

The Contribution of Subsistence Agriculture to the Livelihoods of the Smallholder Farmers in South Kivu Province, Democratic Republic of Congo

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Abstract

Subsistence agriculture is practiced in most parts of the world on a limited space of land by farmers. It is mainly dependent on human power that results into production of food consumed at household level, with little or no surplus for sale. A study about the contribution of subsistence agriculture to the livelihoods of the smallholder farmers in south Kivu province was carried out. A total of 303 smallholder farmers were randomly selected and interviewed to examine the effects of practicing subsistence agriculture on the socioeconomic status of the farmers. How the socioeconomic status attained by the farmers influenced their sustainable livelihoods was also assessed. Data were analyzed using means, frequency distribution, correlation, ANOVA and Chi square test. Thematic analysis was done on qualitative data. The farmers practiced shifting and primitive agriculture, intensive subsistence, and nomadic herding. There was a significant difference in the yields of crops grown ($F = 0.0088$; $P = 0.05$), while education and income status significantly affected the farmer's socioeconomic status by practicing subsistence agriculture ($P < 0.05$). An average mean value of 3.12 for the components of the farmers' livelihoods were exhibited, with the human capital mean value being highest (4.16) compared to natural, social and financial capital. The socioeconomic status attained had a significant effect on sustainable livelihoods of the farmers at $P < 0.05$. This implies that the smallholder farmers need to be trained by the agricultural extension workers better and sustainable methods of farming for higher crop yields. In addition, the Central Government through the Ministry of Agriculture, should avail improved seed inputs to the local community for better crop yields. All these will enable the smallholder farmers improve their socioeconomic status and at the same time attain higher sustainable livelihoods.

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1. Introduction

Globally, there are about 500 million smallholder farming households (World Bank, 2016). In the developing countries, smallholder farmers own land equivalent to 2 hectares or below and are known to produce roughly 35% of the world's food (Lowder et al., 2021). However, according to Sibhatu et al. (2017), many of the world's food insecure and undernourished people are smallholder farmers in developing countries. This could have been brought about by ineffective agricultural sectors that are unable to support small scale farmers to produce food to sustain their livelihoods (Rakotoarisoa et al., 2012). Practicing agriculture on small scale using farm labour produces yields mainly for household consumption and has been recognized as subsistence farming (FAO, 2005; Tisdell, 2011; Alexandratos & Bruinsma, 2012). Mompoti et al. (2009) state that subsistence agriculture contributes to increase in food security among households but however the authors opine that increase in yields from the type of farming depends on the increase in the area cultivated and the type of seeds used in agricultural activities. Smallholder farmers own small pieces of land but the sizes vary from region to region. In China and Vietnam, smallholder families live in farms significantly smaller than 2 hectares, while in Bangladesh, smallholder farms are as small as 0.24 hectares (Tisdell, 2011). In Latin America, smallholder farms tend to be over 2 hectares, whereas in Africa, smallholder farms do not go beyond 0.9 hectares (Tisdell, 2011).

There are two major forms of subsistence agriculture which include primitive subsistence agriculture and intensive subsistence agriculture (FAO, 2005; Dixon et al., 2001a). Primitive subsistence agriculture includes shifting cultivation and pastoral nomadic farming (Styger et al., 2007). In shifting cultivation, farmers typically cultivate a piece of land and eventually abandon it when soil fertility declines which is then followed by a fallow period (Unai, 2005; Teegalapalli et al., 2009). Intensive subsistence agriculture on the other hand, is the type of agriculture in which the farmers maximize food production in relatively small fields (Dixon et al., 2001a; 2001b). The farmers according to FAO (2005) practice double and continuous cropping applying some manure, with no fallow to maximize food production. Such type of farming is expected to improve the livelihoods of the farmers and hence their socioeconomic status (Serrat, 2017). Socioeconomic status is regarded as an economic and sociological measure of a person's work experience and an individual's or family's economic and position in relation to others and may be classified as high, middle and low (World Bank, 2007). If the livelihoods obtained enable the practicing farmers recover from stresses and shocks created as a result of some variations like seasons and crop yields that culminate to some food security, then they may be regarded as sustainable (Krantz, 2001; Serrat, 2017). Sustainable livelihoods enable people achieve lasting improvements against the indicators of poverty (Serrat, 2007). Sustainable livelihood strategies include social, physical, human, natural, and financial assets (Krantz, 2001; Serrat, 2017;) and they result into the sustainable use of natural resources, income, food security and well-being (Serrat, 2017) which leads to improved socioeconomic status of people (Barakagira and Ndungo, 2023; Krantz, 2001).

