



Explanatory Factors for Farm Income Diversity in Kalehe District, South Kivu Province, DR Congo

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ABSTRACT

Despite repeated wars and the persistence of feudal land tenure, the agricultural sector is at the center of economic activity for most rural households in the Democratic Republic of Congo. This study aims to assess the competitiveness of the agricultural sector in relation to other sectors of economic activity, such as mining. To achieve this aim, it analyses and compares the agricultural incomes of different farmers. It also compares these incomes with their incomes from other sectors of economic activity. This study paid particular attention to two factors of production which may explain the differences in income between farms, namely access to land and family agricultural work labor. A survey was carried out among the 33 dynamic and efficient farmers selected on the basis of the results of previous research carried out in Kalehe territory, sud-Kivu province. Households selected depend almost entirely on agriculture and their agricultural activity makes up 91% of the overall household income. Statistical analysis suggests two important facts. First, there are no relation between the mode of access to land, family labor and rural households' income level. Second, it is only the area farmed and the number of fields that have an impact on overall household income.

Keywords: Agricultural Sector, Land Tenure, Farm Income, Farm Households, Poverty, South Kivu

JEL Classifications: Q1, Q12, Q15

1. INTRODUCTION

Agriculture is one of the pillars of sustainable development (Odusola, 2019). It has contributed to economic growth, social restructuring (Gollin, 2010) by playing an important role in the transformation of several countries (Pingali, 2016; Hazell and Pinstrip-Andersen, 1985; OMS, 2020; Gyaneshwar et al., 2002). Poor populations live in rural areas (Ministère de l'Environnement, Conservation de la Nature, Eaux et Forêts, 2006; Lebailly et al., 2014) and depend on the agricultural activity for their subsistence and the income that allows them to satisfy household needs (Lebailly et al., 2014).

However, despite their potential for agriculture (SOS Faim, 2011), several countries in sub-Saharan Africa have devoted inadequate attention to this important area of economic development and source of sustainable food security in both rural and urban households (FAO, 1996; Maano and Mickler, 2020). Such is the case of the Democratic Republic of Congo (DRC). With an estimated population of more than 65 million inhabitants and a surface area of 2,345,409 km², the DRC is one of the largest countries in the world (Bolakonga, 2013; Kenfack, 2014) and has endured several years of conflict and instability. These have created one of the most serious humanitarian crises of the 21st century, with the impoverishment of rural households and resulting rural

exodus (Ansoms and Marivoet, 2010; Weijs et al., 2012; Batory and Vircoulong, 2019).

Agricultural potential in DR Congo is unanimously recognized as being considerable because the country has an estimated cultivable area of some 80 million hectares, of which less than 10 million hectares are exploited (AFDB and OECD, 2005; Bolakonga, 2013; Dontsop et al., 2016). This availability of land and the enormous water resources available to the country, including the Congo River basin, give rise to the hope of greater self-sufficiency in food, which the Congolese insistently demand (Bolakonga, 2013).

Agriculture play an important role in household income for small farmers and landless families (SOS Faim, 2011; Banque mondiale, 2013; Yashle and Mosombo, 2017). Agriculture in DR Congo is largely subsistence, with subsistence farming accounting for about 90% of agricultural production (Ministère de l'Agriculture, 2009; FEM, 2009; Moumami, 2010). About 70% of the population depends on agriculture as their main livelihood (Bolakonga et al., 2013; Lebailly et al., 2014). In addition, being of the itinerant and over-burned type (extensive farming on mainly burnt abattis) (Hugon, 2002), agriculture can be characterized by extremely low productivity, high commercialization costs, and virtually non-existent markets (Lebailly et al., 2014). Additionally, the productivity of local crops and various agricultural initiatives (Bolakonga et al., 2013) are severely constrained by such factors as farmers' limited knowledge of agriculture, the lack of high-quality seeds and other essential inputs (fertilizer, modern tools, pesticide, etc.) and the absence of agricultural credits (Lebailly et al., 2014; Dontsop et al., 2016). These constraining factors, which exist at both local and national levels, adversely affect the well-being of farmers, who rely on agriculture in their daily fight against poverty (Bolakonga et al., 2013; Neema Ciza, 2018).

