6
Nature of targeted credit services	Direct financing	6	35.3	Long process for obtaining an	More than three years	6	35.3
	Agricultural input premium	11	64.7		Variable - Not fixed	8	47.1
Number of smallholder	10,000 – 15,000	11	64.7	Disagree	17	100.0	
	15,001 – 20,000	3	17.6				

farmer loan applications	Less than 200	3	17.6	agricultural credit			
Annual number of smallholder farmers provided credit to	10,000 – 15,000	11	64.7	Length of repayment procedure	Seasonally	17	100.0
	More than 25,000	3	17.6				
Have established ceiling rates for lending to the smallholder farmers	Yes	3	17.6	High agricultural risk perception by institution	Agree	3	17.6
	No	14	82.4				
Ceiling in RWF	70% of expected production	3	100.0				

3.3 Smallholder farmers' typology

Table 3: Principal component analysis of the smallholder farmers

Variable	Principal components				
	C1	C2	C3	C4	C5
Age	0.348	0.765	0.027	0.515	0.125
Gender	0.387	0.126	-0.135	0.820	-0.015
Household size	0.889	0.286	-0.021	0.022	0.028
Number of children under five years of age	0.119	0.197	0.039	0.242	0.880
Duration as a smallholder farmer	-0.478	0.026	0.114	0.817	0.219
Size of land owned	-0.908	-0.267	0.126	0.008	-0.102
Household members provide labor	0.178	0.936	0.137	0.077	0.180
Crop types grown	0.593	0.639	-0.302	-0.188	-0.084
Cost per crop season (In RWF)	0.714	0.175	-0.127	0.459	0.168
Use any chemical inputs during cultivation	0.098	0.607	0.043	-0.084	0.726
Chemical inputs used	0.889	0.286	-0.021	0.022	0.028
Use any agricultural inputs	-0.263	-0.007	0.819	0.169	0.284
Agricultural inputs used	0.113	.0143	0.958	-0.148	-0.036
Cropping systems practiced	-0.633	0.157	0.555	-0.162	-0.221
Practice shifting agriculture	0.704	-0.040	0.263	-0.060	0.581
Practice terrace cultivation	-0.178	-0.936	-0.137	-0.077	-0.180

Following the principal component analysis of smallholder farmer characteristics based on 16 variables that had shown standard deviation at PCA, the resultant principal components were five, with component 1 (C1) being the size of land ownership ($r = -0.908$), component 2 (C2) the practice of terrace

cultivation ($r = -0.936$), component 3 (C3) the agricultural inputs used during cultivation ($r = 0.958$), component 4 (C4) gender ($r = 0.820$), and component 5 (C5) the number of children under five years of age in a household ($r = 0.880$).

Table 4: Final cluster centers of financial institutions

Variable	Cluster		
	1	2	3
Size of land	4.32	1.68	5.19
Practice terrace farming	1.47	1.43	1.59
Agricultural inputs	2.00	1.94	1.91
Gender	1.68	1.56	1.69
Number of children under five years in household	3.47	2.01	1.41

Cluster analysis based on those five principal components revealed that the smallholder farmers belonged to three clusters, of which cluster 2 was the largest cluster defining 44.7% of the three clusters,

(Cluster 1 = 26.7% and Cluster 3 = 28.7%). The most defining characteristic among farmers in this cluster is the number of children under five years in household (Coeff. = 2.01)

Table 5: Determination of cluster descriptive compositions

Variable	Cluster		
	1	2	3
Size of land owned			
Less than 1 acre	0(0.0%)	35(45.5%)	0(0.0%)
1 acre	0(0.0%)	32(41.6%)	0(0.0%)
2 acres	5(26.3%)	10(13.0%)	0(0.0%)
3 acres	8(42.1%)	0(0.0%)	19(35.2%)
	1(5.3%)	0(0.0%)	6(11.1%)
4 acres			
5 acres	5(26.3%)	0(0.0%)	29(53.7%)
Practice terrace farming			
Yes	10(52.6%)	44(57.1%)	22(40.7%)
No	9(47.4%)	33(42.9%)	32(59.3%)
Use of agricultural inputs			
Yes	0(0.0%)	5(6.5%)	5(9.3%)
No	19(100.0%)	72(93.5%)	49(90.7%)
Gender			
Female	6(31.6%)	34(44.2%)	17(31.5%)
Male	13(68.4%)	43(55.8%)	37(68.5%)
Number of children under five years in household			
One	0(0.0%)	26(33.8%)	32(59.3%)
Two	0(0.0%)	29(37.7%)	22(40.7%)
Three	11(57.9%)	17(22.1%)	0(0.0%)
Four	7(36.8%)	5(6.5%)	0(0.0%)
Five	1(5.3%)	0(0.0%)	0(0.0%)

A detailed review of this cluster reveals that this group of smallholder farmers own less than an acre of land (45.5%), practice terracing (57.1%), do not use agricultural inputs (93.5%), and are primarily male farmers (55.8%) with two children below the age of five years in their households (37.7%).