In the DRC, individualism in agricultural practices punctuated with a primitive form of farming that was characterized by burning of trees and shrubs, alongside the use of stones and modified sticks as tools, resulted in inefficiencies in food production, threatening the local people's livelihoods (Murphy et al., 2015; Prokopy et al., 2008). In addition, the unreliable rainfall patterns throughout the year did not tremendously promote subsistence farming among the Congolese communities (Sheil, 2018; Waceke & Kimenju, 2007). This state of affairs led to the introduction of irrigation activities to counter irregular rainfalls by people who practiced subsistence farming (FAO, 2018). However, this seems not to have greatly addressed the problem of food insecurity in addition to improvement on the socioeconomic status of the smallholder farmers in the region (Wambua et al., 2014).

In south Kivu, over 75% of the people leaving in rural areas (south Kivu, Interior Affairs Division, 2018), practice subsistence agriculture (south Kivu, Agricultural Inspection, 2018). Also, the WFP (2016) in addition reported that a poverty rate of 74.3% was experienced. This could have been brought about by farmers who depended on informal seed sources that were not certified and contributed to the low yields of crops grown (FAO, 2005), hence negatively affecting the livelihoods of the local communities. Kruijssen (2009) posit that, farmers usually recycle seeds from the previous seasons' harvest or buy them from neighbours, or local food stores, which explained how pests and seed borne diseases spread leading to low productivity. The inability of subsistence farming to constantly avail food and generation of income forced the most energetic people in the DRC to migrate to urban areas, leaving the young, aged and vulnerable people behind who could not work in the farms to sustainably produce yields for an improved socioeconomic status (Waceke & Kimenju, 2007). On the contrary, Davidova et al. (2012) examined how subsistence farming related to income in addition to agricultural livelihoods and found that subsistence farming in the DRC made significant contributions to household incomes and livelihoods.

It was documented by Kodila (2008) that, agriculture in the DRC was prosperous in 1960s and contributed 40% to the gross domestic product compared to 10% in 2006. Agriculture was qualified as a priority but did not yield positive results in relation to the farmers' socioeconomic status (Kwembe & Guy, 2006). Despite the World Bank's (2008) discussion about the post-2015 development agenda and the United Nations' Sustainable Development Goals recognizing the need to make smallholder agriculture and food systems more improved, it did not spur the farmers in south Kivu to another level socioeconomically. Many agricultural projects were put in place aimed for increasing food production in south Kivu (Lebailly, 2014). Also, some strategies like availing improved seeds to farmers aimed at enhancing the socioeconomic status of the farmers were undertaken (South Kivu Agricultural Inspection, 2015). Authors like Eric et al. (2017) documented that despite the undertakings, there has not been remarkable improvement in agricultural yields and thus low socioeconomic status of the farmers. Contradicting information therefore stem from different authors about subsistence agriculture and socioeconomic status of smallholder farmers of south Kivu province. This prompted the current study to assess the contribution of subsistence agriculture to the well-being of the smallholder farmers in south Kivu. The study was guided by the two specific objectives; that is, to examine the effects of practicing subsistence agriculture on the socioeconomic status of the smallholder farmers found in south Kivu province; and to assess how the socioeconomic status attained influenced the sustainable livelihoods of the smallholder farmers in south Kivu province, DRC.

2. Materials and Methods

2.1. Study Area

South Kivu province is located in the east of the DRC and covers an area of 69,130 km². The province is bordered to the East by the Republic of Rwanda, Burundi and Tanzania. To the west and south, it borders with the province of Maniema. In the south-east, it is separated from Tanzania by Lake Tanganyika (DRC, Ministry of Planning, 2007). South Kivu province is composed of eight territories, that is; Fizi, Idjwi, Kabare, Kalehe, Mwenga, Shabunda, Uvira and Walungu (Health Inspection, Annual Report, 2019) as presented in Fig.1.