In spite of the various endogenous and exogenous constraints which hinder the productivity of the agricultural sector (Mahmood Hasan, 2001) and lead to structural poverty, the sector remains the main source of income for the majority of rural households (Ayodele, 2019; Lebailly et al., 2014, Mahmood Hasan, 2001) and causes inequality between them and urban households (PNUD, 2019) in the Sud-Kivu province.

It has been observed that people in developing countries who depend on agriculture for their livelihoods are generally much poorer than people working in other sectors of the economy (Cervantes-Godoy and Dewbre, 2010), their income level seems low but their livelihood depends only on agriculture Henry de Frahan et al., 2017 and agriculture as a sector contains a disproportionate number of low income households.

In order to evaluate the level of agricultural income, it is important to emphasize that several factors play an important role in the constitution of household income, including access to land and farm work in addition to the price of products and market access by farmers.

The aim of this research is twofold. First, to analyze the different income levels of farmers in order to compare them with each other

and in relation to other sectors of activity; second, demonstrate to what extent do agricultural production factors such as access to land and family labor workforce determine income differences between farmers.

2. MATERIALS AND METHODS

The land tenure in Kalehe territory is feudal, the land belongs to the traditional chief ("Mwami"). Only the traditional chief can confer the right to use the land to people who express a need for it. The mode of acquisition is governed by customary procedures, the most important of which are: fermage ("Bwasa") and sharecropping ("Kalinzi") (APC, 2009; Ansoms et al., 2012) leading to the cyclicity of poverty (Mucukiwa, 2019). Tenant farming and rural exodus result in scarcity of labor workforce and in decreased agricultural production and income (Weijs et al., 2012). Thus, farmers use other non-farm related activities to increase income and meet up their various needs (AFDB and OECD, 2005; Wang et al., 2011; Dontsop et al., 2016; Dontsop et al., 2013). According to research findings about Nigeria, Uganda and the Sud-Kivu province (Giuro, 2013; Dontsop et al., 2013; Vwima et al., 2013; APC, 2012), the share of these other activities in the overall income formation of farmers is often lower than that of field activities.

The choice of this territory was motivated by the fact that it is one of the territories in South Kivu that is experiencing problems of strong competition over land, which is reflected in land conflicts linked to population movements, the accumulation of large tracts of land by elites, land grabbing practices, etc., sometimes with the involvement of armed groups (Mudinga and Ansoms, 2014; Furaha et al., 2016). This territory thus offers a good example for understanding the current context of access to land by rural households in South Kivu.

2.1. Study Site

This study was carried out in Kalehe Territory in 2019. Kalehe is located between 23°40' and 29° E, 1°45' and 2°10' S and between 1460 and 3000 m above sea level. It covers an area of 5 057 km² with a population density of 166 persons per km² (FAO, 2018). It has a mountainous tropical climate, moderate temperature, increasingly depleted and eroded clay soil. The Kalehe Territory experiences an average annual rainfall ranging between 1300 and 1680 mm under a bimodal regime. Agriculture, livestock farming, and fishing are the main economic activities of the population.

Four localities (Bushushu, Munanira, Cibanda and Tshibanja) were chosen from the Mbinga-Sud territorial group, one of the groups with particularly high densities in Kalehe (ICCN, 2010) and where agriculture is the main activity of households. The four localities were chosen mainly for reasons of accessibility and safety: many rural areas in Sud-Kivu are still plagued by insecurity and limited access.

2.2. Data Collection

Data collection for this research benefitted from previous research work by the Rural Economics and Development Unit (REDU) of Gembloux Agro-Bio Tech at the University of Liège. REDU's

research was carried out as part of the “Projet de recherche pour le développement” and used a sample of 120 farmers to study land issues. From the 120 farmers, we made a reasoned selection of 33. Thus, the researcher who conducted the surveys at Kalehe was asked to select a group of thirty three farmers from their sample and the instruction to choose farmers was based on five major criteria: (1) farming as the main activity with at least one cultivated field, (2) access to land, (3) need to develop agricultural activities, (4) their accessible sites and (5) respondents open to exchange. Farmers that were no longer accessible were directly replaced by those recommended by the agricultural monitor according to the same criteria. This resulted in a somewhat homogeneous group of farmers, whom we judged to be the most committed and productive, as the sample for the present research work. The study area covered 4 villages in the South Mbinga subdistrict in Kalehe territory, namely Munanira village, Cibanda village, Tchibanja village and Bushushu village.

