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CHARACTERIZATION OF SMALL-SCALE FARMING AS AN ENGINE OF AGRICULTURAL DEVELOPMENT IN MOUNTAINOUS SOUTH KIVU, DEMOCRATIC REPUBLIC OF CONGO

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ABSTRACT

Mountainous South Kivu is an agropastoral zone in Democratic Republic of Congo where small-scale agriculture is predominant. Due to its location and potential, this region contributes to the food security of the population of South Kivu and neighboring territories. This research aimed to establish a characterization of small-scale farming in this area in order to highlight the factors that differentiate farms. To achieve this objective, we adopted a holistic approach coupled with descriptive statistics, analysis of variance, and Student's *t*-test for data analysis. Data were collected from a purposive sample of 211 farmers in 2018 and 2019, respectively. The results revealed that differentiation of farms is based on the number of plots per farm, the choice of production systems, the cropping system, the land tenure, the gross margin, the gross value added, and the net farm income achieved at farm level. Therefore, solutions such as access to finance allowing farmers to diversify their production system, the restoration of security in rural areas, the rehabilitation of the existing and creation of new feeder roads, and the setting and promotion of very strong and dynamic farmers' structures would allow a significant development of agricultural activities in the study area.

Contribution/Originality: This study is one of very few studies to have investigated the characterization of small-scale farming in mountainous South Kivu, Democratic Republic of Congo. Results revealed that the primary factors that differentiate small-scale farmers are farm economic performance, membership of peasant associations, and crop production systems.

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1. INTRODUCTION

Although small-scale farming (also known as family farming) has been at the heart of international debates related to food security, agriculture, and the environment for several years, it is clear that policy directions and strategies to ensure agricultural support have not been wholly implemented (Coalition Against Hunger, 2015). Further, family farming has sufficient assets for its potential development. It is an effective engine for poverty reduction and to fight undernourishment (World Bank, 2017); it plays a major role in the development and protection of natural resources and landscapes (Laplante, 2014); it produces more than 70% of the world's food, providing food security for hundreds of millions of family farmers as well as millions of other categories of people, and it is the largest employer of family workers who form the majority of the total labor force (Ministry of Agriculture-French Republic, 2013; World Bank, 2008). However, 815 million of people globally are undernourished (Fao, Who, & Unicef, 2017). This situation correlates not only with insufficient production, but also with poverty as reflected in insufficient access to the means of production. Despite a number of solutions that small-scale farming can provide, small-scale farmers are faced with various challenges, such as difficulty in accessing resources, lack of succession and mediocrity, lack of training (McGlynn et al., 2013), lack of appropriate markets (FAO., 2014), threats to their livelihoods from climate change (FAO, 2016), difficulties in accessing credit because their financial returns remain low and risky (Coalition Against Hunger, 2015), as well as many agricultural risks (Mulumeoderhwa Munyakazi et al., 2019). Beyond production and market constraints, family farmers also face broader challenges including health issues, social protection, education, and lack of infrastructure and community facilities, among others (Laplante, 2014).

Several definitions of the concept of family farming have been formulated by different scholars. For the sake of simplicity, we prefer to retain the one that considers that family farming as the types of agricultural production characterized by (1) a close relationship between the family's domestic economy and their farm, and (2) the effective use of family labor without making recourse to permanent waged labor (Sourisseau et al., 2014). From this definition, it may be observed that the main elements intrinsically associated with family farming are the linkage between family assets, farm capital, and the use of family labor. Nevertheless, it is difficult to define family farming easily, given the diversity it contains in terms of different issues at stake, depending on the scale at which one is placed, the place in which one is located, because the economic and social situations, as well as production and the market conditions, and even the family and its logics of spatial mobility are different (Delfosse, 2015). Considering the realities of certain regions in developing countries such as South Kivu Province, family farming refers to any form of agricultural production that uses mainly family labor and other factors of production held by the farmer him/herself or by members of his/her family in order to guarantee the well-being of family members. The small-scale farming referred to in this research is one of the forms of family farming in terms of its differentiating characteristics. The main criteria for characterizing small-scale farming include guaranteed access to resources, capacity to invest, self-consumption, mode of penetration of downstream markets, pluriactivity or system of activity, agricultural diversification or specialization, recourse to capital as a replacement for family labor, choice of strategies, and purposes of the activity (Bélières, Bonnal, Bosc, Marzin, & Sourisseau, 2014). These criteria can be enriched or specified according to the context and realities of the regions concerned in the research.