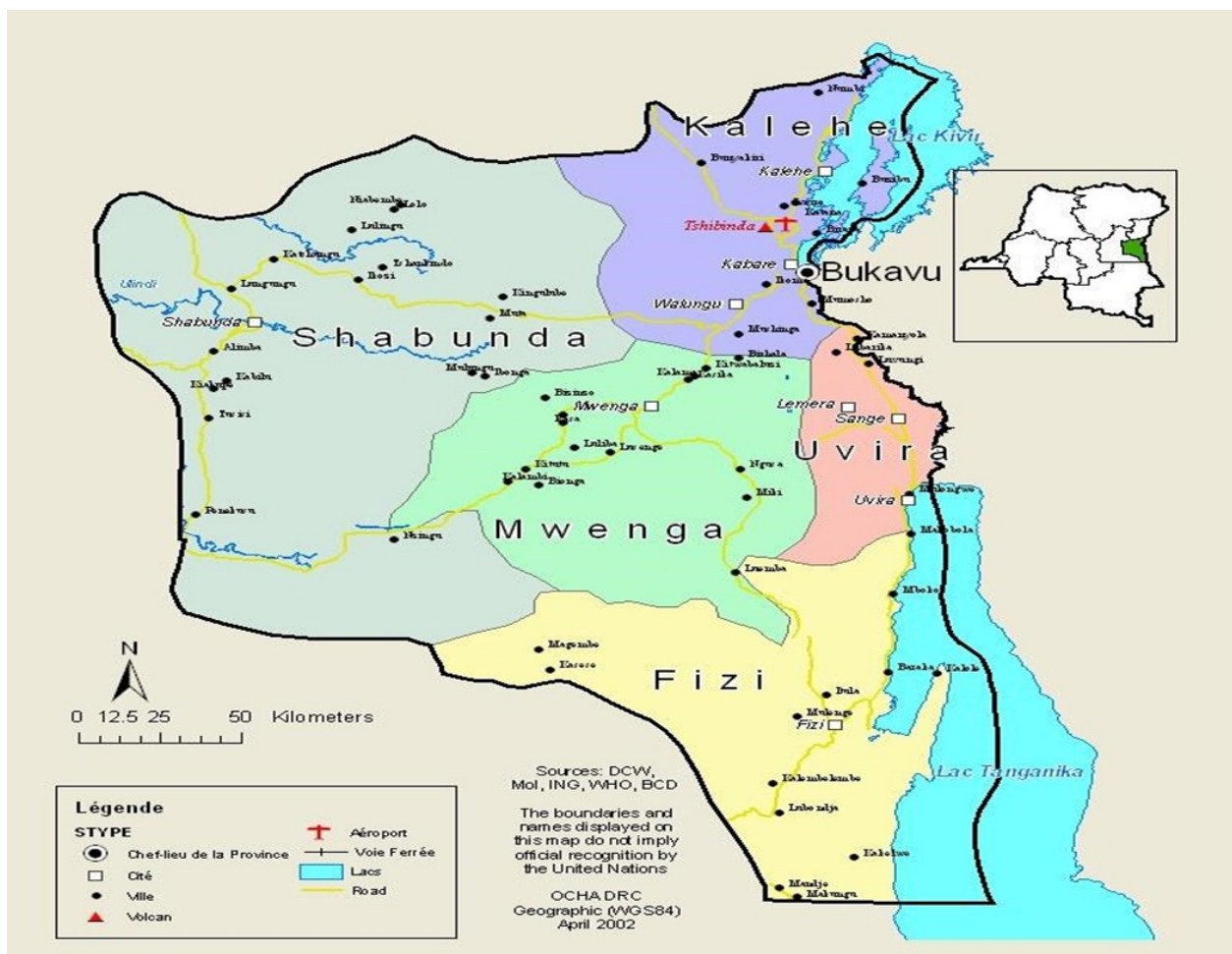


Figure 1. Map of South Kivu Province, DRC

2.2. Data and sampling technique

The research project focused on assessing the contribution of subsistence agriculture towards the well-being of the smallholder farmers in south Kivu, DRC. Both qualitative and quantitative data were obtained from the respondents. According to Lindlof and Taylor (2011), qualitative data verify and enrich the quantitative data used in the study. A cross-sectional survey was used to collect information from the sample that was drawn from a pre-determined population

(Dillman, 2000). The design as reported by Fraenkel and Wallen (2006) is an ideal method when gathering information to depict contemporary facts.