The data for this study were collected through household surveys, with semi-structured interviews conducted in December 2019. The data collected covering the following areas: socioeconomic and demographic characteristics, ongoing agricultural activities, storage and processing of agricultural products, market access, sources and amounts of income, access to credit and agricultural organization membership. These data were collected using a tablet and Open Data Kit (ODK) data collection software.

2.3. Data Analysis

Particular attention was paid to agricultural income, which includes income from the sale of crops as well as other income received from agricultural activities (income-generating activities carried out in agriculture, agricultural labor activity, etc.), and income from the breeding or sale of animals. Non-agricultural income mainly includes income from other non-agricultural activities such as small-trade, education, tailoring, remuneration linked to state functions and officials of groups and localities, local leaders as well as other non-agricultural occupations. As for transfers, they include the amounts received from family members, close or distant, from the restricted or extended family and who are outside or inside the country and this in order to be able to strengthen the level of household life. This type of income is part of this non-farm income analysis. Income was estimated in Congolese francs with an applied exchange rate of 1700 Congolese francs (1700 FC) for 1 US dollar (1 \$) observed during our investigation period.

Geo-referenced coordinates for households were used to generate maps using QGIS 3.6. Maps were produced to show the geographic distributions of the subdistrict in Kalehe territory. The data were processed and analyzed using Microsoft Excel and R 3.6.2 (Development Core Team, 2019). The normality of the data was determined by the Shapiro test, while the evidence of differences and variability between the different study factors was obtained using Pearson’s linear correlation tests, the student t-test, the Chi-square test and the Kruskal-Wallis test, depending on whether the data are parametric or non-parametric.

Therefore, in the analyses we compared the share of farm income and off-farm income in total income. For this purpose, the Chi-square test

was used. To evaluate the effect of family labor on income, we used the “Kruskal-Wallis” test as the Shapiro normality test showed that data do not follow Gauss’ law. The incomes of households accessing land by renting and those accessing land by other modes were compared by a data-matched “Student t-test” while a correlation (Pearson Correlation Test) was made between the number of fields and farm income and between the area of fields and farm income. In all tests performed, the significance level was always set at 0.05.

3. RESULTS

3.1. Socioeconomic and Demographic Characteristics of Farmers

Table 1 presents the main socioeconomic and demographic characteristics of the households.

We briefly provide findings about each of these characteristics:

- Household heads’ age and gender: the majority of surveyed household heads are between 26 and 35 years old, and they are predominantly male. In fact, 76% of households are headed by men, of the 24% headed by women most are widowed, divorced or separated. This is evidence that the Congolese culture and society are patriarchal
- Household heads’ farming experience: most household heads have between 6 and 15 years of agricultural experience. This suggests that agriculture is a main activity in which rural inhabitants participate from a young age
- Household heads’ educational level: the majority of heads of households surveyed in this research have a secondary level of education, unlike in a previous research where the majority could not read or write. This indicates a progress in the training of heads of households
- Household heads’ marital status: heads of households are mostly married: they represent 79% of the surveyed population
- Size of household and its labour workforce: there is an average of 8 persons per household, which shows that Kalehe families are large, and an average of household labour force of 4 persons
- Cultivated area: analyses of trend values (dispersions) show inequalities in terms of the size of farming areas used by rural households. Thus, relating to access to Land and market access, rural households have access to land. The average area farmed by these households is 3 ha with a standard deviation of 2.8 ha (3 ± 2.8) and a maximum of 15 ha. However, 55% of farms are between 2 ha and 3 ha, and 27% of them are between 0.8 ha and 1.9 ha. There is thus a disparity in farmed area size between rural households belonging to a group that is supposed to be relatively homogenous. As regards access to market, 45% of farmers have easy access to it. The market is, however, local, so that the farmers have no product export possibilities
- Type of used inputs: organic manure, compost, pesticide and urea are used by 100%, 58%, 9% and 6% of farmers, respectively.

