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Agricultural Development in the Fight against Poverty: The Case of South Kivu, DR Congo

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Abstract: Agriculture plays a prominent role in the economy of the Democratic Republic of Congo (DRC) and has considerable production potential. One of the most populous and poorest provinces in DRC is South Kivu, where many people live below the poverty line. This paper aimed to understand agricultural development's role in reducing poverty and maintaining rural households' food security in the DRC. This study developed a questionnaire to evaluate the household identity, source of income, access to land, crops grown on the land, farming and animal husbandry practices, and constraints faced by households in relation to agriculture. The survey included meetings with farm heads, data collection from 120 households on household characteristics of their livelihoods (human capital, land capital, social capital, financial, etc.), as well as an overview of living conditions and income from agricultural activities. The data were processed and analyzed using R 3.6.2 and Excel software. The results showed that access to land is problematic with relatively small farms, especially when one considers that household size is high and therefore, the "area per farm" ratio is low. Moreover, agriculture generates very little income and it is therefore very difficult for a farmer to emerge from poverty. As a result, implementing an effective and equitable anti-poverty policy in rural areas is important to address the issue of farming household incomes and target low incomes from all sources of income.

Keywords: land tenure; land access; land capital; rural development; agricultural policy; poverty alleviation

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1. Introduction

There is ample evidence (e.g., Adegbite and Machethe [1]; Faridi et al. [2]) that agriculture may contribute to poverty reduction in ways other than directly affecting farmers' wages. Agricultural development may spur economic expansion in nonagricultural sectors, leading to further jobs and economic growth [3]. Increasing agricultural production increases farm income, increases food supply, reduces costs of food, and enhances rural and urban job opportunities [4,5]. Consumers' demand for goods and services generated in industries other than agriculture may increase as incomes rise. Such connections between agricultural and economic growth have allowed developing nations (such as Burkina Faso, Nigeria, Egypt, Zimbabwe, and Mali) to expand into other sectors with higher growth and earnings [5].

A review of various research demonstrates the diversity of methodologies that have led to the constant conclusion that agricultural output is crucial for poverty alleviation. Mellor [6] discovered that production per unit of land is a statistically important determinant of the poverty gap squared (using national, annual Indian data). Amsalu [7] utilized output per worker as a productivity metric, which Mellor and Malik [8] believe is a superior measure of productivity for identifying nonagricultural growth, since it

encompasses the various sources of income for farm households. Byerlee et al. [9] analyzed 12 countries and evaluated agricultural growth per worker over countries using bivariate analysis. They revealed that nations with the greatest agricultural growth per worker had the largest decreases in rural poverty. Espoir et al. [10] investigated the link between total aspect productivity and poverty results by looking at the returns on various productivity-increasing investments. According to their study, investment in roads and agricultural research, development, and extension had the greatest impact on productivity and poverty reduction.

In emerging and developing economies, one of the basic notions of economic development is poverty reduction through growth in the agriculture sector [11]. The nexus between poverty and agricultural investment poses challenges. Studies [12,13] on economic development, poverty reduction, and agricultural growth have been widely conducted. Nevertheless, different sources of agricultural growth have led to the link between poverty and growth multiplication. In this regard, based on the findings of Mellor and Malik [8] at the national level, poverty was reduced through increased food production and agricultural growth. Poverty rates vary between small-scale and large-scale farmers. However, the existing literature (for instance, Mellor and Malik [8]; Arham and Dai [14]) consisted of theories of growth in agriculture according to the distribution approach. In addition, it lacks the evidence needed based on evidence planning, and does not indicate agricultural growth and its effect on poverty reduction.

Strategies of poverty reduction can be obtained through growth policies and pro-poor transfers [13]. For the poorer sections of society, transfers take place through various planned social programs, which can be increased through foreign aid and public production [12]. Such transfers can often be used to achieve rapid poverty alleviation goals, deal with emergencies, and address marginalized communities that are not even trying to find employment [15]. It is politically difficult to reduce poverty through income redistribution, especially in cases where it is a collective phenomenon. Reducing poverty for a long time is very difficult in a situation where the poor generate independent income. In this case, the better option to reduce poverty for the working class is a pro-poor growth strategy [16]. Various studies (e.g., Mellor and Malik [8]) have been conducted to investigate and analyze the impact of agricultural growth on poverty reduction. Mellor and Malik [8] found that high prices for agricultural products increased poverty in underdeveloped countries. Various studies (for example, Arham and Dai [14]) used the correlation and causality method to measure the relationship between poverty, prices of food at the household level, and growth in the global domestic product (GDP).

According to the Global Hunger Index 2010–2012, the Republic of Congo (DRC) is the world's most food-insecure country, with an agricultural extension system that is apparently ineffectual. For more than 15 years, the DRC has been recovering from civil conflict and a severe infrastructural and institutional vacuum, making it an ideal location to examine policy and institutional reform options, as well as obstacles in prioritizing and sequencing initiatives [17]. The DRC has the potential to be Africa's food basket, but it has so far failed to make the required investments and policy changes to make this promise a reality. Due to the deployment of human resources to the Ministry of Agriculture (MINAGRI), which includes more than 11,000 inspectors and agricultural monitors distributed throughout different regions and sectors, the DRC has one of the highest extension-agent-to-farmer ratios among developing nations [18]. It is, nevertheless, one of the countries with a failing agricultural extension system in terms of transferring new technology and information to rural populations and enhancing agricultural output [19,20]. The DRC is one of the nations in the region and the world with decreased food output per capita, with dropping yields of the most important crops, and the lowest agricultural productivity [21].

Although often rightly cited as the most important development goal for reducing poverty and promoting the country's economic development, agriculture has practically never received sufficient support, and is mainly subsistence agriculture that is barely able to feed the rural population [22,23]. Since independence, the country has gradually

turned to destabilizing imports of basic food products, often cheap and low quality, and these imports are severely hampering initiatives for the development of local production. According to the World Bank [17], despite its agricultural high potential, the DRC remains a net food importer. The DRC's exports are mainly driven by mining products (e.g., crude petroleum, cobalt, and copper) and cash crops such as coffee and cacao. Between 2012 and 2015, DRC imported nearly 8 million tons of food. In this period, cereals imported accounted on average for 51% of food imports. In addition to cereals, fish and sugar are the two other most imported products, accounting for an average of 14% and 12% of food imports, respectively. From 2012 to 2015, 174 million tons of food were produced in the DRC, along with more than 108 million animals. Corn and rice, on average, represent 69% and 30% of cereal production, respectively. The bulk of local rice in the DRC in 2015 came from the former eastern province (Ituri, Bas Uele, Haut Uele, and Tshuapa) at 34.5%. Cassava is one of the country's principal crops, and has a considerable role in the economy of the DRC. Another important point to consider is the youthfulness of the rural Congolese population: we estimated that 25% of the DRC population lives in rural areas and belongs to the 0–14 age group. This represents a significant challenge in terms of providing employment to young people in the near future [24,25]. Currently, the human population density is very high in some areas, and access to land capital is increasingly difficult in many administrative sectors [26]. The rural-to-urban exodus is significant and is due to the deterioration of living conditions in rural areas. Road infrastructure is in poor conditions or nonexistent, which limits farmers' ability to market their produce [27].

The low level of productivity is due to a multitude of endogenous factors, and the main factors are related to the widespread nature of agriculture with a low technical level, lack of quality inputs (seeds, tools, etc.), and lack of credit for agricultural products. In South Kivu Province, these factors are further accentuated by the degradation of soil fertility and parasitic attacks [27–29]. In addition, when producers are able to generate a surplus, its marketing causes many problems [21]. Degradation of soil productivity due to unsuitable farming practices and reduced available land for fallow periods contributed to an overall decline in the available food supply [30]. The need for mineral fertilizer is recognized by the proper management of integrated soil fertility. However, the goal is to maximize crop yields with moderate amounts of fertilizer, which for most farmers is an expensive commodity. Improving disease-resistant germplasm is essential to ensure fertilizer response [28]. Organic matter usually enhances fertilizer productivity, and biomass can be provided by integrating dual-grain cereals into in situ cultivation systems. This may offer the advantages of biological N fixation while providing product revenue [31].

In this context, agricultural development through intensive agriculture and connected agribusiness is often presented as the solution to follow. However, this type of turnaround implicitly advocates the increasing inequalities. In fact, this form of agricultural development presupposes larger farms with more capital, but also farms that use low-cost foreign labor. In recent years, the World Bank has advocated this type of model, commonly called "agro-industrial" parks. However, agriculture will remain the cornerstone of the Congolese economy. In eastern DRC, climate insecurity has caused a number of farmers to abandon their agricultural production, leading to a widespread food deficit. This abandonment coupled with the high number of displaced persons and refugees has reduced the labor supply available for production while at the same time, the war has destroyed marketing chains, particularly in some provinces such as South Kivu.