A total of 13,677 smallholder farmers were found in south Kivu province from whom the sample was derived using the Yamane (1967) formula; $n = N / 1 + Ne^2$. Where n = sample size, N = total number of smallholder farmers, e = level of significance (0.05). Hence, $n = 13677 / 1 + 13677 (0.05)^2 = 389$. The aggregate sample size from each territory, was computed using Sarndal's (2003) formula; $n_1 = (N_1 / N) n$. Where n_1 = aggregate sample size in a given territory, N_1 = number of the smallholder farmers in the territory, N = number of smallholder farmers in the study area, n = sample size used in the study.

For example, Fizi territory; $n_1 = 2735 / 13677 \times 389 = 78$ as shown in Table 1.

Table 1. Sample Size Used in the Study		
Territory	Number of smallholder farmers	Proportionate sample size
Fizi	2,735	78
Idjwi	684	20
Kabare	821	23
Kalehe	1,915	54
Mwenga	1,231	35
Shabunda	2,052	58
Uvira	1,504	43
Walungu	2,735	78
Total	13,677	389

Source: Primary data, 2019

Primary data from the respondents were collected using a questionnaire because of its ability to gather a lot of information in a short period (Oso & Onen, 2009). Qualitative data from the key informants were obtained using a semi-structured interview guide, which allowed greater freedom and flexibility of questions and responses (Kumar, 2011). Pre-testing of the questionnaire was done in some other parts of south Kivu province other than the study areas as recommended by Connely (2008). Pre-testing enabled the interviewers to familiarize and review the contents in the questionnaire. The focus was on assessing how study participants understood the questions and to identify any problems met when answering the questions. Necessary changes were made in the final research instrument.

A questionnaire survey was randomly conducted among 389 smallholder farmers selected from the eight territories of south Kivu province. A total of 303 questionnaires were fully completed and returned making a response rate of 78% of the targeted total sample size which was acceptable according to Amin (2002).

During the study, the randomly selected smallholder farmer was first made aware that the purpose of the research was for

academic purposes and had no implications whatsoever. The respondents were also assured of confidentiality and anonymity. A semi-structured interview guide was also designed and administered to some members of staff who occupy managerial positions in agriculture departments and local government in south Kivu province. Two agricultural extension officers and two representatives of local government authority were purposively selected from each territory as suggested by Minichiello et al. (1990) and Sarantakos (2005). The aim was to gather more information concerning the contribution of subsistence agriculture to the well-being of the smallholder farmers in south Kivu province.

The questionnaire responses were edited and coded and then later entered and analyzed using SPSS Version 20.0 for Windows. Descriptive statistics like the measure of frequency and mean were used to generate information about the respondents' demographics and the contribution of subsistence agriculture towards the well-being of the smallholder farmers in south Kivu province. The relationships between some other variables of the study were also determined using the correlation analysis and ANOVA tests. The qualitative data that were collected was sorted and categorized into themes according to particular items as reported by Sarantakos (2005). Thematic analysis helped to establish which themes emerged during the data collection exercise. The associations of the attributes in the study were determined using the Chi-square test.

3. Results

3.1. Effects of practicing subsistence agriculture on the socioeconomic status of smallholder farmers

Smallholder farmers in south Kivu province practiced mainly shifting agriculture (mean = 2.79) and primitive agriculture (mean = 2.58) which were both above average using a five-point Likert scale. Other types of subsistence agriculture practiced included nomadic herding and intensive subsistence (Table 2).

Table 2. Types of Subsistence Agriculture Practiced by Farmers in South Kivu Province		
Subsistence Agriculture Practiced	Mean	Std. Deviation
Shifting Agriculture	2.79	1.32
Primitive Agriculture	2.58	1.49
Intensive Subsistence	2.15	1.69
Nomadic Herding	1.66	1.01

Range for mean: 4.20 – 5.00 Very high; 3.40 – 4.19 High; 2.60 – 3.39 Average; 1.80 – 2.59 Low; 1.00 – 1.79 Low.

Source: Researchers' questionnaire survey, 2019

The socioeconomic characteristics that were considered in this study were education level of household head, education level of the wife, and income status of the smallholder farmers in south Kivu province as presented in Table 3.