3.2. The Proportion of Farm Income in Total Household Income

In Kalehe territory, although the households surveyed are engaged mainly in farming, they have other income-generating activities.

Table 1: Socioeconomic and demographic characteristics of households in Kalehe Territory

Characteristics	Category	Proportion (%)	Frequencies (n=33)	Decision
Gender of Household head	Male	76	25	***
	Female	24	8	
Farming experience of household head	6-15 years	30	10	**
	16-25 years	18	6	
Age of household head	26-35 years	30	10	***
	36-45 years	12	4	
	46-55 years	9	3	
Education level of household head	Illiterate	30	10	**
	Primary	27	9	
	Secondary	33	11	
Marital status of household head	High School/University	9	3	
	Married	79	26	***
	Widower	12	4	
	Divorced	6	2	
Household size	Other	3	1	
	3-4 persons	9	3	*
	5-6 persons	24	8	
	7-8 persons	30	10	
	9-10 persons	18	6	
Cultivated Area	11-12 persons	18	6	
	0-2	27	9	***
	2.1-3	55	18	
	>3	18	6	
Land tenure	Heritage	67	23	***
	Purchase	61	20	
	Location	55	18	
	Gift	3	1	
Type of used inputs	Compost	58	19	***
	Manure	100	33	
	Pesticide	9	3	
	Urea	6	2	

The frequency of different proportions were compared using Chi-squared test (***P≤0.0001, **P≤0.001 and >0.0001, *P<0.05 and >0.001)

Figure 1: Geographical location of surveyed areas in Kalehe territory in Sud-Kivu

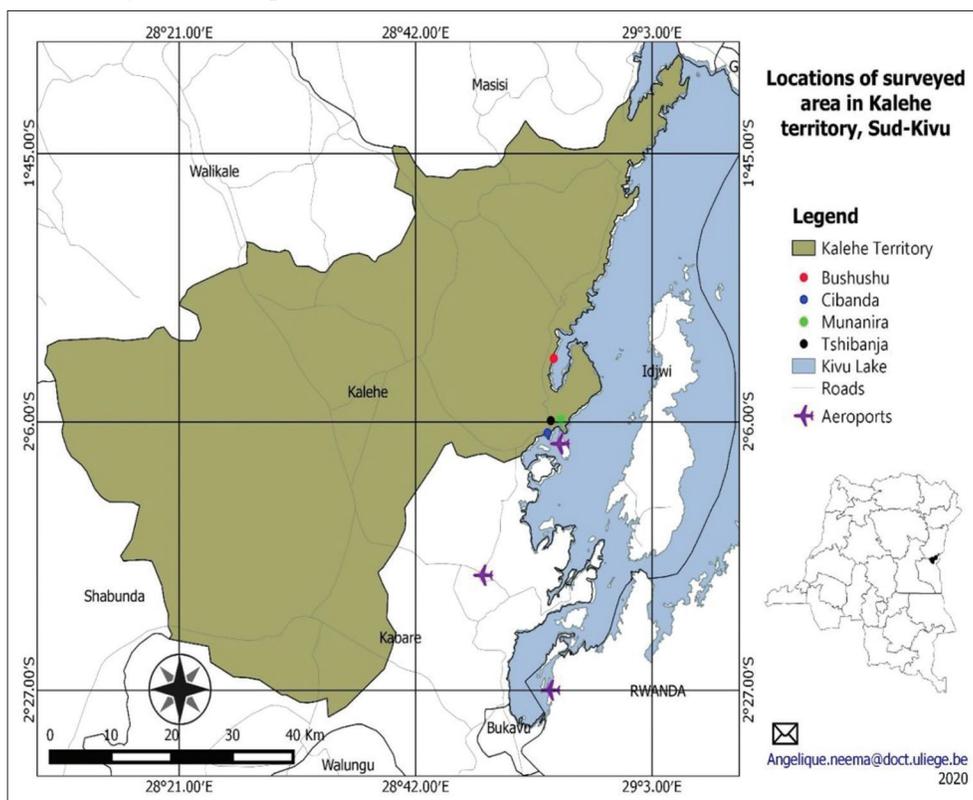


Figure 2: Effect of family workforce size (a) and mode of access to land (b) on household agricultural income

