

Intensive Subsistence Agriculture And Sustainable Livelihood In Democratic Republic Of Congo: A Case Of Smallholder Farmers In South Kivu Province: A Literature Review

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Abstract: This paper reviews literature, examines the effects of Subsistence Agriculture practiced on smallholder farmers' socio-economic status, analyses the effects of socio-economic status on smallholder farmers' sustainable livelihood, and establishes the relationship between the intensive subsistence agriculture practiced and the socio-economic status of smallholder farmers in South Kivu in the Democratic Republic of Congo (DRC's). The study identified gaps and developed a framework to improve agricultural production as a lifestyle in the DRC's South Kivu Province. The paper recommends that Government of the DR Congo should introduce a feasible cultivation alternative to adoption of fixed cultivation which would become a standardized intensive agriculture for small-holder farmers.

Keywords: Intensive Subsistence agriculture; Socio-Economic Status; Sustainable Livelihood.

I. INTRODUCTION

Authors such as Lebailly *et al*, (2014), Mpanzu, (2013), Andrianasy *et al*, (2013), have discussed agricultural development in DRC. They focused on organization, technology, finance, and human resources. Katunga, (2004) analysed the catastrophic nutritional state in South Kivu Province since the colonial era, as the consequence of lack of sufficient adoption of appropriate forestry, agriculture, and pastoralism system, also lack of rural development policy, system of credit and repeated wars and lootings. Nonetheless, Leuven-Development (2005), considers that despite the favourable biophysical environment for wealth production, the main economic activities are agriculture (85 %), followed by small trade and livestock, but diet-related diseases leading to *kwashiorkor*, marasmus and gastrointestinal disorders characterize the nutritional status of the populations. Continuous literature survey on rural agriculture in South Kivu province includes the study of Nyatemu, (2008) who notes that in *Kabare* territory, marshes appear as the only areas that remain suitable for agricultural purposes, where sugar cane occupied 691 hectares of the 1.061 hectares of

marshes. The profitability of the sugarcane ended with a rather mixed result. Regarding social profitability, the study has concluded that the smallholder farmer is far from meeting the social needs and the financial profitability was negative.

Discussing the social change throughout agriculture and population participation in DRC, Nyatemu, *et al.*, (2011) sought to understand the causes of non-adherence of the population living in *Bukavu* town to different works of public interest launched by the Urban Authority to improve sanitation and therefore collective environmental well-being. Participatory research leads to a negative conclusion: the compulsory work demotivates the actors, and apart from real planning, non-organized, without the expertise and in front of the inertia of the urban technical services, the "*salongo*" post-Mobutu revisited a few years by the City urban authorities of *Bukavu* are in deadlock.

Some authors wrote on agricultural policies in DRC. Makala, (2009) and Tshingombe, (2009) revealed that the actions undertaken by the Congolese State as well as by donors, about the Agricultural Policy Note of 2009 are still disparate, uncoordinated and weakly supported in their implementation. For those researchers, the confusion created

by the Congolese law on agriculture does not allow a comparative analysis of the action of the population about the official provisions. However, Kitsali, (2013) notes that the 2011's agricultural policy provides a frame of reference, guidance, and planning for the revival and sustainable development of the agricultural and rural sector, engine of the national economy. The authors noted however, the lack of studies and reports on the application of legal provisions or evaluative studies of the action of the public authorities in the field of agriculture. Hence, the gap at the empirical level rose by the researcher in the current study.

In the agricultural evolution, the population growth is mainly cited as a major factor of agricultural modernization. It implies a progressive transition from traditional to modern society and it entails changes in areas such as occupational structure, material well-being, and an increase in rationality and individualism (Ali, Danladi, 2017). However, Azer *et al.*, (2014) pointed out that the adaptation to the modernization process might be painful for the local communities and the society in general.