Table 3. Socioeconomic Characteristics of the Smallholder Farmers in South Kivu Province

Socioeconomic Characteristic	Frequency	Chi-square
Education level of household head		
No Education	14	
Elementary	57	$\chi^2 = 177.62$;
Secondary	171	df = 3; P = 0.05
Tertiary	61	
Education level of household wives		
No Education	43	
Elementary	97	$\chi^2 = 166.62$;
Secondary	155	df = 3; P = 0.05
Tertiary	8	
Income Status		
Low	267	$\chi^2 = 413.13$;
Middle	32	df = 2; P = 0.05
High	4	

Income Status in US dollars/year: High, 700 – 800; Middle, 500 – 600; Low, <400 (FAO, 2005). Source: Researchers' questionnaire survey, 2019

Majority (77%) of the smallholder farmers' household head in south Kivu province had attained either secondary level of education or above. Only about 33% of the household heads had never studied or only had attained elementary education. Despite a higher percentage of the household heads having at least secondary education, only 26% had attained tertiary qualifications and majority of the farmers were of low-income status. This might be due to most of them (above mean 2.5), practicing primitive or shifting agriculture (Table 2) and were probably not aware of modern methods of farming. Also, about 54% of the wives of the household heads had secondary level of education and above. Only 5% of the household wives had tertiary level of education. The inability of the farmers' household heads and their wives to attain higher education could have accounted for their desire to seek for livelihoods mainly from subsistence farming, but not from other sources such as formal employment. This could have significantly contributed to the low-income status of the majority (88%) of the farmers ($\chi^2 = 413.13$, df = 2, P = 0.05).

In relation to the low household income for the smallholder farmers, one of the Assistant Agricultural Officer said:

"The Government Agencies that concern implementation of modern methods of farming are not active in rural areas. All the development projects are concentrated in the city. The rural environment is neglected and the rural

farmers are unable to think and implement modern methods of farming. This leaves the rural farmers to practice rudimentary and primitive methods of farming that culminates into low yields that does not favour an improved income status of members of the local people”.

Households owned small pieces of land where they practiced agriculture. A bigger percentage of the farmers (81%) owned about 1.10 hectares of land and below, where they mainly planted cassava, beans, rice and pea nuts. The study found out that all the harvests' yields were low. Despite the low yields of the crops grown, an ANOVA analysis showed that there was a significant difference in the yields of crops grown by the farmers in south Kivu province ($F = 0.0088$, $P = 0.05$) (Table 4). The difference in the yields of crops grown could however not improve the socioeconomic status of the farmers in south Kivu province (Table 3).

Table 4. ANOVA of the Yields of Crops Grown by Smallholder Farmers in South Kivu Province

Source of Variation	Sum of Squares	df	Mean Square	Variance (F)
Treatment	696	3	232	0.0088
Residual	211,768	8	26,471	
Total	212,464			

Source: Researchers' questionnaire survey, 2019

A Pearson Correlation Coefficient was performed to determine how some variables of socioeconomic status, that is; household head, education level of wife, income status, and family support of the farmers from south Kivu province were influenced by the practice of subsistence agriculture and the results are presented in Table 5.

Table 5. Effect of the Practices of Subsistence Agriculture on Farmers' Socioeconomic Status in South Kivu Province

Variables	Coefficient	S.E	Sig.	95% C.I	
				lower	upper
Education level of household head Vs Subsistence Agriculture	.205	.064	0.001**	.079	.331
Education level of wife Vs Subsistence Agriculture	.109	.054	0.041**	.004	.215
Income Status Vs Subsistence Agriculture	.280	.061	0.001**	.161	.399
Family Support Vs Subsistence Agriculture	.085	.046	0.062	.004	.175

***Significant at the 5% level; S.E = Standard Error; C.I = Confidence Interval. Source: Researchers' questionnaire survey, 2019*

It was revealed that in addition to practicing subsistence agriculture, the educational level of the household head and the wife, and their income status significantly affected their socioeconomic status ($P < 0.05$). Only family support showed no significant effect ($P > 0.05$) towards the farmers' socioeconomic factors. The effect brought about by the education level of both the wife and household head was probably because of the inability of the farmers to learn and apply better methods of farming, since only a few studied up to tertiary level. For family support, farmers tended to work in groups and their synergies might have contributed to planting bigger fields of crops, leading to bigger harvests that might have slightly improved on their socioeconomic status.

A logistic regression model was done to determine how individual forms of subsistence agriculture practiced in south Kivu influenced the farmers' socioeconomic status (Table 6).