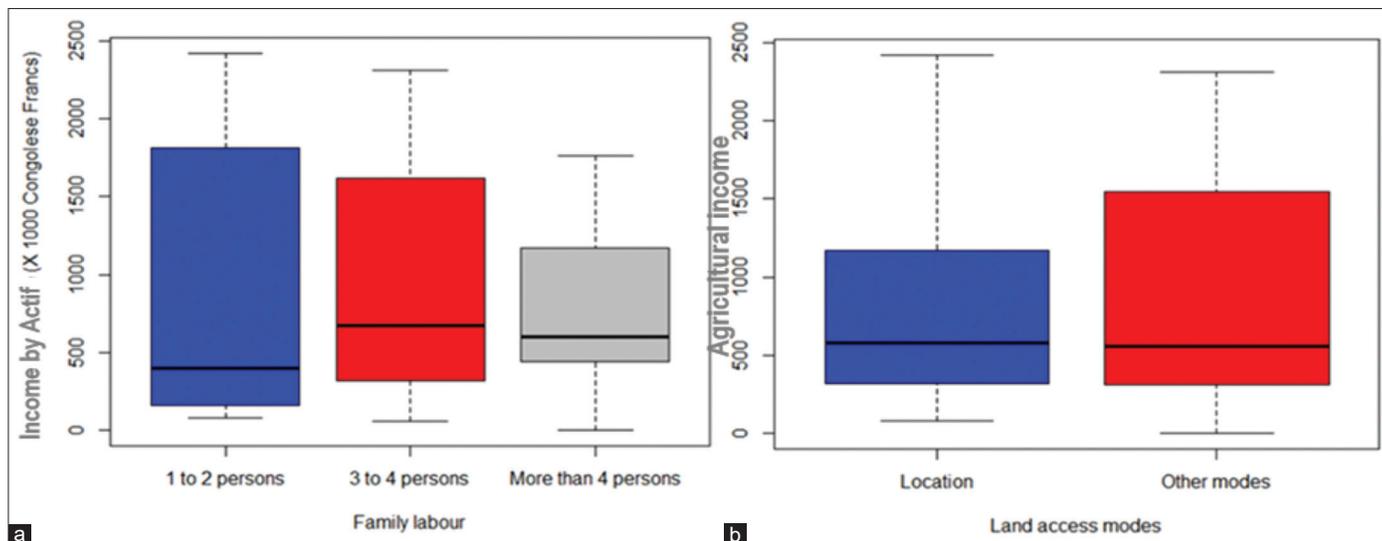
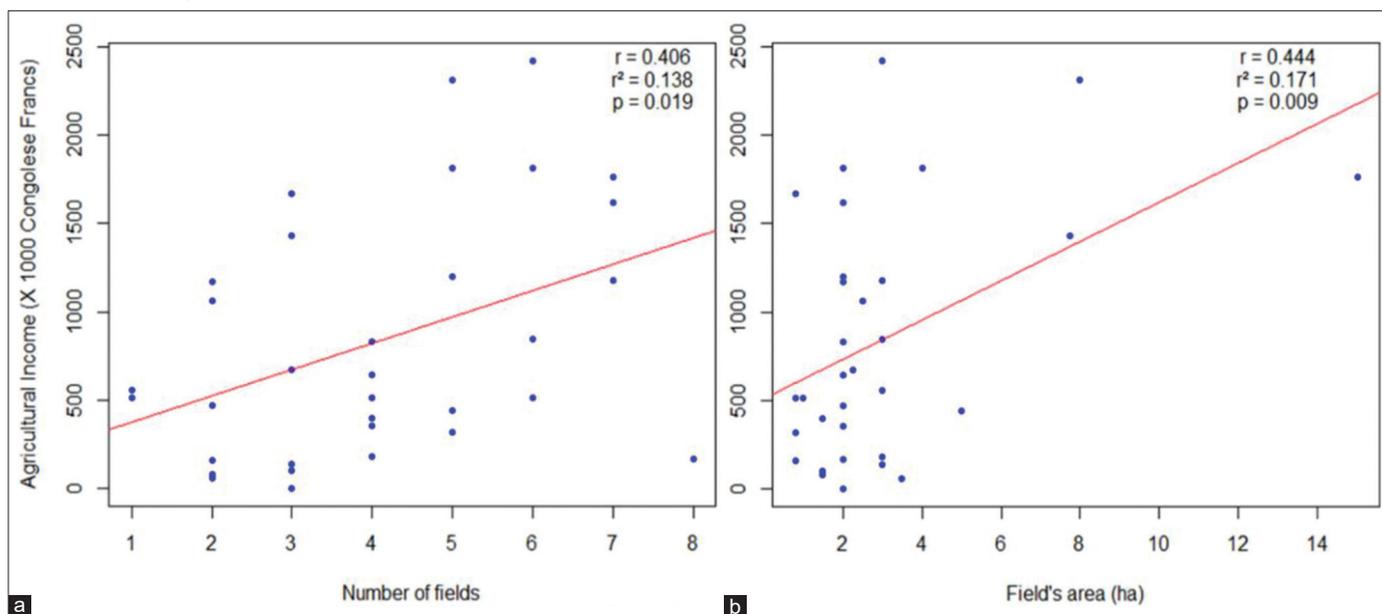