Current practices do not provide security for investors, small or large producers, processors, or trader–distributors of local products. It is also very difficult for them to gain access to inputs, capital, technical knowledge, and markets. It should be mentioned that the DRC is ranked only 184th among the 190 countries analyzed in the ranking "Doing Business" [18]. It should also be noted that the farming profession does not attract young people or dynamic trained Congolese [32]. Those who are forced into the farming profession avoid taking risks and limit production to the needs of the local market. Moreover, these people rarely invest in developing their farms in the long term.

Agriculture is a key determinant of efforts to end poverty for households at all levels and achieve security in sustainable food [33]. A typical West African household makes a living using local or raw materials such as cutlasses and shovels, which can only provide a limited amount of agricultural products for the family to consume. Sackey [34] investigated the influence of social donations on reducing household poverty in Ghana. They used questionnaires that were well constructed by focusing on group discussions and in-depth interviews. This study showed that the capability of livelihood social assistance had an affirmative impact on the consumption of food, the frequency of health facilities, and the rate of school enrollment for children in beneficiary families. According to Sackey [34], cash should be increased by the government, regular transfers should be paid, stakeholders should be connected to free services in the region, more staff should be hired, and opportunities for in-service training should be provided. Adegbite and Machethe [1] conducted an experimental study on agriculture's role in the development of Nigeria's economy. They used traditional and contemporary perspectives on agricultural activities, as well as various descriptive methods to analyze agricultural development and its relationship to the Nigerian economy. This study showed that extensive investigation of the development of the agricultural sector was crucial to the country's development. Sefu et al. [35] conducted a study in Tanzania from 1980 to 2014 with the use of descriptive analysis. They examined the role of agriculture in reducing poverty and economic growth. This study highlighted that population growth and lack of adequate public services in rural areas exacerbated the poverty situation and accelerated the transition from agricultural to nonagricultural activities. The scholars of this study suggested that soft loans should be provided to farmers if the country is to achieve high success in providing agricultural land.

In summary, agriculture is increasingly needed to meet a wide range of basic needs: access to more food for people, higher and more resilient incomes, and environmental services. It also has a crucial role to play in the fight against poverty. The DRC is no exception to this trend even if, as highlighted above, it presents particular conditions that result in the removal of specific constraints. Most of the recent research in this field has been in the field of econometrics, and has focused more on comparing the differences in the effects of total poverty on growth in different sectors. Due to the limited sample size in previous studies, only limited attention was paid to subsectors of agriculture in developing countries at different levels of development, or even to different poverty outcomes, such as food insecurity. In this study, we also highlighted the impact of agricultural potential on job generation and poverty reduction in southern Kivu.

The purpose of this paper was to contribute to the understanding of the role of agricultural development in reducing poverty and maintaining the food security status of rural households in the DRC. In addition, this paper briefly presents some conceptual issues related to the role of agriculture in the rural households and their overall development, and emphasizes its role in poverty alleviation. It also investigates whether agricultural development could be considered as an engine of growth and poverty alleviation in developing countries. The objective of this study was to show that the conditions for a revival of agriculture in the DRC, and more particularly in the Province of South Kivu, are greatly limited by the low incomes that can be generated from this activity. This will be analyzed on a "micro" scale, based on interviews and surveys at the village and individual levels. In addition, this research will clarify the importance of agriculture in the economy of rural households and the level of income allowed by agricultural activities.

2. Literature Review

When it comes to agricultural performance in the economy and its potential for poverty reduction, few economic studies seem to have been done. The majority of the research focuses on economic structural transformations, whether in less-developed nations, where agriculture accounts for the majority of the economy, or in developed countries, where industrial and service sectors account for the majority of the economy [36].

As economies improve, agriculture's contribution to GDP and employment will inevitably decrease [37]. The reason for this is the high demand elasticity for nonagricultural products. Consumers increase their intake of service goods rather than food when their incomes improve. Ironically, this approach frequently results in increased salaries for service industry workers and deteriorating poverty for individuals whose livelihood is solely dependent on agriculture [38]. Several studies have been conducted to determine the link between agriculture and poverty alleviation. To examine how agriculture and poverty are related, Bresciani and Valdés [39] looked at the labor market, revenue of farming, and prices of food. Furthermore, these channels are significant in establishing a theoretical framework, and research has found that nonagricultural sectors have less power to reduce poverty than other sectors, when both direct and indirect agriculture growth is included. They noted that, given its percentage of the GDP, the agriculture sector has a greater potential to eliminate poverty. Agriculture's contribution in the nations studied comes mostly from the agriculture labor market. They noted that in circumstances where mixed agricultural output lacks labor-intensive crop and livestock production, such an outcome-based development model would not be appropriate. Indeed, historically, as agriculture has evolved, technical advances in labor saving have been hampered by such techniques.

According to the findings of Abro et al. [40], agriculture is growing faster than the nonagricultural sector. For the bottom decile of household expenditure, this is consistent with the assumption that agriculture's development is more important than that of the nonagricultural sector. These findings are the polar opposite of those seen in rich families, when nonagriculture spending elasticity exceeds agricultural growth. Their findings support the notion that agricultural expansion benefits the poor. According to Ogundipe et al. [41], agriculture's contribution to poverty reduction is different due to the advantage of expansion, which may be easier for pro-poor communities to obtain, but it is dependent on where they are politically, geographically, and economically. Growth in agriculture is more successful than development in other sectors in reducing poverty. According to Deininger et al. [42], the agriculture sector, like other sectors in China, is the driving factor toward poverty alleviation. In terms of overall poverty reduction in China, they found little sign of development in nonagricultural areas. According to most studies, agricultural growth is more important than development in other sectors due to the sector's potential; however, this varies based on institutional structures and the economy in question [15]. Poverty weakens agriculture's ability to generate national economic growth, as Christiaensen [43] pointed out. Nonagricultural sources helped to reduce rural poverty in the United States in the 1960s.

Because rural poverty is higher and more dependent on agriculture, most studies (e.g., Badibanga and Ulimwengu [44]; Varga [45]) implied that agricultural growth is more successful in reducing poverty than growth in any other sector. Non-farm-income growth, on the other hand, is more successful in reducing poverty among nonagricultural people when poverty is low. For poor farming families, nonagricultural sources of income may be more significant than income from farming. Agriculture's growth is more essential than that of all other industries, as agriculture accounts for a major portion of the GDP. Agriculture's growth, according to most researchers, is more effective than that of any other industry.

In Africa, Adekambi et al. [46] suggested that productivity development through the acceptance of newly established rice varieties had statistically significant benefits on poverty reduction in Benin. Alene and Coulibaly [47] reported data for 27 countries in Sub-Saharan Africa, suggesting that agricultural research had statistically significant effects on productivity and per capita incomes, implying that it helped to alleviate poverty. According to Abro, Alemu, and Hanjra [40], agricultural productivity improvement had statistically significant poverty reduction effects in Ethiopia.

This research will examine the link between poverty reduction in South Kivu and agricultural development, source of income, access to land, crops cultivated on the land, farming, and animal husbandry techniques. This study's contribution will aid policymakers

and the government of South Kivu in formulating the best managerial suggestions for strengthening agricultural credit programs for the populace.

3. Theoretical Framework

3.1. Agricultural Development

Mellor and Malik [8] discovered that agricultural labor productivity (output per worker) has a considerable impact on the first income quintile's (poorest) average income, and that this link is stable across areas. However, agricultural productivity has a lesser impact on the lowest people's earnings than the productivity of nonagricultural labor. Agriculture accounts for an increasing proportion of revenue in the second and third quintiles of disadvantaged countries. This is consistent with the findings on the influence of wage employment and rural nonfarm economic growth on poverty reduction, which is examined more below. Finally, Mellor and Malik [8] discovered that gains in agricultural labor productivity benefit richer quintiles more than poorer quintiles. This second aspect is consistent with the importance of assets in achieving increased productivity, which is discussed further below.

3.1.1. Increasing Farm Productivity and Output

The success of African agricultural productivity increase may be observed in both farm and off-farm sectors of foods and fibers. Diversification away from cereals, regionalized yield advancements (such as rice in Mali), development of higher-yielding maize varieties, increased production of noncereal staples such as cassava, improved cotton productivity in francophone Africa, enhanced coordinated action in high-value crops (such as horticulture in East Africa and specialty coffee in Rwanda), and effectiveness in marketing essentials are instances of such achievements [48,49]. In other examples, including rice cultivation in Mali, careful scheduling of technological progress, institutional adjustments, and sectors and macroeconomic reforms produced productivity gains [50].