3.4 Characterization of the financial institutions

Table 6: Principal component analysis of the financial institutions

Factor	Component		
	C1	C2	C3
Type of financing institution	-0.049	-0.994	-0.082
Duration of providing financial services	-0.583	0.064	-0.113
Requirements for accessing credit from institution	0.758	-0.438	0.465
Provide any targeted agricultural credit to farmers producing maize and rice	-0.081	0.377	0.916
Type of targeted agricultural credit	-0.925	0.290	0.233
Number of farmers who apply for agricultural credit from institution annually	0.587	-0.807	0.052
Number of farmers institution provide agricultural credit to annually	0.877	-0.447	-0.165
Have any established ceiling rates for lending to farmers	-0.0787	-0.448	0.420
Require any collateral from farmers	0.787	0.448	-0.420
Form of collateral usually required before loan disbursement	-0.771	0.631	0.069
Mechanisms or measures established for loan defaulters	0.945	-0.073	-0.309
Interest rate for farmers	0.317	0.474	-0.821
Length of payment period for agricultural credit	-0.055	0.998	0.016
Perception of agricultural risk	-0.345	0.922	-0.174

Component 1 (C1) of the three principal components (Table 6) is correlated with characteristics including;

the duration of providing financial services, requirements for accessing credit from institution,

type of targeted agricultural credit, the number of smallholder farmers who apply for agricultural credit from institution annually, the number of smallholder farmers' institutions provide agricultural credit to annually, whether the institutions have any established ceiling rates for lending to the smallholder farmers, whether the institutions require any collateral from smallholder farmers, the form of collateral usually required before loan disbursement, and the mechanisms or measures established for loan defaulters. This component is defined as the mechanisms or measures established for loan defaulters ($r = 0.945$).

Component 2 (C2) is correlated with the type of financing institution, the number of smallholder farmers who apply for agricultural credit from

institution annually, the form of collateral usually required before loan disbursement, the length of payment period for agricultural credit, and the perception of agricultural risk. The component is most correlated with the length of the payment period for agricultural credit, i.e., its defining variable ($r = 0.988$).

Component 3 (C3) is highly correlated with the requirements for accessing credit from institution, provision of any targeted agricultural credit to the smallholder farmers producing maize and rice and the interest rate for smallholder farmers. However, the component is most highly correlated with the provision of any targeted agricultural credit to the smallholder farmers ($r = 0.916$).

Table 7: Final cluster centers of the finance institutions' typologies

Variable	Cluster	
	1	2
Mechanisms or measures for handling loan defaults established	3.00	1.64
Length of payment period	2.00	5.57
Provide any targeted agricultural credit to smallholder farmers	1.00	1.36

The K-means clustering and the cluster membership provided therein found that C2 comprised the biggest cluster (82.4%). Finance institutions in this cluster are defined by their possession of mechanisms or measures established for managing loan defaults, the

duration for loan payment, and the provision of targeted agricultural credit to farmers. The length of the payment period is the most pronounced defining characteristic for this cluster.

Table 8: Descriptions of the financial institutions per cluster

Variable	Cluster number	
	1	2
Mechanisms or measures for handling loan defaults		
Refinancing, rescheduling, collateral release	0(0.0%)	11(78.6%)
Sell out collateral	3(100.0%)	0(0.0%)
Refinance and insurance use	0(0.0%)	3(21.4%)
Length of payment period		
One year	3(100.0%)	0(0.0%)
More than three years	0(0.0%)	6(42.9%)
Variable - Not fixed	0(0.0%)	8(57.1%)
Provide any targeted agricultural credit to smallholder farmers		
Yes	3(100.0%)	9(64.3%)
No	0(0.0%)	5(35.7%)

More than three quarters of the financial institutions (78.6%) used refinancing, rescheduling, or collateral release as mechanisms to handle defaults; more than half of them had a variable loan payment period (57.1%), while almost two thirds of the farmers provided targeted agricultural credit to smallholder farmers (64.3%) (Table 8).