Two main theories underpinned this review of literature. Firstly, Thomas Malthus's theory (1766-1834) of population growth widely discussed, analysed and followed by recent authors like Richards *et al.*, (2017) and Mervyn, (2020) originally conceived that the human population would outstrip food supply unless it is checked by some external factors such as war, famine, etc. The theory is therefore "Food Centred Theory". Secondly, the theory of Agricultural Intensification by Ester Boserup (1910-1999) defines agricultural intensification as a key response to population pressure that may induce positive change in the production process. In other words, agricultural intensification is an increase in agricultural production per unit of additional inputs even if the land remained constant (Ali *et al.*, 2017). Population increase is, therefore, seen to have positive effects on the agricultural production process, particularly, being the major stimulus by labour for increased agricultural production. Increased population pressure should therefore lead to technological changes in food production to offset the increasing food demand. The theory further maintained that the challenge of feeding more people will always transform and improve the farming method to produce more food (Orach-Meza, 2011). The theory is, therefore, "Input Centred Theory". In other words, inputs, of which land, people, and capital should be the main concern for improved socio-economic status despite a population increase.

Agricultural Intensification was seen by Orach-Meza (2011) and Ali *et al.*, (2017) as a key response to population pressures. It includes increased cropping intensities, like shorter fallow, and introduction of land saving techniques. According to the authors, the process of agricultural intensification is based on increasing agricultural production per unit of input which may be labour, time, seed, feed, cash, and fertilizer, so as to achieve higher productivity. Acquah *et al.* (2006) also speak on the use of agricultural biotechnology which consists of two components: cell and tissue culture and DNA technologies. On the one hand, Graff *et al.* (2006) have appreciated the micro propagation of banana, potatoes, and sugarcane in Cuba and ornamental plants in India which has contributed to improved economic status of the subsistent

farmers. Another example comes from Kenya, where disease-free banana plantlets have greatly increased yields from 8-10 to 30-40 t h⁻¹ (Anonymous 2001). On the other hand, FAO, (2019) and Brookes *et al.*, (2018) stated that Agricultural biotechnology has a high potential of effectively addressing hunger and poverty (Millennium Development Goal 1) by stabilizing yields, providing enhanced nutrient and better-quality food, improving rural incomes, reducing negative environmental impact and contributing to improved plant resistance to pests, diseases, and tolerance to abiotic stresses.

Waceke and Kimenju (2007) highlighted the importance of improving the delivery of Extension services and improving basic infrastructure in Agricultural Intensification. Given the importance of extension services to the smallholder farmers, measures must be put in place to enhance them and make them much more impactful. The extension services should be analysed from a cost-benefit perspective and the necessary infrastructure inputs.

This paper reviews the relevant literature that highlights the links between intensive subsistence agriculture and sustainable livelihood. The paper also empirically evaluates the relationship between intensive subsistence agriculture and sustainable livelihood of smallholder farmers' and their socioeconomic status in south Kivu, eastern Democratic Republic of Congo.

II. METHODS

Relevant literature and several other secondary data sources online were reviewed and statistically analysed to derive the effect of intensive subsistence agriculture on sustainable livelihoods in Democratic Republic of Congo's South Kivu province.

III. RESULTS AND DISCUSSION

A review of the relevant academic and policy literature revealed numerous assessments that are extremely varied in terms of focus and method. The assessments are usually dedicated to particular groups of farms in specific geographical areas and results are seldom directly comparable across regions. For instance, Deininger and Byerlee (2011) have focused on the potential of large farm structures to constitute a more efficient form of production predominantly in areas that report a low population density.

Regarding primitive agriculture, in some societies across the world, it is still practiced but on a varied scale. Murphy *et al.*, (2015) reported a primitive form of farming characterized by burning of trees and shrubs alongside the use of stones and modified sticks as tools that resulted in production inefficiencies within the Democratic Republic of Congo. Murphy and colleagues also reported this form of farming as crippling food security efforts within the households. In support of the foregoing result, a study investigating the technical efficiency amongst producers of cassava (Muayila and Mujinga 2018) reported that some farmers still use primitive systems which are inadequate to propel food security and economic development. In another study that examined

the evolution of the so-called plough, Lal *et al.*, (2007) found that, over the time, the digging sticks were modified and used in some societies. In a recent debate, Adger (2003) stated that primitive agriculture was characterized by high vulnerability and limited adaptive capacity. Following the analysis of the effects of subsistence farming on sustainable livelihoods, Suarez and Sajise, (2010) found that forest-dwelling mammals and tree plants were highly disturbed by shifting cultivation and that only a fraction of the species was found in second-growth habitats created by slash-and-burn agriculture, while the forest area was reduced to 828,745 ha in 1990 compared to 1,215,636 ha in 1980. In addition, 100 to 250 metric tons of fertile soils per hectare per year were eroded due to shifting cultivation.