Figure 3: Correlation between number of fields and farm income (a) and between field area and farm income (b)



The data shows that agricultural income accounts for 91% of the total income of the households surveyed in Kalehe. The Chi-square test carried out on these data showed that the contribution of farm and non-farm income to total household income is significantly different ($P = 0.0001$)¹ suggesting that households depend almost entirely on agriculture. In addition, the agricultural income on average across all households surveyed is 488 USD, versus 50 USD for non-farm income.

It should be noted that no household in the study area is more dependent on non-agricultural income since they gain more from agriculture as their main activity despite the fact that they have small off-farm activities that bring in almost no income.

¹ $\chi^2 = 19995558$, $ddl = 1$, $p\text{-value} < 0,0001$

3.3. Effect of Family Workforce Size and Mode of Access to Land on Household Agricultural Income

Figure 2 shows that agricultural labor workforce consists essentially of parents (i.e. male household heads and their wives or female household heads, who are mostly widowed, divorced or separated). Agricultural labor force is thus not abundant enough. The reason for this is threefold: (1) household heads need to combine their agricultural activities with other activities to increase their incomes. (2) Children participate in agricultural work only when they are not in school (or when they are on holiday). And (3) most young people are not interested in agriculture. Family labor has no effect on farm income ($P = 0.973$)². The results of the test show that there are no significant differences at the 5% level between farms employing 1-2 family laborers, 3-4 family laborers and

² $\chi^2 = 0.055$, $ddl = 2$, $p\text{-value} = 0.973$

more than 4 family laborers. We examined the link between available labor force and agricultural income, and the impact of land renting on household income.

The comparison between the modes of access to land (rental and non-rental) did not show a significant difference ($P = 0.685$)³ although the average annual agricultural income between those who rent land (461 ± 385) and those who do not rent (520 ± 437) is slightly different. This means that the mode of access does not significantly influence the income of farmers in Kalehe territory. It shows that a farmer with a purchased field may also have another field rented, which leads to a demarcation between the number of fields owned by a farmer and the area farmed, as the latter may be dependent on rental, purchase, inheritance or donation.

However, family labor and access to land did not show any influence on farm income because a household may have a large labor force but very few or very small farm fields. Similarly, a household may have acquired its fields by purchase or inheritance (not rental) but if these fields are reduced in area or number this will lead to a low level of farm income.

In terms of income from the household labor workforce, the figure above shows a form of disguised unemployment since incomes (per farm family labor) do not increase when agricultural labor increases. This is explained by the fact that there are more mouths to feed and therefore a larger share of self-consumed agricultural production. Similarly, for households who rent the land, agricultural incomes do not increase, on the contrary. There are probably more food products to consume. In addition, we wanted to establish the correlation between the number of fields, the area of fields and household agricultural income.