Raising agricultural production can help to drive rural development and improve the process of pro-poor development [51]. Increasing agricultural production increases the income of poor farmers, which in turn increases the demand for goods and services provided by rural nonfarmers [52]. Through forward and backward communication, increasing agricultural production supports employment in the nonagricultural rural and urban sectors. This reduces urban poverty by reducing migration to cities and lowering food prices [53]. Thus, agricultural expansion supports poor farmers and landless workers by increasing production and employment, so both the urban and rural poor benefit by growing in a rural nonagricultural economy. As seen in Table 1, the entire general equilibrium consequences of this increase are felt in the farm, rural nonfarm, and national economies.

Table 1. Pathways to poverty reduction through increased agricultural development.

Farm Economy
Higher incomes from agricultural production On-farm employment
Rural Economy
More employment in agriculture and food value chains, both upstream and downstream Employment in rural nonfarm sectors that are expanding Increasing incomes and employment make it possible to improve investments in diet, health, and education, which indirectly leads to higher labor productivity Increases local tax income and demand for improved infrastructure, adding to second-round impacts that benefit the rural economy Linkages in the production chain foster trust and knowledge, helping to create social capital, and promote nonfarm investing
National Economy
Reduced food and raw material prices improve real earnings for the urban poor while lowering wage costs in nonfarm industries Savings and taxes generated by farming enable investment in nonfarm industries, and thus provide employment and income in other areas Foreign exchange earnings allow the import of capital goods and vital inputs for nonagricultural products Farm labor liberalization enables productivity in other areas

Sources: Abro et al. [40] and Mellor and Malik [8].

3.1.2. Price Effects

Agricultural productivity influences food prices, which in turn influence labor costs and the profitability of marketable commodities, resulting in a cascade of factors that determine the real income consequences of increasing output for agricultural households [54]. Increasing agricultural production can affect farm output prices with respect to replacement or complementary goods, as well as the costs of production inputs [55]. Increasing agricultural output may not result in better real farm revenue if increased output pushes down product prices or increases production costs owing to increased demand [56]. If pricing impacts offset the production gain, output growth may not improve farm household incomes; however, food price impacts are dependent on the tradability of the food. Food staples in developing countries dependent on agriculture are generally nontradable since they are made up of crops that have no international markets (cassava, sorghum, millet, etc.), and the local food economy is safeguarded by high transportation and marketing expenses. Because they are nontradable, their pricing is unaffected by international competition [54].

Figure 1 demonstrates the complexities of the connections between enhancing agricultural productivity and alleviating poverty in an agricultural system in which food production is at least mostly interchangeable. The income effect of increasing output for farm households is determined by price effects in the market for agricultural products. These pricing impacts also provide input to the producer, allowing them to forecast prospective output levels. Because rural families can afford to consume more, production decisions induce labor market reactions that affect the demand for food. When the new general equilibrium raises both farm incomes and the real wage rate, multiplier effects in the rural nonfarm sector boost real household incomes for both farming and nonfarming families, lowering poverty.

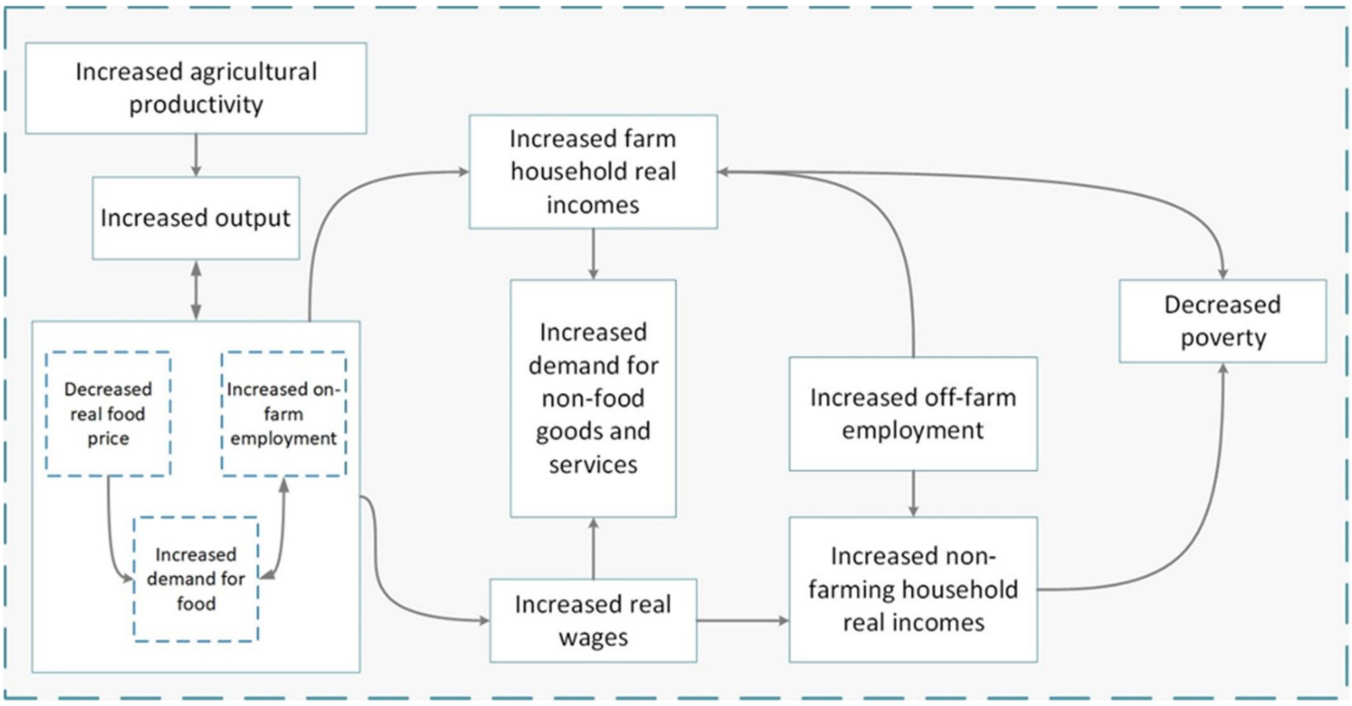

Figure 1. Conceptual framework of the study. Source: Authors' elaboration.

4. Materials and Methods

4.1. Study Area

South Kivu Province, located in the east of the DRC, occupies about 3% of the country's area, covering 69,130 km^2. It is for the most part a mountainous region [57]. Based on the data from de Saint Moulin [25], South Kivu Province, with an estimated population density of 58.24 in hab./km^2, has the third-highest density in the country after Kinshasa and North Kivu, which influences land pressure. Of course, the situation of South Kivu cannot be representative of all rural situations in the DRC. In addition, we focused our data collection on the Kalehe territory in the mountain zone of South Kivu. Regarding the demographic situation in the DRC, the scientific census of 1984 remains the last census known to the DRC. These estimates and projections were made on the basis of the growth rate obtained during this census and corrected using the period sector studies. This is notably the approach used by national and international institutions working on socioeconomic and demographic issues in the DRC, including the World Bank. Based on the obtained data, South Kivu has features that do not allow one to assert that it is totally representative of the DRC. In this study, three major zones in the DRC, the forest zone, the savanna zone, and the mountainous zone (essentially the two Kivus), were analyzed. More generally, most authors agree that there is a lack of secondary data to characterize the agricultural sector in the DRC. Due to a lack of resources, decentralized agents extrapolate data from the past without being able to verify or refine the estimates. Over the years, these data have become questionable, and should be treated with great caution.

The province of South Kivu is also affected by climate change, which is reflected in the often sudden and late return of rains, high temperatures, and unusual periods of drought [35,58]. In addition to the city of Bukavu, its capital, South Kivu is divided into eight territories, namely: Fizi, Idjwi, Kabare, Kalehe, Mwenga, Shabunda, Uvira, and Walungu. The territories of Kalehe were the focus of this study (Figure 2), and have been the subject of several primary data collections.