In order to act effectively on the transformation and development of the agricultural sector in South Kivu, research on the characterization of farms remains essential to guide the actions of public authorities and other development partners. The general objective of this research is to establish a characterization of small-scale agriculture in the mountains of South Kivu. More specifically, it aims to identify and analyze the differentiating factors of family farms in this region. It focused on small-scale farmers whose landholdings are above the mean average size at national level. This choice is supported by Neema, Manners, Schut, Ngezirabona, and Lebailly (2021), who reported the average land size of 3 hectares among farmers who participated in their study. With the intention of differentiating small-scale farms, this study focused on selected criteria, namely the number of land parcels per farm, the adopted production systems, the cropping system practiced, the land tenure patterns, as well as the farm performance indicators (gross margin, gross value added, and net farm income). The results will provide some guidance to small-scale farmers for them to make rational decisions regarding the choice of crops to be grown.

The existing literature shows that a household in mountainous South Kivu farms between 0.35 ha (Civava, Malice, & Baudoin, 2013; Rutakayingabo, Muhigwa, Lwaboshi, Barhakana, & Amato, 2016) and approximately 1 hectare (Furaha, Namegabe, & Lebailly, 2016b), while the national average ranges between 1 and 1.5 ha (DRC, 2013). Besides significant demographic pressure, the socioeconomic situation in South Kivu Province is explained by land spoliation of land by the elite, who sell it fraudulently (Utshudi, 2008).

Despite its potential to facilitate food self-sufficiency and to export surplus production, South Kivu Province is characterized by a large proportion of the rural poor, poverty caused by a very high unemployment rate (UNDP,

2009), a very worrying nutritional situation (DRC, 2014; UNDP, 2015), food dependence on neighboring provinces and countries (Vwima, Mastaki, & Lebailly, 2012), nonexistence of financial institutions in rural areas, lack of adequate basic rural infrastructure, asymmetric information that benefits intermediaries, rural exodus, and low profitability that does not encourage financial institutions to lend to farmers. Solutions to these problems are needed to enable the development of the agricultural sector in South Kivu Province so as to respond to certain essential issues of sustainable development, particularly to meet the food needs of both present and future generations.

2. MATERIALS AND METHODS

South Kivu Province is located in the east of the Democratic Republic of Congo, approximately between 1°36' and 5° south, and 26°47' and 29°20' east, with a mean altitude of 1.000 m above the sea level. It is bordered to the east by the republics of Rwanda, Burundi, and Tanzania; to the south-east by Tanganyika Province; to the south, west and north-west by Maniema Province; and to the north by North Kivu Province (DRC, 2005). South Kivu Province covers 3% of the country's surface area, equal to 69,130 km². The region is characterized by an equatorial climate with year-round rainfall in one part, and a tropical climate with a rainy season and a dry season in another. Average annual temperature ranges between 11 and 25°C. The majority of the population of South Kivu Province (78.4%) live in rural areas; its urban population represents 5% of the DRC's urban population (UNDP, 2009). These specificities demonstrate that agricultural development in South Kivu is fundamental to enable poverty reduction among rural households, which make up a significant proportion of the province's population. The choice of mountainous South Kivu as a framework for analysis is explained by the predominance of small-scale agriculture based on the average area farmed per household compared to the national average. The sampled territories of Kabare and Kalehe were formerly characterized by a predominance of both high-fertility volcanic soils and medium-fertility soils of ancient rocks in those parts not affected by the extension of lava flows (Wils, Caraël, & Tondeur, 1986). Unfortunately, high demographic pressure and overexploitation of land resources have affected soil fertility in this region (Mastaki, 2006), especially in Kabare where the population density (360 inhabitants per square kilometre) is higher than that in Kalehe (105 inhabitants per square kilometre) (IPAPEL South Kivu, 2018). Nevertheless, this area remains very favorable to agriculture and livestock farming.

For sample constitution, two criteria were considered, namely (1) farms that produce mainly for the market and (2) crop and activity diversification on the farm. Due to the absence of a census of farmers in South Kivu, a purposive sampling was carried out and 211 farmers were selected on the rates of 50 farmers in Bugorhe locality, 50 farmers in Irhambi locality in Kabare, 60 farmers in Mbinga Sud locality, and 51 farmers in Mbinga Nord locality in Kalehe, respectively. We used non-probability sampling (reasoned choice sampling) due to the lack of sampling frame. The number of farmers selected per locality was motivated by their availability during the survey. Qualitative and quantitative data collection from farmers on crops (expenses, revenues, selling prices, cropping system, etc.) was facilitated by a survey questionnaire and interviews. These surveys were organized in two phases, in 2018 and 2019, respectively. This study adopted a holistic approach to farms and focused on comparative analysis of the performance indicators of speculations. The study also used descriptive statistics (mean, frequency, proportion, and standard deviation). In addition, ANOVA and Student's *t*-test were used to test for the variability of farm measures and performance indicators among certain groups of farmers.