In their study on factors influencing the adoption of better management practices by farmers, Tingting *et al.* (2018) stated that primitive agriculture, social norms and peer pressure can have a profound impact on farmers' perceptions and attitudes, and play a key role in adopting better management practices. Prokopy *et al.* (2008) noted that other farmers would emulate progressive farmers of the community who are successful which led to rapid spread of the good practices throughout the community. The findings in this study do not differ except that factors influencing the adoption or non-adoption of a new agricultural strategy depend on the context of each community. Prokopy *et al.* (2008) for example alluded to individualism when the context in the DRC is increasingly community-based.

Studies (FAO 2018) however report the effect of nomadic herding on socio-economic factors for instance the effects of neglecting and excluding pastoral communities, violence, displacement, and militarization of pastoral livelihood systems. FAO added the precarious land rights and natural resource management, the increased risk of animal and zoonotic diseases, and climate change and climate variability as the prevailing effects. For his part, Catley, (2017) found that the creation of international borders, the emergence of new states, and the on-going redefinition of state boundaries during the colonial and postcolonial eras limited the mobility of pastoralists and their access to grazing areas. For the Humanitarian Policy Group, (2006) geographic locations where pastoralism is practiced are marginal areas that have experienced processes of continuous marginalization. While, Hesse and Odhiambo (2006), and Reda (2015) found that the representation of pastoral communities is limited or non-existent, and their capacity to defend pastoral interests is reduced.

Intensive subsistence farming is expected to provide food for farming communities throughout the year but does not do so because of the scarcity of rainfall (Waceke and Kimenju, 2007). This is consistent with the results of studies by Darlong (2004) that indicated the increasing loss of forest cover resulting in depleted water sources and unreliable rainfall patterns.

FAO, (2005c) indicated that intensive subsistence farming, which had evolved over the years as a result of irrigation becoming an integral part of farmers' strategies for dealing with irregular rainfall. Lamm *et al.* (2006), however, indicated a low result for irrigation because of lack of appropriate irrigation technologies, measures to reduce water

wastage, and policies to regulate its use. Complementarily, the inability of intensive subsistence farming to become a sustainable food and income generation system has led to an ever-increasing migration of rural areas, especially young people and men (Waceke and Kimenju, 2007). Women who remain behind the wheel of intensive subsistence production are considerably outnumbered by the wide range of responsibilities, including those traditionally incumbent upon men. The situation is further clouded by the fact that the majority of women managing production systems lack legal and secure authority over land because of discriminatory property rights as stated by Waceke and Kimenju, (2007).

To overcome these impacts and challenges of intensive subsistence agriculture Thompson *et al.* (2007) suggested possible interventions in term of using modern agricultural technologies, moving to agroforestry, use of agricultural biotechnology, use of affordable irrigation techniques, improving the delivery of extension services, and raising the productivity of women in subsistence agriculture by increasing women's access to resources, involvement of women in the decision-making process, and improving basic infrastructure.

Other studies reported some kinds of farming with bearing on livelihoods that characterize the farmers. A study by Pingali *et al.* (2005) that investigated the commercialization of smallholder farmers found that sustainable livelihood alongside food security was not adequately possible in the case where smallholder farmers were engaged in the subsistence form of an agricultural system. On the contrary, a study that examined how subsistence farming related to the incomes in addition to agricultural livelihoods by Davidova *et al.* (2012) found subsistence farming making significant contributions to household incomes and livelihoods. The authors have proposed a technological improvement in the practice of smallholder farmers, which required a fairly advanced level of knowledge.