4. DISCUSSION

The findings of this study show that the majority of the farmers in the Southern Province own less than an acre of land, a finding that is consistent with what has been reported by Ngenoh *et al.* (2019) and Jaimovich (2015) who found that the average land size among their farmer respondents was 0.9 acres. This finding

has a number of implications. Smallholder farmers in the Southern Province own land that perhaps does not make them substantial agricultural producers, i.e., they own relatively small pieces of land, and generally, they do not use biological or chemical inputs. The subsequent implication of this typology is that most of the smallholder farmers in the province may find it difficult not only to access agricultural credit (as they could be perceived to be high risk debtors), but also the substantial amounts of credit, given that some of the financial institutions give credit with a ceiling based on agricultural productivity. That aforementioned hurdle in agricultural credit access is further buttressed because with a small land size comes less valuation in terms of collateral, which

further affects the amount of credit that farmers can access. As such, financial institutions need to be made aware of the general typology and its ramifications to better understand and deal with credit disbursement to farmers with relatively lesser agricultural production and collateral asset.

The second typology of the smallholder farmers shows that more than half of them practiced terracing (57.1%), which is commonly practiced among farmers in the hilly Southern Province. This finding is consistent with other studies by Karamage *et al.* (2016), Bizozza (2014), and Kagabo *et al.* (2013) in Rwanda. Hence, some smallholder farmers who have managed to use the hill sides thus have greater access to arable land (Table 1). The implication of the increased use of terracing puts around 50% of the farmers in the Southern Province potentially conducive to access agricultural credit. The converse is also crucially important, i.e., the other half who may not be in that position.

A negative characteristic in the typology of the farmers in the Southern Province is the low use of agricultural inputs (93.5%). There seems to be a loss of opportunity given that many farmers cannot invest in intensive farming based on inorganic inputs, which is by and large more capital intensive compared to organic agriculture that is relatively cheaper and locally producible. Thus, the low-input based organic farming coupled with the low access to agricultural credit implies that the farmers may not be using any farm inputs as some may not be able to afford chemical inputs, as confirmed by the descriptive findings in Table 1. This point is a serious concern that could significantly affect both short- and long-term agricultural productivity, potentially worsening access to credit to institutions with loan caps based on agricultural productivity.

The results also show that the majority of the farmers sampled were male (55.8%) (Table 4), which is similar to findings by Gebre *et al.* (2019) and Palacios-López *et al.* (2017), and with the implication that most of the farmers in the Southern Province own land and also have access to rental and (Ali *et al.*, 2016; Gebre *et al.*, 2019; Palacios-López *et al.*, 2017; UN Women, 2020), in addition to having higher productivity (Ali *et al.*, 2016; Gebre *et al.*, 2019). These authors further identified that the gender aspect was essential for smallholder farmer households' access to land ownership and rental and markets. Male-headed families had more land ownership and access to rental land that favourably reduced the risk perceptions among financial institutions.

Moreover, it was found that some of the households sampled had two children below five years of age with the implication that most of them have no (or reduced) family labor available for farm production, and therefore, have to hire it. That can either be human or machine labor of which the former is cheaper and hence the most common option. However, most of the farmers in the Southern Province could likely replace

farm labor by employing small-scale agricultural mechanization through direct financing from financial institutions.

The findings further show that the institutions adopted three categories of managing high-risk loans, which were reported to be refinancing, rescheduling, and collateral release. These findings imply that the financial institutions in Rwanda employ both on-balance sheet (internal) and off-balance sheet (external) mechanisms to reduce the stock of non-performing loans (Grodzicki *et al.*, 2015). However, based on the three mechanisms reported as being in use, two are internal recovery mechanisms and one is an external write-off mechanism. On a positive note, therefore, financial institutions in Rwanda employ a mix of strategies to manage high-risk loans (Sienso *et al.*, 2015), which makes the institutions perhaps more flexible in managing potentially high-risk loans, even in the context of servicing smallholder farmers. That is especially true for the on-balance sheet mechanism of refinancing as it can allow a smallholder farmer to get an additional loan to service the old one, which can even help reduce the interest rate. This is a positive signal to loan takers. Smallholder farmers could be reassured that on-balance sheet approaches could help them better manage and cope with gradual repayment over the medium to long term.

Concurrently, however, the findings further indicate that the financial institutions seem to consider using only on-balance sheet mechanisms, which in themselves can be a potential dissuader, especially for smallholder farmers. That is premised on the fact that the farmer typology has revealed that they own relative land sizes that they perhaps use as collateral, with some not engaged in off-farm activities. Such a dividend of smallholders can be hesitant to access credit from an institution that emphasizes the use of restructuring, liquidation, or foreclosure activities in case of default. With such mechanisms, the risk of losing one's collateral, in this case, land, can be heightened especially when foreclosure is ensues, which can be a significant loss for a smallholder farmer. This seeming risk of irreversible loss could be one reason why smallholder farmers' access to credit could still be low in Rwanda.