3. RESULTS AND DISCUSSION

3.1. Small-Scale Farming and Membership of Peasant Organizations in Mountainous South Kivu

Results show that more than 60% of the surveyed farmers are not members of any farmer association. Non-members (61.4%) reported that they did not participate in farmer associations because of their poor management, explained by their lack of dynamism. Other reasons included discrimination by some leaders in the distribution of external aid (16.6%), that the benefits granted by associations were not sufficiently interesting, inability to pay for membership fees, the feeling that leaders are exploiting their members, etc. Table 1 shows the distribution of surveyed farmers by production systems and by their membership of farmers' associations.

Table-1. Distribution of surveyed farmers according to their membership of farmers' associations.

Membership of farmers' association	Agricultural production systems					
		System 1	System 2	System 3	System 4	Total
Non-members	N	90	17	19	1	127
	%	72	34	59.4	25	60.2
Members	N	35	33	13	3	84
	%	28	66	40.6	75	39.8
Total	N	125	50	32	4	211

Note: System 1: Production of food crops; system 2: Association of food and vegetables; system 3: Food, industrial and forestry crops; system 4: All crops associated.

Members of farmers' associations (39.8%) reported that the benefits from farmers' associations include collective bargaining power, access to small loans and assistance from peer members during both positive and negative events, mutual assistance, access to certain training on agricultural practices, and access to certain donations, grants, and subsidies (seeds, farmyard animals, agricultural equipment such as hoes, etc.). It is important to note that the types of farmers' associations mostly formed in the region of mountainous Kivu South are mainly Village Savings and Credit Associations (VSCAs), Mutual Solidarity Organisations (MUSOs) initiated mostly by local NGOs, or other rural

organisations created by farmers themselves to help each other. This self-help mechanism developed by farmers to resolve certain social issues and strengthen solidarity between farming communities has spread rapidly in Central Africa (Manirakiza, Mulumeoderhwa, Maniriho, Ndimanya, & Lebailly, 2020) thanks to the various interventions of NGOs and the awareness of certain community leaders. Such a mechanism has contributed to increasing farm income and improving farmers' welfare (Maniriho, 2021).

3.2. Total Owned and Exploited Farm Sizes in Mountainous South Kivu

Results from our analysis show that the size of the surveyed farms varies from one site to another and from one territory to another. The mean farmed land size per holding in Kalehe is 3.9 ha while it is 2.7 ha in Kabare. Results point also to the highly significant variability of land size among the four localities, for both total owned land size ($P=0.002$) and exploited land size ($P=0.009$). This situation is shown in Table 2.

Table-2. Variability in size of owned and exploited land among production sites in mountainous South Kivu.

Agricultural production sites	Total owned land size (ha)			Cultivated land size (ha)		
	Average	Min.	Max.	Average	Min.	Max.
Land size by territory						
Kalehe	3.9	0.3	40	2.9	0.3	13.5
Kabare	2.71	0.4	15	2.05	0.3	7
Land size by locality						
Mbinga South	4.84	0.3	40	3.31	0.3	13.5
Mbinga North	2.76	0.5	8	2.8	0.5	7
Irhambi	2.7	0.4	15	1.9	0.3	7
Bugorhe	2.72	1	7	2.2	1	7
Overall study area	3.33	0.3	40	2.5	0.3	13.5
Significance level (Prob > F)	0.002**			0.009**		

Note: Significance levels of the variable: ** $P<0.05$ implies moderately significant variability.