In some studies, the socio-economic statuses of the farmers are reported to have some effects on their respective sustainable livelihoods. Dillon *et al.*, (2011) found that improvement in income status has a direct proportionate linkage to social capital levels as a form of sustainable livelihood. Consistent with this result, a more recent study done in a rural setting in Ethiopia by Gebrekidan *et al.* (2019) found that the income status of a household had a bearing in strengthening of the social bonds amongst members. Concerning forest household income, a study done in South Korea by Jang-hwa *et al.* (2019), found that the age of the household head, the work capacity of the household head, the savings, the type of enterprise, the size of the cultivated land and the region were significantly associated with the foresters' income. In another study on socio-economic analysis of shifting cultivation, Rahman, *et al.*, (2012) and Miah (2007) demonstrated how deforestation has reached an alarming rate in recent years. To the authors, shifting cultivation, which is still prevalent among ethnic minority groups in the province despite great efforts of the government to fix it, significantly contributed to the forest losses. This agricultural practice is also the main cause of land degradation in the highlands. As a solution to ensure the success of the transition from shifting to fixed cultivation, the authors suggested that the features of

shifting cultivation as well as its driving forces should be well understood so that feasible cultivation alternative could be introduced.

Examining the differences in livelihoods that existed between the migrants and non-migrants within Madagascar, Nawrotzki *et al.*, (2012) found the socio-economic factors particularly level of education as having a positive significant effect on sustainable livelihoods. In agreement but additionally, a study that investigated how trans-boundary Infrastructure affected livelihoods in a rural setting, Perz *et al.*, (2015) found socioeconomic factors particularly occupation, education, infrastructure, income, and wealth as significant determinants of an individual's social capital in a society. Christaensen, *et al.*, (2007) found in low-income countries, the effect of agricultural growth on poverty is three times higher than in non-agricultural sectors. In sub-Saharan Africa, the effect of agricultural growth is 4.25 times higher than the growth of the services sector. The authors concluded that agriculture is much more effective in reducing poverty among the poorest groups (measured by the US \$ 1 per day poverty gap) and up to 3.2 times higher for poverty, reducing poverty, and reducing poverty index of US \$ 1 per day on average.

Ducourtieux (2006) determined that families do many activities to achieve income need, and shifting cultivation comes in second place, behind collection and hunting, fishing, and gathering. It provides more than 40% of the income of the family in the forest villages. These imply increase in various techniques to achieve those activities. Zhifei *et al.*, (2018) analysing the livelihood strategies of farm households, indicated that these strategies depend on the conditions of their assets, and that farm households face risks and shocks through portfolios of different types of assets. Describing the low crop productivity, food insecurity, hunger and malnutrition; inadequate farming knowledge and skills, as consequences of the unsustainable traditional systems of slash and burn practices, Nkala *et al.*, (2011) argued that conservation agriculture can guarantee higher crop productivity, food security, improved livelihoods, and environmental protection. For the author, the effectiveness of conservation agriculture towards better livelihood outcomes remains debatable, especially when supportive government policies are lacking.

In another study on social capital, Ghimire and Axinn (2010) stated that the proximity of various non-family services was closely linked to the changing expectations of family life. They also found that living in an agricultural setting influenced the behaviour of the family by speeding up births. Besides, Cairns and Brookfield (2011) reported that shifting cultivation in Asia-Pacific is a collective exercise: although the weeding activity is undertaken by family members, most other agricultural operations such as slaughter, burning, fencing, sowing, harvesting and postponing crops are all group's activities undertaken with clan members or members of the entire village.