3.4. Correlation Between the Number of Fields, the Area of Fields and Household Agricultural Income

Figure 3 below shows that farm income is influenced by the number of fields ($r = 0.406$) and field area ($r = 0.44$). It explains the relationship between variables and proves the existence of significant differences for the number of fields ($P = 0.019$) and field area ($P = 0.009$). Figure 3a below shows that the number of fields influences the income of rural households in the Kalehe territory. The relationship between the variables evolves in the same direction for Figure 3b because the test shows the highly significant difference that the larger the area farmed, the higher the income earned.

Hence the test shows that there is a positive relationship between income, field area and number of fields for farmers in South-Kivu Province.

4. DISCUSSION

4.1. The Analysis and Comparison of the Levels of Farmers' Agricultural Incomes

Agricultural incomes of the main source of income for surveyed farming households. These results support those of (ICCN, 2010; Efa and Gashaw,

2017; Batano et al., 2017), who also found that households engage in other income-generating activities in to subsidize these incomes and to meet their household needs (Wang et al., 2011; Dontsop et al., 2013; Dontsop et al., 2016). These other activities include small trade, cutting, sewing and mining (Arslan and Taylor, 2012).

At this point, it is worth comparing farmers' agricultural income with their income from another benchmark sector of activity in Kalehe, artisanal mining. A study by Matthews, 2000) found that, in reality, farm household incomes are now at least as high as non-farm incomes, and the incidence of farm poverty is lower than in the economy as a whole. This study found that agriculture generates a higher income than non-agricultural activities in surveyed farms of the Kalehe Territory. This finding is the opposite of Kamundala and Ndugu's (2017) finding, according to which no-agricultural activities bring in more income. The reason for this divergence seems to be that our study, unlike the other, took into account the fact that farmers do not place a monetary value on self-consumed products from their farms and on the labor provided by their household workforce.

Another point worth mentioning in this connection is that Kamundala's study (Kamundala and Ndugu, 2017) focused on the incomes of rural households living in and around mining sites in Sud-Kivu province. Based on their study, the artisanal gold miners obtained an average monthly income of \$338. These incomes are higher than those of cassiterite miners, who only made \$187 per month (Weijs et al., 2012). That study estimates the overall income of farmers around mining site for the most part according to different crops. Although they are handicapped by the cultivable surfaces, they earn much higher incomes since they are devoted to several cultures which are sold directly on the local markets being in and around the mining sites. In addition, heads of farming households also engage in mining activities to boost their income and improve their standard of living.

Thus, in rural households in Kalehe territory, households whose main activity is farming have an annual average income of 538 USD for all sources of income. According to Kamundala and Ndugu (2017), mining generates a gross annual income of 4,053 USD or a net income of 2,253 USD once annual food expenses (1800 USD) incurred by miners during their work are deducted. Conversely, agriculture yields an average annual income of 538 USD. From this perspective, agriculture is far less profitable than mining (Kamundala and Ndugu, 2017). This comparison does not, however, take into account these three important considerations: first; the monetary value of what farmers produce for self-consumption; second; the fact that agricultural work consumes less time, labor and energy than mining work; and, third, the fact that farmers, unlike miners, are able to participate in other income-generating activities. It seems plausible to assume that once these factors are taken into account and converted into appropriate monetary values, agriculture will appear to generate more income than mining.

Also, a study conducted by Ansoms and Hilhorst (2012) proves that, in households, three quarters of the income comes from agricultural activities.

³ Student's t-test, $t = -0.410$, $ddl = 28.255$, $p\text{-value} = 0.685$

4.2. Access to Land and Family Labor Workforce as Factors Which Determine Income Differences Between Farmers

As for study of (Ansoms et al., 2012), findings on farmers' access to land suggest significant inequalities in access and ownership in the Kalehe territory. These findings are corroborated by Huggins (2010), which discovered that land tenure in Kalehe benefited landowners and disadvantaged the rest of the population, and that in the wake of armed conflict land grabbing practices flourished in this territory at the expense of farmers. This unfortunate situation leaves farmers with no other choice than a recourse to land renting. Also, as proved by our analysis in relation to access to land, household may have acquired its fields by purchase or inheritance (not rental) but if these fields are reduced in area or number this will lead to a low level of farm income. Regarding the quantities produced and even if the relationship between land and income could not be highlighted, it goes without saying that farms better endowed with fertile land capital will be able to produce more and increase their income.