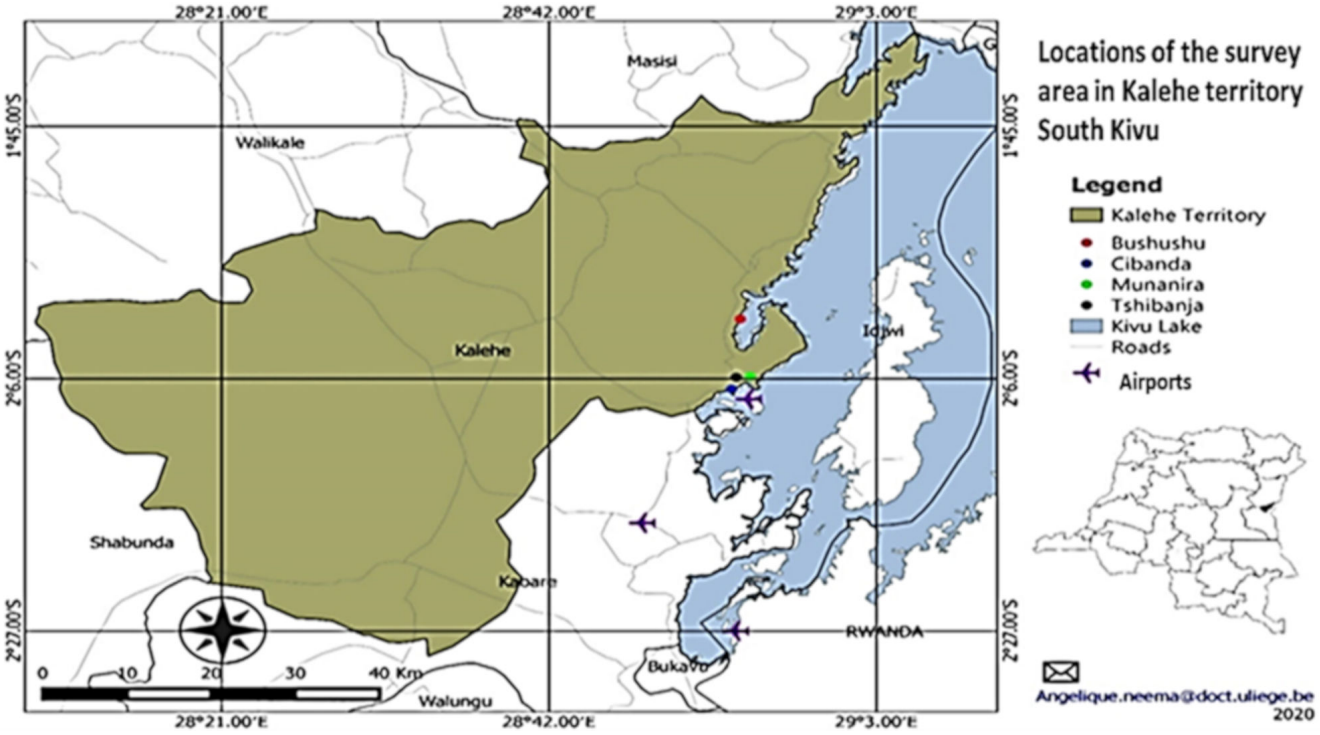

Figure 2. The study area (Kalehe territory in South Kivu). Source: Authors' elaboration.

Kalehe is located in the south of Kivu. It was chosen because it has many problems and conflicts in the competition for land. Other problems in the area include movements of the population, land-grabbing practices, and large tracts of land being accumulated by elites, which sometimes include armed groups [59,60]. Therefore, this territory is a good example to use to understand the current context of land access by rural households in South Kivu Province. The choice to focus the study on Calais's territory due to its proximity to major consumption centers (Bukavu in the south, Goma in the north) made the security situation and their share in agriculture less worrying than in other areas.

4.2. Survey Mapping and Sampling Method

First, this study focused on the structural data of the farm in order to obtain detailed knowledge of the production factors available. Then, the approach consisted of identifying the income obtained by ensuring that the data could be crossed. It was also necessary to take into account the fact that the data collection had to be done in 2–3 h maximum. A preliminary survey was conducted in the framework of a project financed with Belgian cooperation that focused on the land issue in South Kivu and the territory of Kalehe. The first household surveys were conducted during the months of October and November 2017. A questionnaire was used for this purpose. It included questions broadly related to household identity, source of income, access to land, crops grown on the land, farming and animal husbandry practices, and constraints faced by households in relation to agriculture. These surveys were carried out in the Mbinga South grouping in the Kalehe territory. A sample of 120 households was considered in four localities (Cibanda, Tshibanja, Bushushu, and Munanira); i.e., 30 households were selected at random per locality. The four localities were chosen in particular for their accessibility and especially for security parameters, which are not always met in rural areas in South Kivu. In this study, based on the characteristics of the farms obtained in the study, a subgroup of farms with agriculture was selected as the main activity among the most efficient. We also selected the most participatory targeted interviews to collect quantitative and qualitative data on income generated at the family level. The choice of 33 households was facilitated by the list of farmers identified during the previous studies carried out by researchers from the Rural Economics and Development

Laboratory of GxABT/ULg. The selection made corresponded to what is practiced in farm management [61]. To form a top group, the quartile (25% of farms) with the best results was selected. In this study, the aim was not to be representative at a geographical level, but to analyze the incomes obtained by a group of farms that are known to be performing well. Since this group had low incomes, it was evident that the incomes of the other farmers in the area covered would be even lower. This was the principle adopted in our approach.

We, therefore, did not make a random but a reasoned selection, and then, the criteria for selecting these households were based on agriculture being their main activity, having at least one field for cultivation, and accessing land resources. Due to the strong ethnic differences between these groups, income inequality or wealth inequality was very evident in these social groups. This measure was only about how income changed in relation to other members of a population, and was not overly sensitive to the characteristics of income distribution. The exception was in income redistribution, which leads to a minimum income for all. As shown by Shu and Xiong [61], when populations are classified, representative values can be calculated if their income distribution is an approximation of a known function. One might have expected similar overall incomes, but this was not the case. Furthermore, the selection made was consistent with what is done in farm management to form a superior group, which is to select the quartile (25% of farms) with the best results [62]. Items that were no longer available were directly replaced by the same criteria recommended by Agricultural Supervision. Thus, exhaustive surveys and semistructured interviews were conducted, and the study parameters concerned socioeconomic data (to assess the level of income realized by rural households in Kalehe). These data were mainly related to the demographic characteristics of households, agricultural activities performed, processing and storage of agricultural products, access to markets, the amounts of household income and its sources, access to credit, and membership in an agricultural organization. Data collection was performed using a tablet with the Open Data Kit (ODK) tool. The review phase was conducted in December 2019. The survey included meetings with farm heads, data collection from 33 households on household characteristics and their livelihoods (human capital, land capital, social capital, financial, etc.), as well as an overview of living conditions and income from agricultural activities. On average, two farms were visited daily, with one interview for 2 h and 30 min.

4.3. Data Analysis and Variables

The R 3.6.2 and Excel software applications were used to handle and analyze the data [63]. Furthermore, the Shapiro test was used to determine the data's normality, and the Pearson linear correlation test, Student's *t*-test, Chi-squared test, and Kruskal–Wallis test were used to confirm differences and variations among various study factors, depending on whether the data were parametric or nonparametric. The data were collected covering the following areas: socioeconomic and demographic characteristics, living conditions, land allocation, ongoing agricultural activities, access to market, the amount of income and its sources, credit access, and membership in an agricultural organization. The intended redundancy of certain questions was highlighted. This was done in order to cross-check the information given by the farm manager.

In this study, agricultural income was given special attention, including income from the sale of agricultural products, as well as other agricultural production and activities, and the breeding or sale of animals. It corresponded to the gross output of agriculture defined by Matthews and Coulter [63]. The income accounts began with the revenue that farmers (agricultural holder and his spouse) received for selling their crops and livestock. As Gendarme [64] pointed out, when analyzing the results, it is important to remember that there is a share of production that is destined for self-consumption. Given that a farm supports both a family and business, it is difficult to estimate the share of production. There is a dichotomy between livelihood and agricultural products. For the majority of farmers, the first priority is risk aversion and not higher income. Income from other nonagricultural activities such as small businesses, training, tailoring, remuneration related to government

duties and group and district officials, local leaders, and other nonagricultural occupations is extra-agricultural income. This transfer involves receiving money from close or distant family members, from an extended or limited family, and abroad or within the country. This type of income was included in this nonfarm income analysis in order to improve the living standards of households. The calculation of the income components is summarized in Figure 3.