Table 6. Influence of Subsistence Agriculture Practices on the Socioeconomic Status of Farmers in South Kivu Province

Agriculture Practices	Coefficient	S.E	P-Value	95% C.I	
				Lower	Upper
Primitive	.015	.023	0.534	-.031	.061
Nomadic	-.042	.036	0.248	-.113	.029
Shifting	-.014	.024	0.552	-.062	.033
Intensive Subsistence	.265	.023	0.000**	.220	.309
Overall Subsistence Agriculture	.269	.035	0.000**	.220	.338

*a. Dependent Variable: sustainable livelihood; **significant at 5% level; S.E = Standard Error; C.I = Confidence Interval.*

Source: Researchers' questionnaire survey, 2019

The model indicated that some individual subsistence agricultural practices (primitive farming, nomadic farming and shifting agriculture), had no significant effect on the socioeconomic status ($p > 0.05$) of the smallholder farmers in south Kivu. Only intensive subsistence farming showed a significant effect on the socioeconomic status ($P < 0.05$) of the farmers. However, it was observed that the overall subsistence agriculture practiced in south Kivu had a significant effect ($P = 0.000$) on the socioeconomic status of farmers. This is in agreement with results obtained concerning the education level of the household head and the wife (Table 5). Subsistence farming which was characterized by primitive and outdated methods of farming were not able to substantially improve on the socioeconomic status of the farmers in south Kivu province.

3.2. Influence of the socioeconomic status on the sustainable livelihoods of the farmers

The livelihood components of the farmers of south Kivu that were covered under this study included social capital, human capital, financial capital and natural capital. The results that concern the livelihood components were obtained using a 5-point Likert scale (Table 7).

Table 7. Mean Scores for the Farmers' Livelihood Components in South Kivu Province

Farmers' Livelihood Components	Mean	Standard Deviation
Human Capital	4.16	0.90
Natural Capital	3.52	1.46
Social Capital	2.55	1.32
Financial Capital	2.18	0.88
Pooled Mean	3.12	1.19

Range of the mean: 4.20 – 5.00 Very high; 3.40 – 4.19 High; 2.60 – 3.39 Average; 1.80 – 2.59 Low; 1.00 – 1.79 Very Low. Source: Researchers' questionnaire survey, 2019)

The results showed an overall average value (mean = 3.12) for the components of the farmers' livelihoods. However, of the four components, human capital had the highest mean value (4.16). The highest mean depicted by the human capital was probably because of the high skills and competences that enabled the farmers to provide for their households. Such high scores for human capital were also shown by the fact that the respondent farmers often could undertake farm-related activities that improved on their livelihoods.

Natural capital had the second highest mean value, probably because the farmers had a high access to land which is mainly used for production. Farmers also had easy access to the organic manures such as ash and fermented household food wastes. In relation to uses of natural capital as a means of providing money and food, one of the respondents stated:

"The forests in our surrounding environment are abundant and are a gift from God. We have been utilizing the forest resources for a long time and they will always be there for us even for many years to come".

A correlation analysis was conducted to determine the effects of socioeconomic status on the sustainable livelihoods of the farmers in south Kivu province (Table 8).

Table 8. Effects of Socioeconomic Status on Sustainable Livelihoods of Farmers in South Kivu Province

Variables	Coefficient	S.E	P-value	95% C.I	
				lower	upper
Education Level of Household Head Vs Sustainable livelihood	-.032	.029	0.275	-.089	.026
Education Level of Wife Vs Sustainable livelihood	.085	.035	0.016**	.016	.153
Income Status Vs Sustainable livelihood	.371	.028	0.000**	.317	.425
Family Support Vs Sustainable livelihood	.040	.048	0.287	-.034	.114

a. Dependent Variable: Sustainable Livelihood; **Significant at 5%; S.E = Standard Error; C.I = Confidence Interval.

Source: Researchers' questionnaire survey, 2019

The correlation results indicate that the education level of wife and income status had a significant effect on the sustainable livelihoods of the smallholder farmers of south Kivu province at $P = 0.016$ and $P = 0.000$ respectively. This is probably because the percentage of the wives who qualified at tertiary level was small (Table 3) and majority of them could not either search for alternative means of eking a living through formal employment and mainly relied on primitive ways of agriculture that did not substantially promote their livelihoods. Additionally, since majority of the farmers' income status was low, it could also not contribute to their sustainable livelihoods. The crops grown by the farmers were mainly consumed at household level, hardly leaving any surplus for improving on their livelihood standards or be used to recover from stress and shocks in case there was some acute food shortage. Although the aggregate farming activities (primitive, nomadic and shifting) showed that they could promote the socioeconomic status of the farmers, their overall subsistence agricultural activities had a significant effect on their socioeconomic status and also on their sustainable livelihoods. This is probably because the farming activities are practiced at a very low scale, coupled with low yields to contribute to a significant change in the livelihoods of farmers.