On seeds quality, Nzuve, *et al.*, (2014) indicated that due to the low level of education and influence, many farmers have bought bad seeds in the markets. On infrastructure and their influence on food security, the authors noted that poor road infrastructure and unfair trade practices contributed significantly to making food unaffordable in local markets. The poor state of the roads prevents the distribution of food

inside and outside the region and prices are therefore controlled by market forces. Many farmers depend on donkeys and bicycles as the main means of transport. Poor transport conditions prevent local farmers from moving their goods and services to places where prices might be better. Atamov *et al.*, (2006) pointed out that in the Indian hills, the mountain ecosystem is a determining factor in vegetation, when Pullin, & Knight, (2009) had already stated that due to repeated fires, forest species were being replaced by secondary vegetation such as shrubs, exotic grasses, and hardy grasses and some of the native species have disappeared.

Natural topography forces peoples to adopt traditional secular culture that is the only way to survive (Verma *et al.*, 2017). For the authors, the destruction of natural vegetation in shifting cultivation is alarming, and it causes massive destruction of forest genetic resources, land degradation, and the loss of ecologically and economically important flora and fauna. On the other hand, Kumar (2011) informed on the lack of comprehensive basic information and effective implementation mechanisms, an appropriate monitoring system, complex inter-tribal land ownership, degradation and erosion of soils due to the clearing of natural vegetation, as causes of some socio-economic constraints on sustainable livelihood.

Mbuyamba (2011) in a study on cassava production and consumption explained that a Congolese consumes on average 453 kg of fresh roots per year or 145 kg of cassava flour. Cassava leaves are at the forefront of all leafy vegetables consumed in DRC, where a household of 7 to 8 people consumes nearly 4 kg of cassava leaves a week. However, despite its importance in human nutrition in the DRC, processing techniques (fermentation) are artisanal and rudimentary. Due to the lack of standardized processes, trade-in cassava products are very limited and most products are only available on the local market.

The DRC's Food Balance Sheet, contained in the Food Security Report prepared by the DRC' Ministry of Agriculture (2018), indicates that gross cereal production was estimated at 3.2 million tonnes for the 2017 year's consumption. As a result, the country's food deficit would be about 6.9 million tonnes or -22% of national food requirements. The country has a large cereal deficit (-10.7 million tonnes, or 83%). Grain and food balance sheets confirm that food insecurity is more a problem of access than of availability.

According to UNICEF (2017) report for DRC, indicators show that about 43% of children under five are malnourished and six out of 26 provinces have a prevalence of more than 50%, which is considered an emergency threshold. The cost of hunger shows that the total losses related to malnutrition are estimated at 1 636.9 billion Congo Democratic Francs, or 1771 million dollars for the year 2014. These losses correspond to 4.56% of the GDP for the same year. The most important trigger for these costs is the potential loss of productivity due to mortality associated with malnutrition.

The influence of socio-economic factors on the sustainable livelihood of smallholder farmers has been established by the various authors. Nevertheless, the researcher notes nuances, in the contextual and methodological level in particular.

According to Baiphethi and Jacobs (2009), intensive subsistence agriculture is the largest type of agriculture practiced around the world, which is highly dependent on animal power and is commonly practiced in the humid, tropical regions of the world. As the word implies, this form of subsistence agriculture is highly labour intensive on the farmer using limited space and limited waste. For the authors, this is a very common practice in East, South, and Southeast Asia where population densities are high and land use is limited. The most common form is wet rice fields, but could also include non-wet rice fields like wheat and barley. In warm locations and long growing seasons, farmers may be able to efficiently get two harvests per year from a single field, a method called double cropping.

The global population is projected to reach 9.3 billion in 2050 (Alexandratos and Bruinsma, 2012 and Richards et al., 2017). Virtually all the increase is expected to be in developing countries. Countries with large and growing rural populations will depend even more on agriculture, not only for food but for employment and income. Population growth and rising incomes mean that food consumption will increase. It is estimated that the total world consumption of all agricultural products will grow by 1.1 percent per year from 2005/07 to 2050. This means that global production in 2050 should be 60 percent higher than that of 2005/07 (Grunert 2011 and Saunders et al., 2015). In developing countries, smallholders produce between 60 and 80 percent of the food consumed and generate approximately between 40 and 60 percent of total rural income. Can they achieve production increases to meet the demand for food and be at the heart of the solution? Helping smallholders to close the yield gap is crucial (Losch et al. 2012). Labour- and input-intensive farm practices can increase production per hectare significantly. But what are needed to promote both food production and employment are significant increases in labour productivity.