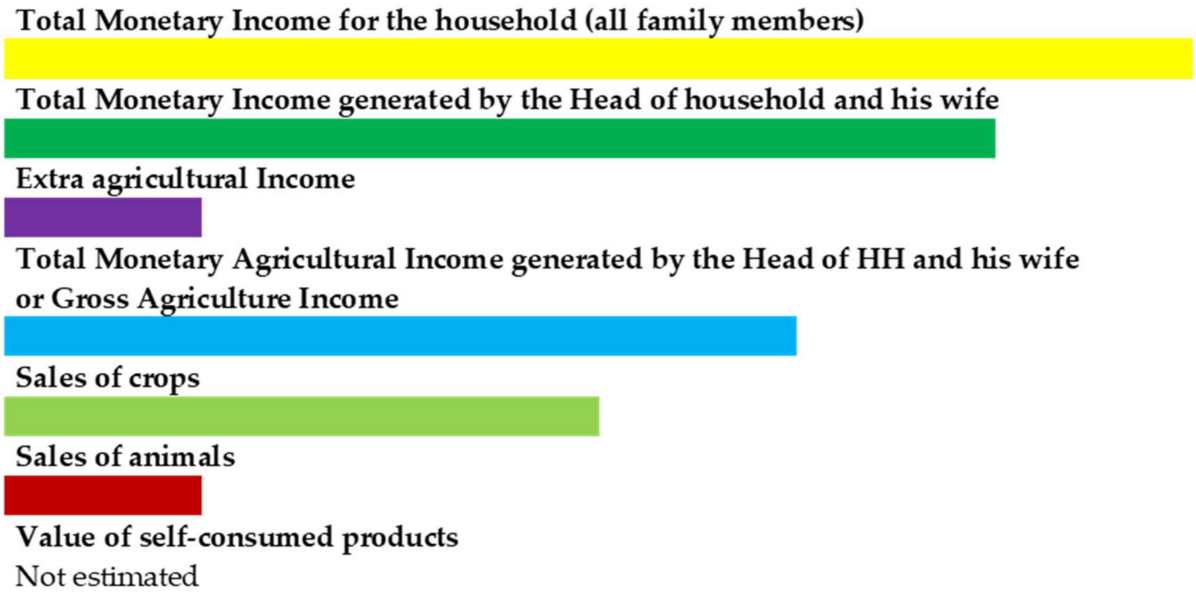

Figure 3. A summary of income components. Source: Authors' elaboration.

As recommended by Matthews and Coulter [63], the income account began with the revenue that the farmer (the head of household and his wife) received for selling their crops and livestock during the last year. It corresponded to the gross output of agriculture limited to monetary income. In addition, the household could receive other monetary incomes generated by extra-agricultural activities undertaken by the head of household or his wife (named in the figure as "Extra agricultural Income") or by other family members. When a farmer or other family members work off-farm, they generate additional income for the family that is referred to as plural activity.

Income was estimated at an exchange rate of 1700 Congolese francs (FC) per USD. To estimate the global income and the agricultural income, this study used the following process. During the interview with the farmers, a question about the family's total annual monetary income from all the activities was asked. This question was asked once the respondent presented the characteristics of their household and living conditions. The estimation of total income was examined in the context of various questions related to cash inflows and outflows of the households. Then, after having questioned the head of the farm about the use of this income, its components were successively evaluated for agricultural income by distinguishing between crop and livestock production. For crop production, data were collected separately according to the farming practice (pure or associated crop), and they included the cultivated area, the quantities produced, the share of production sold, and the selling price. For animal production, we limited ourselves to a quick survey of the species held and the income made from sales. On the basis of the figures provided, it was possible to reconsolidate the information and obtain an estimate of agricultural income. It should also be noted that at the end of the interview, the income question was asked again to ensure the stability and cross-examination of the information.

5. Results

This section presents the results in three complementary but rather distinct categories, including income estimation, access to land, and living conditions.

In this study, we selected a group of farmers who have had good performance in generating income from agricultural activities as the main group. The general goal of this study was to examine the availability of resources, living conditions, and income generated by the activities of the region's leading farmers. It is worth mentioning that the presented results belonged to the leading farmers in the region. Table 2 shows the main characteristics of the 33 households studied in our survey.

Table 2. Characteristics of sample.

Characteristics	Category	Proportion (%)	Frequencies (n = 33)
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
	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
	High school/university	9	3
Marital status of household head	Single	0	0
	Married	79	26
	Widower	12	4
	Divorced	6	2
	Other	3	1
Household size	3 to 4 persons	9	3
	5 to 6 persons	24	8
	7 to 8 persons	30	10
	9 to 10 persons	18	6
	11 to 12 persons	18	6

Source: Authors' elaboration.

Overall, in the absence of data on the general characteristics of sampled farms in South Kivu Province, determining whether the respondents matched the provincial or territorial average was difficult. It should be noted, however, that the results obtained corresponded to those commonly accepted for family farming in the DRC's mountainous zone, which is densely populated.

5.1. Income

Estimating income was the main purpose of this survey, as this is a key element in fighting poverty and reducing migration. Therefore, the main question was how to maintain farmers in rural areas if the activity did not allow generation of a significant income.

Surveys conducted on 33 farmers in the Kalehe region showed that the agricultural income of all households surveyed was FC 27,396,103, and their nonagricultural income was around FC 2,817,103. This finding corresponded to an average agricultural income estimated at USD 488 per household surveyed, and an average of USD 50 for nonagricultural income. Although agriculture was the primary source of income for the households surveyed, most of them had other occupations (e.g., workers, ranchers, or drivers) to enhance their income and improve their livelihood. However, 91% of the total income of these households was related to agricultural activities. The maximum income of farmers

was FC 2,426,250, and the minimum was FC 20,000. This indicated the income level of a household based on their agricultural activities. Thus, the minimum and maximum income per agricultural production were around FC 218,219 and FC 232,714, respectively (with a standard deviation of USD 128 ± 137). We also analyzed the distribution of this overall income among the farms to assess inequalities by calculating the GINI index (the index was equal to 0 if the distribution was equal, and 1 if the income was highly concentrated on one farm). This index was 0.5, which indicated a more unequal income distribution than expected in the income earned by the surveyed farms.

Additional information was also collected on marketing, the constraints of which can be a barrier to earning income from agricultural production. Of all the households visited, 45% stated that they had easy access to the market close to the farm, where products could be transported using family labor. Those who were far from sales points or distribution centers faced high transportation costs due to the lack of means to transport their products to market. This constraint required the households to sell their products at the outskirts of the farms, or only produce primarily for their personal consumption.

When we compared the two groups, those who were closer to the markets earned FC 411,000 more from the sales of their products (all crops combined) than those who did not have access to the market (with a difference of USD 242 for the two cropping seasons). The difference, which may appear insignificant, was however an important element in the fight against household poverty. Furthermore, differences were found between those who stored their products before selling and those who did not. It should be noted that storage depended on the practices applied by farmers. In theory, harvesting one's production, storing it well, and waiting for the period of shortage before selling is a strategy to improve farm income. According to the results, two-thirds of the farmers stored their production, while one-third did not. The difference in terms of sales was minor, with a difference of FC 72,000 (USD 42) between the two growing seasons. It should also be noted that only 15 farmers (45%) were members of agricultural cooperatives. It appeared that the off-farm income obtained by the other members of the household was not considered by the head of the household. In the absence of the physical presence of these household members during the interview with the head of the farm, it was not possible to accurately determine the amounts obtained from nonagricultural activities.

In general, all the income from agricultural and nonagricultural activities at the household level should be considered as a whole. However, it was sometimes difficult to obtain reliable data. As a result, in this study, instead of providing figures that could not be properly identified or estimated, we chose to use the available valid and reliable data.

5.2. Access to Land

In regions where the soil structure is poor, there exist discrepancies between rural families when it comes to land as one of the most essential agricultural inputs (unfertilized lands). The average area under cultivation of rural households was 3 hectares, with a confidence interval of 2.8 hectares (3 ± 2.8) and a maximum of 15 hectares. More generally, 55% of the farms had an agricultural area of between 2 and 3 hectares, while less than a third (27%) had only 0.8 to 1.9 hectares. Therefore, there was a difference between farms belonging to groups that should have been relatively homogeneous.

It is worth mentioning that the primary goal of this study was not to generalize the findings (by using a large sample size) to the whole population. In fact, a sample of 33 farmers was chosen using the census sampling method. This could be considered as a subset of farms that showed an agricultural production performance. By limiting surveys to this subset, less variability could be expected than from a larger, random sample that included more vulnerable and small farmers with limited cultivable lands. It is also worth mentioning that these 33 farmers were all identified as elite and key-informant farmers who provided researchers with rich and key information. More importantly, because the economic situation of these 33 farmers was better than that of others, their remarks could be applied to the entire community and main population, because other farmers had a

lower economic status. In other words, their economic implications were applicable to the rest of households with lower and/or poor economic conditions.

Most of the respondents (67%) received their lands from their parents (inheritance). The majority of the land owned by the farmers was therefore inherited or purchased. Land rental is also common in this area (55%) due to the high selling price and lack of enough agricultural lands. Faced with these constraints, farmers must rent their land using a lease, usually for one year, by paying rent (the farmer pays the landowner a fixed amount agreed upon by both parties), or to practice sharecropping (the farmer gives part of the harvest to the landowner). This new trend in land tenure was often cited by the respondents as the major constraint taking place at farms. During the interviews, the issue of access to land was systematically addressed. The responses showed that there was a worrying trend in which most farmers became poor to meet landowners' deals. While access to land was not an issue for family farmers according to the existing customary law, there is confusion over the multiplicity of land access approaches today (legal, informal, and customary). Moreover, depending on the system to obtain it, the same land can be claimed by various actors.