The educational level of the household head and family support had no significant effect on the sustainable livelihoods of the farmers in south Kivu province at $P = 0.275$ and $P = 0.287$ respectively. This is probably because a slightly higher percentage of the household heads (20%) had attained the tertiary level of education (Table 3) and hence had the capacity to seek for employment in the formal sector, in addition to working on their farms to supplement on their livelihood needs. Family support also significantly contributed towards sustainable livelihoods of farmers since it was realized that the support did not significantly affect the socioeconomic status of the farmers (Table 5).

4. Discussions

The different agricultural practices undertaken by the smallholder farmers in south Kivu province mainly include shifting agriculture, primitive agriculture, intensive subsistence and nomadic herding in that order. Shifting agriculture is commonly practiced probably due to the presence of small-sized pieces of land owned by farmers in south Kivu province. Other farmers practiced primitive agriculture where rudimentary tools such as slashers and hoes were being used for farming. Burning of trees and shrubs in the fields and then using ash as a fertilizer was a common practice, which could not significantly contribute to an improved socioeconomic status of the farmers in south Kivu province. In relation to the findings, authors such as Waceke and Kimenju (2007) and Lal et al. (2007) stressed that the use of slash-and-burn method, hoes and ash in agricultural practices were regarded as primitive and rudimentary and that these methods did not favour an improvement of the economic status of farmers. On the contrary, Ake et al. (2020) and Cannon (2020) reported that farmers who practiced traditional composting, which was obtained from small livestock like hens, goats, sheep and rabbits realized an increase in their crop yields and yet they were regarded as primitive agricultural farmers.

The educational level attained by both the household head and the household wives did not significantly contribute to the

socioeconomic status of the farmers in south Kivu province. It was also revealed that despite the farmers planting a variety of crops, little was achieved towards improving their income status. In line with education, the findings differ from the general outlook in DRC where Wambua et al. (2014) and the World Bank (2005) reported that there was a general increase in the number of school enrolment in the country in the years 1986/87 and 2001/02 exhibited by increased number of schools, students and teachers. This according to the DRC, National Institute of Statistics (2015), literacy rate among the population aged between 15 – 49 years improved by 76%. And that in some cases, according to Marmot (2004), occupational status reflected the educational attainment of the individuals and rhymed with income levels that contributed to the improvement in the people's socioeconomic status. Majgaard and Mingat (2012) in agreement with the study findings documented that majority of the people in the sub-Saharan Africa have not studied to higher levels where about 98% of the children who enroll for primary education, only about 67% strive to complete their primary studies and the percentage goes on dwindling. This probably is the reason why members of the local community mainly seek employment in the agriculture sector (Byerlee et al., 2009; Gollin, 2010). This state of affair may not lead to the enhancement of the socioeconomic status of the indigenous people since according to FAO (2005), subsistence agricultural activities enabled the practitioners live a basic life (1 US dollar / day or less).

In addition, subsistence agricultural practices to a large extent did not lead to an improvement in the socioeconomic status and hence sustainable livelihoods of the people in south Kivu province. Pingali et al. (2005) was in agreement with the findings where they stated that subsistence agricultural practices did not significantly promote sustainable livelihoods amongst farmers. Alistair (2017) states that without implementing agricultural modernization, it is impossible to improve the farmers' socioeconomic status and later on provide good level of education. On the contrary, Ickowitz (2006) and Davidova et al. (2012) submit that subsistence farming somewhat promotes households' incomes and hence improves livelihoods.

Related to a variety of crops grown in the study area, a fall in agricultural production to 40% since 1990, combined with the consumption of most of the foods grown at household level, left little or none of the surplus for sale to enable an improvement of the socioeconomic status of the citizens (UNICEF, 2017).