Ortiz et al., (2011), and Ngugi, et al., (2006) estimated that this will strengthen the demand for labour and raise the rural wage, benefiting the landless poor, and setting the conditions for growth.

In many developing countries, small-scale agriculture is better placed to initiate growth. Its strong and positive linkages with the nonfarm sector have historically played an important role in economic development. Today, to tackle the triple challenge of producing more food, creating more jobs, and enhancing the resource base, small farms require the continuous introduction of better and more sustainably productive technology. In the conceptual framework (Figure 1), the variables (IV) Intensive Subsistence Agriculture practice (ISA) and (DV) Sustainable Livelihood (SL), and Moderating Variable Socio-economic status (SES) should be measured using a scale of agricultural type, practitioners, and a scale of ownership.

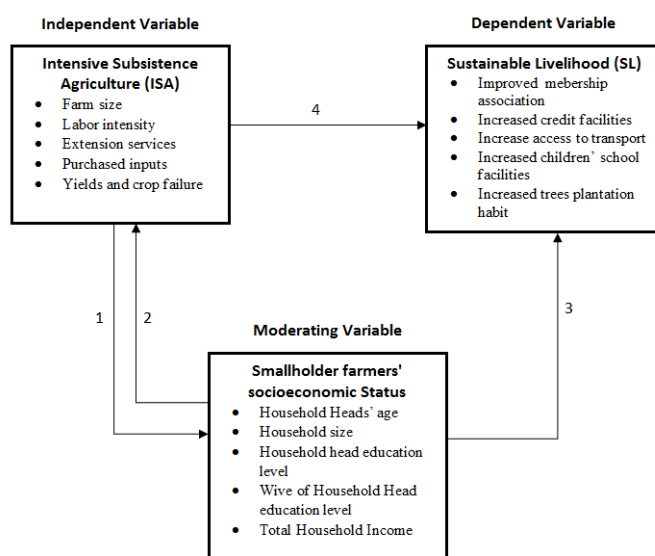


Figure 1: Intensive subsistence farming and sustainable livelihood in DRC (Author, 2019)

It is conceptualized in Fig. 1 that by empowering smallholder farmers to adopt increased agricultural practices through agricultural intensification methods of farming, it is expected it would significantly contribute to improved smallholder farmers' socioeconomic status and enhance their membership to associations, credit facilities, and access to road/transport, children's school facilities, and tree planting habit and so on. As illustrated, the assumption was that the intensive subsistence agriculture practice in South Kivu province could affect and be affected by farmer's socioeconomic status (arrow 1). An iterative effect is expected when arrow 2 goes from socioeconomic status to intensive subsistence agriculture. Indeed, the smallholder farmers' socioeconomic status could influence the sustainable livelihood such as level of social, human, financial, physical, and natural capitals, (arrow 3) while to establish the relationship between the intensive subsistence agriculture practiced and the socio-economic status to ensure sustainable livelihood among smallholder farmers, (arrow 4) could provide information on more sustainability of rural lifestyle.

IV. CONCLUSION

Intensive Subsistence agriculture in South Kivu province of Democratic Republic of Congo would supports livelihoods of several farmers, despite of poor funding received from both the provincial and national governments. Agricultural intensification has a positive implication on livelihood security in terms of better economic condition. Several factors bring relatively higher income from intensified agriculture. These factors are intensive care of plots by farmers during leisure time, use of high yielding varieties, high inputs of chemical fertilizers compared with traditional cultivation system, high labour inputs and high market prices of the crop they have chosen. As well, in social conditions, agricultural intensification enhanced the quantity of food produced improvements in food security, and farmers are also able to consume more nutritious food in terms of more green

vegetables in their diet. Agricultural intensification has increased employment opportunities for local people, and the decision-making processes at household level have been changed after the intensification process has been introduced. Finally, agricultural intensification emerged community-based local institutions in which all member households participate in a regular meeting regarding experiences about the farming.

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