On average, there were eight people and four workers in each household, which indicated that the families in Kalehe were large. In the past, faced with this phenomenon, farmers were given more fields to cultivate. Today, this is no longer possible. It should be pointed out that only 3% of the households surveyed were able to receive their land as a gift from the community leaders. This is explained by the fact that in the DRC, there is a juxtaposition between the state and customary power in access to land. It is a customary law that has no association with any formal entity [30]. There are in fact two types of land acquisition that result from a gratuitous transfer of property: inheritance and gift. In Kalehe Province, this takes place under the cover of a traditional authority (the tribal chief). The farms visited during our survey did receive land capital by inheritance from their parents who had obtained it from the tribal chief. This access to land was a very common method of land ownership in the study area (67% of the respondents). Among the respondents, only one inherited farm was reported by the traditional authority, indicating a relative shortage of land and the dominance of a new practice involving the sale of farms by the authorities.

Figure 4 illustrates the phenomenon of disguised unemployment on the farms surveyed. The labor factor was hardly valued in terms of monetary income. There was no relationship between household size and income (Figure 4). The number of people in a household did not influence household income. Farmers were also asked about the number of plots of land being farmed. On average, four plots were cultivated (with a confidence interval of 1.8). The maximum number of plots encountered for a farm was eight, and the farmer with the largest area (15 hectares) held seven plots under cultivation. There was only one farm that had its entire area in one piece. We therefore observed a generalized fragmentation issue in the study area.

Overall, it emerged from our surveys that access to land was problematic on relatively small farms, especially when we considered that the household size was high, and therefore, "area per farm production" was low. From the point of view of agricultural systems, the agriculture practiced was oriented to ensure the survival of the households surveyed, and the most commonly grown crops were food crops. Indeed, cassava is the staple food in the region, and beans are the main source of protein. The predominance of cassava in the area is justified by its ability to grow even in exhausted soils. In the past, the field close to the house and owned by the farmer was mainly occupied by banana trees, particularly in association with beans. Bacterial wilt attacks destroyed many banana plantations in the past decade and have gradually effected cassava plants on Kalehe plantations, with catastrophic consequences for the soil fertility in this mountainous province.

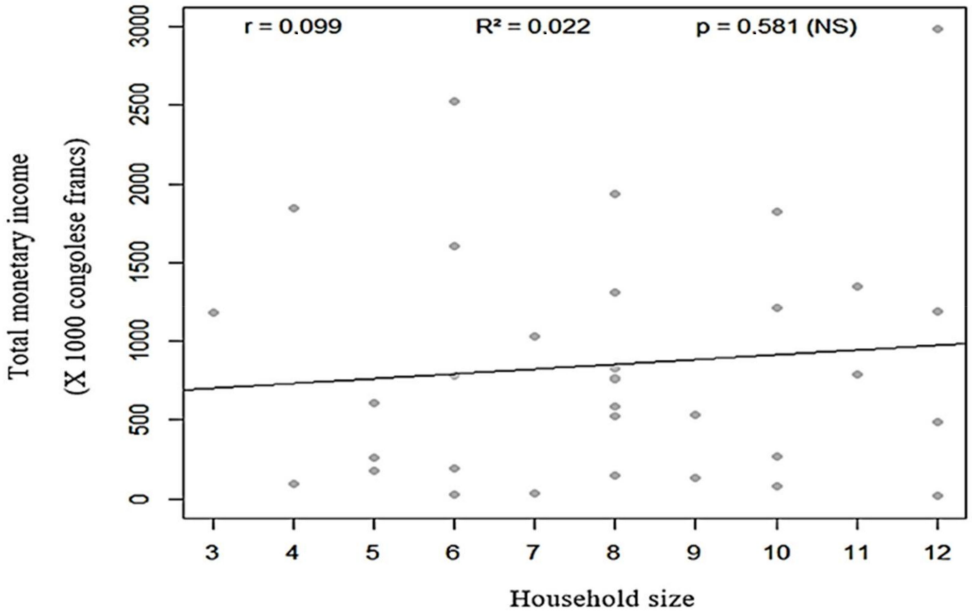

Figure 4. Relation between household size and total monetary income generated by the head of household and spouse. Source: Authors' elaboration.

According to the findings, farm size was a critical component in enhancing agricultural output and, as a result, in decreasing rural poverty. Thus, if considerable farmer commercialization (which can stimulate agricultural change and contribute to widespread rural poverty reduction) is to be realized, raising the average farmer's land size is required. Furthermore, several circumstances, such as high land prices, inequity in the allocation of farmers' land, and traditional chief ownership, might hinder farmers' ability to use the land. Several studies have examined the factors that influence inequalities in Africa and other emerging countries. According to Randall et al. [65], Africa has a high level of inequality, which is due (in part) to the underlying distribution of outputs, particularly land and physical and human capital. In a study of growth and poverty in India, Christiaensen et al. [66] discovered that beginning inequality in interaction with literacy, agricultural productivity, and output distribution had an impact on the link between growth and poverty. Bigsten et al. [67] use panel data to find that land ownership, education, crop type, reliance, and geography were the most significant predictors of poverty in Africa. In addition, Bigsten, Kebede, Shimeles, and Taddesse [67] found that the growth of nontraditional export products increased per-capita spending, reduced the likelihood of spreading poverty or chronic poverty, and improved the likelihood of exiting poverty.

As demonstrated in Figure 5, there was no significant difference in tenure types of access to land (rental and nonrental) (t-value = −0.410; ddl = 28.255; p-value = 0.685). However, the average annual agricultural income differed significantly between those who rented land (461 ± 385) and those who did not rent land (520 ± 437). This indicated that the farmers' revenue in Kalehe area was unaffected by the tenure pattern of access.

Cattle ownership was also an important element to be considered in the analysis of farm income, as shown in Figure 6. The results showed the importance of organic manure (cow manure) in managing soil fertility and obtaining marketable surpluses. The comparison of incomes between farmers who raised livestock (cows) and those who did not showed that there was a significant difference between them (t-value = 2.526; df = 30.451; p-value = 0.016). Those farmers who raised livestock had more income (1211.462 ± 569.726 X1000 FC) than those who did not (617.955 ± 777.341 X1000 FC).

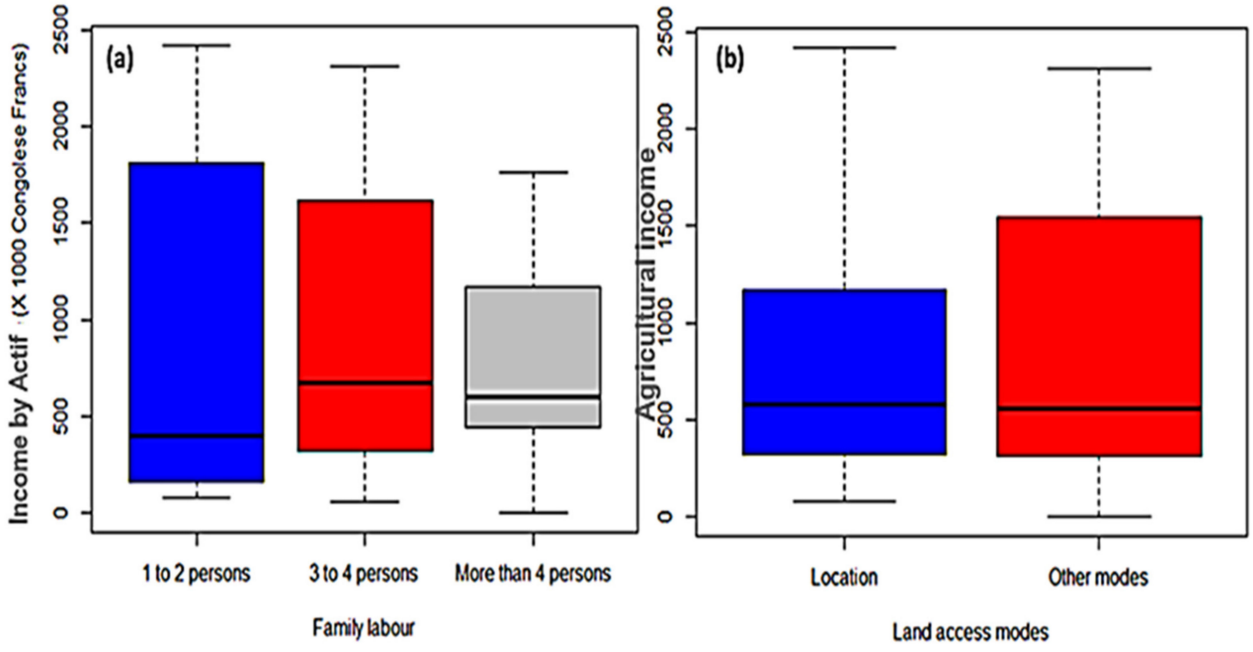

Figure 5. Effect of family workforce size (**a**) and mode of access to land (**b**) on household agricultural income. Source: Authors' elaboration.