The socioeconomic status attained by the farmers in south Kivu as a result of getting involved in subsistence farming activities did not significantly contribute to their sustainable livelihoods. Among the farmers' livelihoods components, human capital seemed to be the component that highly impacted on the farmers' sustainable livelihoods, followed by social capital. This was further supported where family support among other livelihood variables showed a significant contribution towards sustainable livelihoods of the people. In relation, Grootaert and Van Bastelar (2002) stated that society's social capital depicts people interacting in some activities that contribute towards improving people's livelihoods and hence economic development. Also, Bayat (2005) envisages that when people interactively work together, their adaptive capacity improves (Kremen et al., 2012; Djoudi et al., 2013), which results in beneficial outcomes. Other authors such as Ellis (2000) agree that when social capital amongst societies is enhanced, there is access to a stream of income which improves their economic status.

In relation to human capital, authors such as Korina and Habiyaemye (2017) and Zobolo and Mkabela (2006) posit that

practicing subsistence agriculture by communities is generational and sometimes, application of indigenous knowledge may give a comparative advantage for the adaptation strategies when other models are absent. Similarly, Muller (2005) stated that transfer of indigenous knowledge concerning agriculture such as the storage of harvests was transmitted through daily interactions of communities during farm work, which built human capital. On the contrary, Nawrotzki et al. (2012) stated that the level of education amongst the communities was a very crucial aspect necessary for the building of human capital. For financial capital, Serrat (2017) stated that among low-income earners it was the least available livelihood asset that might spur their economic status to a better level.

For the farmers' education level, authors such as Wambua et al. (2014) and Gabre-Madhin (2001) agreed with the findings when they stated that the lower levels of education attained by farmers did not allow them to search for and plant high quality seeds, which eventually led to poor yields and low sustainable livelihoods. On the contrary, Shivakoti et al. (1999) states that when members of the community are much involved in education activities and educational level was part of the community characteristics, there was less use of land for agricultural purposes which might not promote sustainable livelihoods of the farmers.

Concerning the income status, Farrington et al. (2002) agrees that income is supposed to secure the needs of life and that according to Perz et al. (2015), it determines the social capital of members of the community. Adger et al. (2003) states that communities involved in subsistence agriculture are very vulnerable and are in most cases entwined in low sustainable livelihoods. Also, Barakagira and Ndungo (2023) state that agricultural production especially that leaning towards subsistence is at most times negatively affected by climate change effects which eventually affects people's livelihoods. Kuiper et al. (2006) and the World Bank (2009) add that, the majority of Africans who depend on rain-fed, small-scale agriculture is often stressed because of low crop yields that emanate from seasonal crop failures (Yaro, 2006), which state of affairs minimally contribute towards attainment of their sustainable livelihoods.

5. Conclusions

Smallholder farmers in south Kivu province practiced shifting cultivation, primitive agriculture, intensive subsistence and nomadic herding as the main subsistence agricultural activities that enabled them earn a livelihood. The farmers mainly cultivated cassava, beans, rice and pea nuts which in most cases were consumed at household level leaving very little or no surplus for sale to substantially improve on their socioeconomic status. Overall, the different subsistence farming practices done in south Kivu province significantly affected the socioeconomic status of the farmers. In addition, the farmers from south Kivu exhibited the highest level of human capital followed by the natural capital among the components of the farmers' livelihoods.

The educational level, together with the introduction of high yielding crops are paramount in promoting the livelihoods of farmers in a given area, which in turn may improve the socioeconomic status of the members of the local community.

Hence, for the socioeconomic status of the farmers to improve, better farming methods needs to be identified by Ministry of Agriculture and farmers encouraged to practice them for better yields that may contribute to sustainable livelihoods. The

Central government, through the Ministry of Agriculture should avail improved seed inputs to members of the local community, to encourage them plant high yielding crops for improved livelihoods. In addition, agricultural institutions should train and emphasize better and modern methods of farming to students who opt to train in the field. Agricultural extension services should be brought closer to the farmers for purpose of training them better and advanced farming practices for the betterment of agricultural outputs. All these may lead to increased yields of crops and production of surplus, which may result in improved income status. The higher the income status, the better the socioeconomic status of farmers, which most likely may culminate into their sustainable livelihoods.

Statements and Declarations

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Author contribution

- **ANZ:** Formulated the title; Searched for related literature; Collected the data; edited the manuscript.
- **FO:** Searched for related literature; Edited the manuscript
- **AB:** Formulated the title of the study; Searched for related literature; Analyzed the collected data; discussed the findings; typeset the entire manuscript.

Competing Interests

The authors declare that no competing interests exist.

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Data availability

The data presented in the manuscript is available on request.

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