In light of the results of this study, both mean owned land size (3.3 ha) and mean exploited land size (2.5 ha) in mountainous South Kivu appear to be high compared to the average (between 0.35 and 1 ha) generally reported in the literature on this region (Civava et al., 2013; Furaha, Mastaki, & Lebailly, 2016a; Rutakayingabo et al., 2016). This difference could be explained by a few factors. First, the population density of 105 inhabitants per km² in Kalehe compared to Kabare, whose population density was 360 inhabitants per km² in 2016 (IPAPEL South Kivu, 2018). Second, the presence of farmers who practice afforestation and thus grow different types of trees (eucalyptus, grevillea, cinchona, etc.) which can occupy large areas compared to other crops, which undoubtedly has an impact on the size of the landholding. Third, the large landholdings for farmers in the region of Kalehe highlands around Kahuzi-Byegga National Park. In this region, when farmers go to their farmland they say they are going to the 'forest'. Most of them exploit forest crops and livestock (cattle and sheep). They use Rwandans who have settled there, mainly as their herdsmen for their flocks and as labor for the production of potatoes and maize. Fourth, most farm parcels have not been measured; this would lead farmers to give false estimates of their acreage. However, it is important to note that it would require an in-depth study to empirically confirm this hypothesis. However, the average of 3 ha of cultivated land per farmer in Kalehe as reported by Neema et al. (2021) is one of the motivations of our study; this average is close to our findings where we found an average of 2.9 ha per farmer in the same territory.

Table 3 provides the results on comparison of cultivated and total owned land size between Kalehe and Kabare. Results indicate a highly significant difference for cultivated land size ($P=0.003$) and a moderately significant difference for total owned land size ($P=0.037$) between the territories.

Table 3. Comparison of farmed land size between Kalehe and Kabare.

Land size (ha)	Kalehe (N=111)	Kabare (N=100)	Difference	P-value
Surface of cultivated land	2.9	2.1	0.8	0.003***
Total owned land size (ha)	3.9	2.7	1.2	0.037**

Note: *** $P<0.01$ implies highly significant variability; ** $P<0.05$ implies moderately significant variability.

3.3. Land Tenure in Mountainous South Kivu and Combination of Crop Farming and Livestock

In mountainous South Kivu, farmers who combine crop farming and livestock represent on average about 59% of the farmers surveyed. This percentage varies by both the production systems practiced and production sites. The types of livestock reared in this region are mainly goats (74.2 %), poultry (35.5%), cattle (30.7%), sheep (5%), pigs (14.5%), guinea pigs (14.5%), and rabbits (3.2%). It should be noted that combining crop farming and livestock remains a very common practice among farmers in mountainous South Kivu (Furaha et al., 2016a; Ndjaji et al., 2021). The main reasons for farmers combining crop farming and livestock are savings, production of organic fertilizers, and milk and meat supply, mainly for family members. Farmers decide to sell their livestock only when they want to address more important issues, such as paying school fees for their children, acquiring new farmland, or making a large investment. The analysis carried out on different production systems shows that farmers with high farm incomes represent a large proportion of those who combine crop farming and livestock (System 4, 100%; System 2, 64%; System 3, 62.5%).

The predominant mode of land tenure in mountainous South Kivu is renting, at the rate 97.8% (Table 4). People who rent out their land do so mainly for risk aversion, because the season may be very bad and have a negative impact on the harvest. The annual cost of renting a quarter hectare was estimated at USD 70 on average in the surveyed sites in Kalehe and USD 120 in Kabare. The relatively low land rental price in Kalehe can be explained by the existence of land reserves: 1 ha of uncultivated land per farm household in Kalehe compared to 0.7 ha in Kabare (Table 2), the reserve land being the difference between owned and cultivated land size). Nevertheless, it should be noted that the price of agricultural land in these territories also depends on other factors, including the location of the land (in the lowlands or on the hills), the distance of the field from communication routes (mainly roads), the quality of the soil, and the relationship established between the tenant and owner. Table 4 shows the combination of crop farming and livestock, as well as the modes of land tenure across production systems in mountainous Kivu South.

Table-4. Small-scale agriculture: interaction between livestock and land tenure patterns.

Item	Agricultural production systems					Overall study area
	System 1	System 2	System 3	System 4		
No combination of farming and livestock	N	57	18	12	0	87
	%	45.6	36	37.5	0	41.2
Combination of farming and livestock	N	68	32	20	4	124
	%	54.4	64	62.5	100	58.8
Total	N	125	50	32	4	211
Land tenure patterns						
Land renting	N	93	46	31	4	174
	%	97.9	95.8	100	100	97.8
Share cropping	N	2	2	0	0	4
	%	2.1	4.2	0	0	2.2
Total	N	95	48	31	4	178

3.4. The Predominance of Mixed Crop Farming in Mountainous South Kivu

Mixed farming (also known as multicropping) is predominant (almost 92%) among the farmers surveyed in mountainous South Kivu. Only around 8% of farmers practice pure cropping or monoculture. The main reason that persuades farmers to opt for multicropping is risk version in the face of various hazards in the agricultural sector that can also affect their farm income. Among farmers in production System 4, 50% practice pure cropping or monoculture. This can be explained by the fact that the average size of these farms (System 4, 6 ha) is the category of selected crops whose farming techniques and exploitation procedures require larger parcels or plots than the other production systems (System 1, 2.3 ha, System 2, 2.8 ha, System 3, 2.4 ha). In addition, access to other resources, particularly financial and material, would also explain the adoption of pure cropping systems or monoculture, which implies that such farming is practiced by better-off farmers. Details on the cropping systems practiced on family farms in mountainous South Kivu are provided in Table 5.