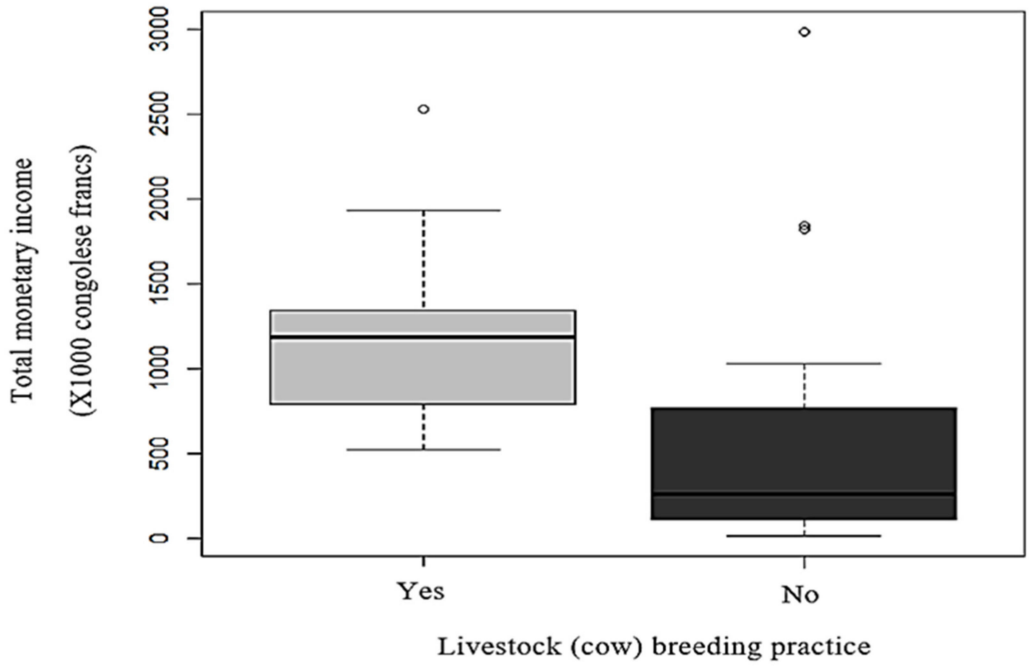

Figure 6. Comparison of income generated by the head of household and their spouse related to husbandry practice (cows). Source: Authors' elaboration.

5.3. Life Conditions

The characteristics of the houses owned by the farmers' households reflected the level of their poverty. For example, only 15% of the households lived in a permanent house, and 3% in a partially permanent house. About 61% of the households lived in metal houses, and there were still 21% of households living in mud houses. The majority did not allocate part of their income to housing improvements due to family burdens and other expenses they had to bear for their survival (the living conditions according to the types of houses and toilets are shown in Figure 7).



Figure 7. The living conditions according to the types of houses and toilets. (**a**) Plank house with a roof made of sheet metal in the Munanira groupment; (**b**) dwelling house made of mud and a roof made of petiole in the groupment of Cibanda; (**c**) toilet made of plank and sheet metal in the Bushushu groupment; (**d**) mud and plank toilet in the groupment of Tshibanja. Source: Authors' elaboration.

Another important aspect to be taken into account in the analysis was rural households' access to basic services such as education, drinking water, electricity, health care, transportation, and various sanitary facilities. Our survey showed that 88% of the households had easy access to water. However, this remained highly questionable given the quality of this water, which was not potable. Only four households declared that they managed to boil water before drinking it or before using it for cooking. Others drank water without boiling it, which was not without consequences to their nutritional and health status, as this exposed them to the risk of certain diseases.

In terms of access to health care, just 50% of the respondents had access to services related to health, and others failed to access health care. The main reasons included lack of facilities (high cost compared to the farmer's financial resources) or other special circumstances that did not meet their expectations, including the need to pay before care. It was also very difficult for the majority of the respondents to access health services due to the distance of health care centers from their houses. Most of our interviewees had no information about the existence of a few mutual health insurance companies in the area. Because of their difficult living conditions, the majority of these households were unable to afford the exorbitant costs of health care, and were frequently forced to resort to self-medication and the inherent risks involved.

In addition, sanitary conditions in the community remained poor. The households had unbuilt outhouses, and sometimes shared toilets that were used by two or three households at the same time. As a result of the living conditions of rural households and a lack of means, farmers were unable to have a clean and well-equipped toilet at each household. In addition, in 12% of villages in the Kalehe region, electricity was available through the Society National Electricity (SNEL). However, 76% used only solar

panels to provide lighting in their houses. The results also showed that 18% had a TV and 64% had a cell phone, but no household had a tap, and only two households had a motorbike, representing 6% of the sample. Access to firewood remained the main means of cooking in rural households, and this is an environmental, domestic, and economic issue. Although this cooking method has several drawbacks in rural areas, it remained the main cooking preference, with 79% of households using it, leading to deforestation and human exploitation of the environment. Indeed, a vicious circle of poverty is driven by mankind, as poor soil management means that agricultural yields remain low, production and food become insufficient, and human health deteriorates as the population continues to grow despite the decrease in agricultural production. This is because the consumption of wood or makala (charcoal) for cooking remains an issue that leads to deforestation, soil degradation, and soil erosion.

6. Discussion

The results indicated that land was one of the most important production factors. In this study, inequalities were observed between rural households at the level of exploited areas. The interview with agricultural households showed that the new trend in land tenure was a major constraint faced by farmers. In this way, most people became poor in favor of landowners. Another issue was that the same land could be claimed by various actors. Generally, the findings of this study indicated that land access was almost as difficult for small-scale farmers, particularly when the household size was large, and therefore the "area per farm" ratio was low. Another challenging issue was access to basic services such as education, drinking water, electricity, health care, transportation, and various sanitary facilities by rural households. Furthermore, poor soil management in the study areas could reduce agricultural yields, and thus reduce agricultural production and the amount of food, and endanger public health. The question of the role to be played by agriculture in development in general and rural development in particular is not a simple one, and has been the subject of much debate in the scientific world and in international organizations [68,69]. According to the World Bank, and supported by various authors [70,71], agriculture is an engine of development insofar as its growth has a greater impact on the poor. For others [70], this needs to be qualified: The small farm development model has been widely challenged despite its confirmed success, and the debate is still open. With globalization and the integration of international markets, we can observe intense competition, offering some opportunities but also new risks. Although the answers varied greatly by context, for the Democratic Republic of Congo, the development of agriculture remains a key option.

The results presented above showed that agriculture generated very little income, and that it was therefore very difficult for an agricultural producer to emerge from poverty. These farmers earned an average income of USD 41, which is about the same as the average monthly income in the DRC province (https://www.journaldunet.com). This agricultural income was not really profitable, especially since these farmers had the highest yields. It should also be noted that this income did not take into account self-consumption. Therefore, less-efficient farmers would still have a lower income. Given the data available, it was not easy to obtain an accurate and complete picture of the situation for farmers in the DRC in general and in South Kivu in particular. The last study on Congolese agriculture was conducted in 2009, and was carried out by a consultancy firm [70]. At the provincial level, the detailed data on agriculture go back to more than 20 years ago [70,72]. They showed the enormous agricultural potential of the province, which should enable it to provide its population with a satisfactory diet both from quantitative and qualitative points of view. However, many problems of malnutrition have already been reported, which, according to the authors, are due to the land situation and demography, as observed where land is scarce and the population is abundant. It should be noted that the report underlined the role of women in South Kivu, who play a very important role in agricultural production. The labor force used in agriculture essentially includes females.

Another important point is that South Kiwi has experienced decades of weak governance and conflict, which has put the state in a very fragile position. The province is still strongly feeling the after-effects of this long period. All the sectors of economy have been affected, and the standard of living of the population has been greatly affected by this situation, particularly through demographic imbalances. In addition to the destruction of productive physical production, the conflict has had an enormous toll in human capital. It has influenced the availability of human capital through migration [72]. The population has been resilient and has shown a surprising economic dynamism. However, the conflict reduced returns by destroying the infrastructure and stopping the exchange of goods and freedom of movement. Sources of income are linked to short-term commercial activities, as well as day-to-day activities; i.e., precarious, volatile, and not very capital-intensive activities. This makes land grabbing common among elite leaders, especially of Congolese peasants, that, by controlling the performance of a corrupt Congolese government, gain social land titles, sometimes with the participation of ordinary leaders.