According to EURAC, 2017, in the past land access and customary rights were not really a problem for small farmers but today there is confusion caused by the plurality of modes of access to land - customary, legal and informal - as the same land can be claimed by different actors depending on the procedure by which it was acquired. The lack of information makes farmers vulnerable because well-defined practices of land grabbing have developed among the elites, who, by mastering the workings of a Congolese administration characterized by corruption, manage to obtain titles to community land, sometimes with the complicity of customary chiefs, as also demonstrated by [53] in its work published in 2017. In addition, a small number of people and some religious community have large areas of land while peasants are landless. Hence the implosion of land conflicts that sometimes leads to violence, particularly in eastern DR Congo, because of the strong land pressure.

According to the family labor workforce, the studies conducted by [50], not only do family laborers work for self-consumption, but they also work by constraint and only consider working at another non-farm activity, on the other hand, the paid labor employed by the household explains the level of household income, since for the latter, farming is considered as a profession in its own right and therefore affects the productivity of the farm, which corroborates with the results of our study.

In further research, this study reveals new questions such as: diversification of activities and market access by farmers remain issues to be taken into consideration in further research. Both aspects play an important role in improving farmers' incomes and, in consequence, their livelihood and thus their well-being.

Aside from facing land access problems, farmers also face the problem of access to large markets outside their rural areas. The only markets to which they have access are the local ones, which are weekly. It should be noted that inaccessibility of large markets because of poor or non-existent road infrastructure was a major constraint for rural farmers and an important obstacle not only to their development potential and

resilience but also to the development of the agricultural sector and economy in the DR Congo.

Self-consumption was not quantified as an element of monetary income in the context of this study. However, it is an important qualitative element highlighted by the vast majority of respondents during our interviews. Another constraint that also hinders the development of this sector and linked to the low income generated by agricultural activity in general is the low and unremunerative prices as testified by the farmers surveyed. Thus a related issue will need to be addressed in future studies.

This study inform better policies and development programs that the absence of an agricultural policy and the multiple harassments when marketing agricultural products have so far undermined rural initiatives for the food supply of the Congolese. We therefore recommend that both local and national authorities reform the land sector because the land issue remains central to ensuring harmonious agricultural development in the DR Congo in order to boost the agricultural sector, which is the basis of all development. Also, systematic discrimination against women farmers, whether in terms of access to land (and especially control), inputs, technology, and income from their own work represent particularly strong constraints to be mitigated in the coming days in order to improve productivity, increase income and fight against poverty and improve livelihood conditions for rural household in Kalehe. Finally, farmers should receive public support to improve agriculture and develop no-agricultural activities in order to increase household income. To protect the viability of rural areas, policies focusing particularly on strengthening the town and village network and creating in farm employment opportunities should be pursued.

5. CONCLUSION

This paper performed a comparative analysis of incomes of farms within the agricultural sector of Kalehe territory, which is contextualized against households deriving income from other sectors. It also investigated whether land access and household workforce size determine agricultural income differences between farmers. We found out that there are significant income differences between farmer households and that each household's agricultural income is higher than its non-agricultural income. We also discovered that agricultural income inequalities between farmer households are shaped by their land access and labour force size. Despite Kalehe farmer households' greater dependence on agricultural incomes and the enormous agricultural potential of the South-Kivu Province, it is worth stressing that agriculture is not sufficiently lucrative for the farmers: there are various constraints hindering the development of this sector in DR Congo. One of these constraints is the feudal land tenure system: it is responsible for the widespread phenomenon of 'landless peasants' and the cyclical poverty of farmers.

The agricultural development of Sud-Kivu and the DR Congo remains an important project for the next decade. It must contribute to the food security of the country, but also to the fight against poverty, which is essentially rural. Our analysis made it possible

to show the low income generated by agricultural activity and the comparison with the mining sector speaks volumes on this subject. To protect the viability of rural areas, policies focusing particularly on strengthening the town and village network and creating in farm employment opportunities should be pursued.

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