For the mixed-cropping system, farmers' choice is motivated by land scarcity, and also by the demographic pressure and the monopolization of large land areas by the rich, the politicians, and religious denominations (Bainville, Mena, Rasse-Mercat, & Touzard, 2005). In Kalehe, surveyed farmers mentioned the phenomenon of land occupation around Kahuzi-Biega National Park and the Masisi South Forest Reserve by displaced people from Rwanda. One study (Ansoms, Claessens, & Mudunga, 2012) indicates also that Rwandans without identity came to buy land in Kalehe because there was more land available than in Rwanda. As reported by some surveyed farmers, this phenomenon seriously threatened indigenous farmers.

Table-5. Analysis of cropping systems practiced on farms in mountainous South Kivu.

Production systems	Pure cropping system or monoculture		Multicropping system	
	N	%	N	%
System 1: Food crops	10	8	115	92
System 2: Food and vegetable crops	3	6	47	92
System 3: Food, industrial, and forestry crops	2	6.3	30	93.8
System 4: All associated crops	2	50	2	50
Total	17	8.1	194	91.9
Production sites				
Mbinga South	8	13.3	52	86.7
Mbinga North	5	9.8	46	90.2
Irhambi	4	8	46	92
Bugorhe	0	0	50	100

3.5. Characterization of Small-Scale Agriculture Based on Economic Performance Indicators

The farms surveyed in mountainous South Kivu are characterized by positive values for economic performance

indicators, namely gross value added (USD 1,117), gross margin (USD 906), and net farm income (USD 628). Results show that Mbinga South and Bugorhe performed better than the others in terms of net farm income (USD 851 and USD 837), gross value added or wealth created (USD 1,485 and USD 1,356), and gross margin achieved (USD 1,156 and USD 1,137) for Bugorhe and Mbinga South, respectively. The main reason for this trend in Bugorhe is the cultivation of high-value crops, mainly tomato; in Mbinga South it is due to the ability of farmers to combine several crops on their farms. Accordingly, by importance, production System 4 comes top, the production System 2 is the second, production System 3 is the third, and the production System 1 comes fourth. Table 6 shows the variability in farm performance across production sites and systems. Results reveal significant variability in all farm performance indicators ($P < 0.05$) across production sites and production systems.

Table-6. Variability in economic performance indicators of small-scale agriculture among production sites and production systems in mountainous South Kivu.

Indicators	Production sites				Weighted average	Significance level (Prob>F)
	Mbinga South (average)	Mbinga North (average)	Irhambi (average)	Bugorhe (average)		
NFI (USD)	836.7	334.8	453.8	850.6	627.9	0.000**
GVA (USD)	1,356.4	783.2	802.6	1,484.9	1,117.1	0.000**
GM (USD)	1,136.6	621.2	670.6	1,155.6	906.1	0.000**
Production systems						
	System 1	System 2	System 3	System 4		
NFI (USD)	515.5	788.5	720.1	1,396.6	627.9	0.023**
GVA (USD)	922	1,446.7	1,251	2,020.2	1,117.1	0.001**
GM (USD)	774.3	1,105.4	1,022.6	1,603.2	906.1	0.018**

Note: With NFI = Net farm income; GVA = gross value added; GM = gross margin; ** $P < 0.05$ implies moderately significant variability.

4. CONCLUSION

This article has attempted to highlight the factors that differentiate farms in mountainous South Kivu. The surveyed farmers reported that farms are characterized by common factors, but they are distinguished by specific factors with respect to the production system practiced. Results from descriptive and statistical analyses show that for the majority of farmers land renting is the predominant mode of land tenure. Results also indicate that a large majority did not participate in farmers' associations, despite the benefits these can provide. With significant variability across production sites and the production systems, the main differentiating factors for farms are the size of landholdings and cultivated land, the cropping system, the use of land, and farms' economic performance. From the results and their discussion, access to finance, security and peace restoration, creation of infrastructures, and enhancement of strong and dynamic peasant associations would allow small-scale farmers to diversify crops or farming activities and boost agricultural development in the study area.

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