Thus, a handful of people have access to large tracts of land, including religious communities, alongside almost-destitute peasants [73]. As a result of intense pressure on the land, an explosion of land conflicts has occurred, which sometimes causes violence, especially in the eastern part of the DRC [74]. Securing the land tenure status of farmers is considered an indispensable condition to encourage agricultural production [75]. This theory states that the formalization of private-property rights is supposed to promote investment and economic efficiency. The positive link between securing land status and encouraging investment has also been established in agriculture. It is interpreted in the sense that the security of land tenure for farmers is a prerequisite for farmers to be able to carry out their activities, invest in agriculture, and benefit from their efforts [76]. The positive relationship between the formalization of private ownership rights to agricultural land and productivity is still being debated [77]. Many land policymakers continue to believe that the formalization of private-property rights mechanically induces productivity gains. A study conducted in Benin on the mixing of land pressures with conventional norms and formal laws in land management showed the limitations of the predictions of the evolutionary theory of private property rights as a condition for intensifying agricultural production.

From the surveys carried out, it was clear that the limits of agricultural development based on access to land are being reached in Kalehe. The rental system that is currently being developed is not compatible with the management of the fertility of the already-impoverished soils. There is no simple solution, but the paths advocated for international land can contribute to reflection on this sensitive issue. As it is difficult to obtain further data on farm incomes in the province at the level of incumbent jurisdictions, we exploited the results observed for income from cassava production in the neighboring territory for comparison purposes [15].

In the Kabare territory near Kalehe and not far from Bukavu, cassava producers are small family farmers who peel fresh cassava, then dry it before selling it to rural collector-wholesalers on a dry basis. Most of the work is done by women. Production is mainly rainfed, and is generally intended first for domestic consumption, and then for marketing to generate income. The total area cultivated by the household never exceeds one hectare and varies between 0.45 and 0.95 ha, with an average of 0.76 ha. The area sown with cassava in the total cultivated area varies between 0.10 and 0.80 ha, with an average of 0.33 ha; this represents 43% of the total cultivated area. The cultivated soils are largely of volcanic origin and are considered very favorable for food crops, especially cassava.

The average production was estimated at 695 kg of cassava per farm (which is three times less than the yields obtained under good agronomic conditions). The share of self-consumption in the total cassava production of the agricultural household in Irhambi/Katana is significant; it is estimated at 45% of total production, while the quantity destined for the market represents only 30%. In this value chain of cassava production in Irhambi/Katana, the overall value added generated by the actors is estimated at USD

810/metric ton. Producers capture less than half (46%) of this global value added, i.e., USD 373/metric ton. It should be kept in mind that a farmer only markets 200 kg of cassava. He can therefore only obtain a derisory cash income, estimated on average at a maximum of USD 70. This study, which did not focus on the overall farm incomes, but on those of a significant production at the start of the value chain analysis, confirmed the low incomes derived from agricultural activity. In addition, we were able to observe convergences between our results and those of a GIZ study conducted by Nget et al. [58] in mining areas that found that mining activities brought in more income than agricultural activities.

According to their study, miners of gold artisanal earned an average annual income of USD 2027, or USD 337.80 per month. As a reminder, in Kalehe rural households, whose primary activity is agriculture, their average annual income was FC 915,543, or USD 538 for all sources of income. According to the study conducted by GIZ, a monthly income of USD 337.80, which corresponds to an annual income of USD 4053, was observed for the exploitation of a single mining product. Excluding food costs, which were estimated at USD 150 per month or USD 1800 per year, their average annual income was USD 2253. The farmer, on the other hand, works on their farm to feed their family (consuming what they have produced), only earning an average annual income of USD 538. This confirmed that agriculture provides very little income for households.

On the other hand, it was therefore noticeable that the farmers in our study realized very little income, unlike those living in and around mining sites. Their outlets were the local markets surrounding the mining sites, and they easily accessed them, unlike in the Kalehe territory, where farmers experienced difficulties in accessing the market. In our review, two important approaches were omitted. The first was to examine the recording of up-to-date information and its role in agricultural land information in achieving the security of agricultural enterprises and land governance in general. Second, researchers had consideration for other factors that affected the security of companies, especially in rural areas, such as the important role of special local traditions and development programs (tax on land consolidation). In this study, the methods used in other studies could not solve the problems related to the complexity of access to land, so it affected agricultural approaches and productivity.

7. Conclusions

Agricultural development in South Kivu and the DRC remains an important and uncertain task for the next decade. This contributes to the country's food security and the fight against poverty, particularly in rural areas. The issue of land is still important to ensure coordinated agricultural development in the DRC, and the current system is insufficient for long-term agricultural revitalization. Generally speaking, there are still major uncertainties about the possibility of cultivating land for a sufficiently long period of time to guarantee a return on the investments that soil fertility degradation in particular requires. Formal rights can be important instruments to ensure equitable access to land, but in the Congolese context, it must be recognized that the reality is often complex, and that rural contexts are more complicated than the formal rules that they usually provide. There are some questions that may arise regarding the effects of formalizing private property rights on the security of land tenure, as well as the heterogeneity of the results based on the effects of private-property rights theory on farm productivity. In addition, there was instability linked to the armed conflicts that have affected the region. Finally, the state of roads and infrastructure, in general, was an aggravating factor in rural areas. In addition, land conflicts in southern Kivu are one of the main common causes of conflict in the region. Conflicts are the result of improper, uncertain, and confusing land boundary restrictions; family disputes over inheritance issues; and conflicts between farmers and ranchers. Moreover, access to economic and natural resources, underfinancing of local farming, and political neglect are also significant issues. In other words, it is essential to accompany the security of land tenure of farmers with appropriate measures that allow a better valorization of agricultural land whose occupants have a secure land status.

It is important to implement an effective and equitable antipoverty policy in rural areas to address the issue of income targets for farming households and to target low incomes from all the sources of income. Despite the huge potential of agriculture in supplying food to the national and international markets of South Kivu Province, agricultural activities there are not very profitable, and farmers have many problems with their livelihood. This reflects various constraints that generally hinder and reduce rural development. Based on the results, the first issue to be addressed is the low income from agricultural activities. The main contribution of this study was that it provided the possibility of creating proper income for different farms. Agricultural activities alone do not reduce the poverty of farming households. The existing literature did not focus on this aspect of the problem; instead, it focused on the constraints of population growth that were offset by the scarcity of available agricultural lands.

The absence of sufficient infrastructure, inability to cope with rapid technological innovation, and inequality in land distribution are currently the key factors for the agricultural sector's poor performance. It is essential that this sector be efficient and diversified. There is a need for reconstruction, revitalization, and transformation in the agricultural sector to be able to meet the growing challenges and to meet its full potential. Moreover, it must be understood that the impact of agriculture on poverty reduction cannot be assessed solely by focusing on this sector, because such an assessment neglects the important forward and backward links between different sectors of an economy. In fact, the impact of agriculture must be considered simultaneously with other sectors, and therefore balanced development of the economy with the growth of all sectors at a satisfactory rate is essential. We concluded that if the income from the agricultural activity of a sample of 33 farmers (considered to be performing well) is relatively low, we should not be surprised to see a rural exodus and a lack of interest in agriculture among young farmers. Thus, the main policy implication is that we must increase agricultural incomes if we are planning to make the agricultural sector the engine of the country's development (as has been stated far too often by the current president). It is also worth mentioning that given the fact that the selected sample had a better economic condition, the economic implications suggested by these groups are applicable to the entire population.

As in other studies, this study had some limitations, such as the small sample size. It should be noted that there were significant constraints to conducting surveys in the DRC and South Kivu Province. Farmers were difficult to communicate with, and frequently refused to respond to interviewers. More importantly, they expected to receive an incentive (payment) to participate in the interviews. In addition, it was required to travel several times in order to obtain an in-depth interview lasting approximately two hours, while the villages were remote with impassable roads in mountainous areas. As a result, this study focused on a small sample of interviewees who cooperated fully and provided reliable data. These issues can be explored in future studies by conducting structured interviews on the challenges and opportunities of smallholder production, explanatory factors for farm income diversity, sustainable livelihoods of smallholder farmers, nonagricultural activities, and smallholder income. In addition, more research is needed on the determinants and farmers' willingness to adopt large-scale agricultural production and increase investment in the agricultural sector.

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