The other characteristic that defines the institutions is that many of them provide targeted agricultural credit to smallholder farmers in the country, which means that most financial institutions in the country provide direct or indirect financing. This is a positive finding, which indicates that some financial institutions in the country are by and large aware of their role in promoting the agricultural sector development. However, the result suggests that most institutions offer agricultural input premiums rather than direct financing. The implication of this is that most financial institutions require a smallholder farmer to have a certain amount of money for purchasing inputs, upon which premiums can be provided (as a top-up) to enable the purchase of the inputs. Thus, although

quite enabling, agricultural input premiums are limited to smallholder farmers who already have some cash at bank for investment in agriculture, which is not always the case, especially for smallholder farmers who have no off-farm income, and own small pieces of land.

The kinds of financing options and strategy offered in institutions matter, and they will shape and influence smallholders' production strategies and their interest in accessing credit. Therefore, we argue that enhancing the flow of information and interactions between financial institutions and smallholder farmers are crucial in bridging the current agricultural credit gap. Currently, most of the institutions that received smallholder loan applications constitute less than 1% of the country's farming population (World Bank, 2018). Therefore, the majority of the smallholder farmers are missing out on the numerous advantages of direct financing, including loans for land purchases, loans for pre-harvest and post-harvest activities, loans for agriculture and allied activities, loans for purchase and distribution of inputs such as fertilizers, pesticides, and seeds, loans from Primary Agricultural Credit Societies (PACS), loans to cooperative societies, and loans for construction and running of storage facilities (warehouses, market yards, and silos), among others. There could be a number of reasons behind the non-availability of both direct financing strategies for smallholder farmers in the country, chief among which could be asymmetry of information on the part of the institutions, that might be, as a result perceiving the high risk of default in the population. The lack of availability and low uptake of direct and indirect financing strategies by the farmers could be responsible for the domestically suboptimal production of rice and maize, given that such financing strategies include provision of farmers with improved (high-yielding) inputs through pre-harvest financing.

The other characteristic that defines financial institutions in Rwanda is that most of them have variable credit repayment periods. While the use of on-balance sheet credit default prevention mechanisms is prevalent, the institutions also provide input premiums and other forms of generic agricultural credit at non-fixed repayment periods. The non-fixed repayment period is ideal for smallholder farmers, for most of whom revenues occur post-harvest. In the context of rice and maize production, farmers may be cash-strapped up to a period of five to seven months, depending on the size of and types of crops grown on their cultivated land. In addition, with a non-fixed repayment period, a farmer can start repaying their loans within a month of acquiring it, thus lowering interest rate costs, which can also help farmers' loan decision-making, if the smallholder farmers are made aware of it.

5. CONCLUSION AND RECOMMENDATIONS

Most smallholder farmers in the Southern Province of Rwanda are male, own less than a half an acre of land on which they practice terrace farming with little use of agricultural inputs. The majority of them have two children under five years of age. As for the financial institutions, most of them provide targeted credit to smallholder farmers, with flexible payment periods, and have mechanisms or measures established for managing loan defaults including refinancing, rescheduling, and collateral release.

Therefore, whereas smallholder farmers in the Southern Province should be made aware that the financial institutions in their province offer credit packages tailored for them, with flexible payment terms. These institutions have mechanisms put in place to handle credit default. On the other hand, the institutions should also be made aware that the farmers in the province may not be able to use the land as collateral as many have small parcels of land and the risk of default (and loss of land) would be too great to undertake. Likewise, using loan ceilings based on agricultural productivity will not be as effective since only a small proportion of farmers use agricultural inputs. However, the institutions could consider adopting direct financing strategies to provide such inputs, in addition to lobbying for the provision of more public guaranteed funds via the Business Development Fund (BDF), to cater for shortages in farmers' collateral assets.

There is a need for the government of Rwanda, along with the associated agriculture ministries, authorities, and organizations in the private sector, to strengthen and augment efforts to increase the use of agricultural inputs in smallholder farming, including improved seed and climate resilient practices in the Southern Province. That will enhance their productivity and enable them to access larger amounts of credit, especially from institutions with loan ceilings based on a farmer's agricultural productivity.

The fact that the majority of the farming households in the Southern Province are made up of five people, of which two to three are children implies that most of them lack family adult labor. Farm labor shortages can be costly if hired laborer is used. As such, financial institutions are also urged to make available to farmers with credit products that are in the form of direct financing. Farm labor replacing inputs such as medium-sized machinery like ploughs (motorized or not) can be provided, alongside cash. Doing so will directly and positively impact agricultural production among those farmers, which will, in turn, enable them to invest and access larger amounts of credit. Such a measure will also lower the negative risk perceptions of these farmers, as their productivity will be substantially higher than the average low-input smallholder production.

Finally, we recommend that financial institutions in Rwanda adopt more of the refinancing

and rescheduling mechanisms for managing loan defaults rather than collateral release or foreclosures, as they can be a significant barrier to credit access among farmers for whom a loss of land would be too great of a risk.

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