



REVIEW OF LAND FRAGMENTATION, CAUSES AND EFFECT ON AGRICULTURAL PRODUCTION

ABSTRACT

This paper, reviewed and gave a brief highlight on the causes and effect of land fragmentation in respect to agricultural production. The paper pointed out that cultivable land area is one of the major limited resources that farmers depend on for their livelihood, and most often farmers use land for agricultural purposes in parcels distributed in different areas, a

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Introduction

The sustainability of agriculture relies on nature, and depends on the availability and accessibility of arable land. The importance of land to man cannot be over emphasized. Land is the important resource for food, shelter and clothes. It is an essential natural resource, both for the survival and prosperity of humanity and for the maintenance of all global ecosystems (Food and Agricultural Organisation (FAO), 2008; Akintayo and Lawal, (2016). Land is a major resource needed in agriculture which, if absent, makes other resources less useful. It serves as a basis for most agricultural operations (Apata, 2016). Cultivable land area is one of the



practice which is called land fragmentation. Land fragmentation as indicated in this paper, is a prominent phenomenon not only in Nigeria but several other countries, which has existed since 17th century and is found to have stands as a key empirical problem in Africa as it requires huge cost to lessen its effects and result in efficient allocation of labor and capital input. As a positive effect, land fragmentation allows farmers to cultivate many environmental zones and also encourages them to cultivate a variety of crops, and it enables farmers to optimize schedule of cropping activities, giving them variety of soil and growing condition, which reduce total crop failure and facilitate crop rotation and fallowing. The paper further reveals that land fragmentation causes more harm than good to agricultural productivity in a number of ways. It hinders mechanization, it affects the access to irrigation networks as well as efficient use of other modern agricultural technologies which on the long run may cause less efficient production; it increases production cost in terms of transportation for management, supervision and in securing of the scattered plots. Sometimes the small and scattered plots, waste land area and require more efforts in fencing, border constructions, paths and roads. The risk of disputes between neighbors is also said have form part of the problems that can result from land fragmentation. Small fragmented land holdings might also cause difficulties to grow certain crops, and prevent farmers from shifting to high-profit crops such as fruits which require larger plot areas. Hence, if the farmers only possess small and fragmented plots, they may even be forced to grow only less profitable crops thereby affecting crop performance. Furthermore, empirical evidence has proved that there is a significant positive relationship between farm size and yield while the number of plots and yield were inversely related. Therefore, land fragmentation measured in terms of number of farms per household had a negative impact on yield thus land fragmentation hinders agricultural development.

KEYWORDS: Land Fragmentation, Effect, Causes, Agriculture Production, Parcels, Land

major limited resources that farmers depend on for their living, People use land for agricultural purposes in parcels distributed in different



areas, such type of practices is called land fragmentation. Alemu *et al.*, 2017 and Kentaro, 2010 define Land Fragmentation as a situation in where a single farm or ownership consists of numerous spatially separated plots of land likewise farmers operating two or more geographically tracts of land taking into account the distance between those parcels. Some problems are believed to be associated with land fragmentation but those that are prevalent are the small size, irregular shapes and dispersion of parcel.

Land fragmentation phenomenon is prominent in several countries since 17th century and is found to play an important role in less developed agricultural system. It is seen as major factor hindering agricultural development in Nigeria and a key empirical problem in Africa because it hinders agricultural mechanization, requires huge cost to lessen its effects and result inefficient allocation of labor and capital input (Tan *et al.*, 2006; Kiplimo and Ngeno, 2016; Van *et al.*, 2007). On the other hand, it's also allowing farmers to cultivate many environmental zones and also encourages farmers to cultivate a variety of crops (Kadigi *et al.*, 2017; Obayelu *et al.* 2019).

In view of these considerations, numerous land consolidation and land reform policies have been implemented to reduce fragmentation in European countries like Netherlands and France, in African countries like Kenya, Tanzania and Rwanda (Wheeler, 2002; Sundqvist and Andersson, 2006). In Africa, land tenure system has generally been broadly described as rigid, creating obstacles in the way of development. Solutions to the land tenure system have involved the adoptions of some institutional changes such as the promulgation of legislation or the adoption of some revolutionary principles.

In Nigeria, the intervention into the land problem involves the promulgation of the 1978 Land Use Act. The act has been designed to deal with several problems encountered by the various operatives on land since colonial times. Land fragmentation at the household level



depends on external policy and market factors, agro-ecological conditions, and farm household characteristics. The resulting level of fragmentation, together with external factors, agro-ecological conditions and farm characteristics, affects agricultural production (Chukwukere *et al.*, 2012).

Land fragmentation was said to cause more harm than good to agricultural productivity in a number of ways. It increases transport costs. Management, supervision and securing of scattered plots can also be difficult. Small and scattered plots waste land area and require more efforts involved in fencing, border constructions, paths and roads. Land fragmentation might also increase the risk of disputes between neighbors ((Rose & Richard, 2002; Mwebaza and Gaynor, 2002). According to World Bank (2005) Small fragmented land holdings might also cause difficulties to grow certain crops, and prevent farmers from shifting to high-profit crops such as fruits which require larger plot areas. Hence, if the farmers only possess small and fragmented plots, they may be forced to grow only less profitable crops. Bentley, (1990) revealed that land fragmentation affects farming performance but as a positive scenario it enables farmers to optimize schedule of cropping activities, giving them variety of soil and growing condition, which reduce total crop failure and facilitate crop rotation and fallowing.

Causes of Land Fragmentation

Mathias (2010) revealed that Land inheritance, extreme land scarcity and land nature are causes of fragmentation. He argued that land inheritance leads to land fragmentation when farmers desire to provide each of several heirs with land of similar quality. Fragmentation goes on increasing through the activity of succession from one generation to another as parents continue to bequeath land to their children. Similarly extreme land scarcity also leads to land



fragmentation, as farmers in quest of additional land tend to accept any available plot of land within a reasonable distance of their house. When population pressure on land is high and when there are no other off-farm activities upon which the population can earn a living, fragmentation results. While nature of the land itself may force farmers to own scattered land holdings in a sense that geographical barriers such as waterways and wastelands limit the possibilities for land consolidation. Expansion of the farm under such circumstances requires acquisition of new separate pieces of land which when done, implies land fragmentation. Egalitarian objectives and state laws may also limit possibilities for land consolidation. For example, in China during the 1970s and 1980s, community leaders carried out land redistribution based on equality.

Dhaka and Khanal (2018) review that the rate of land fragmentation in the village district council has been increasing due to High rate of population growth, infrastructure development, and legal provision based on inheritance division and land tenure systems which are responsible for land fragmentation in the study area. Land fragmentation is been caused by inheritance, land sales, social/government fiat, population growth and other factors including shortage of land and nucleated settlement, In Nigeria among the Igbos, change in land tenure system are related to change in land use ownership because private lands are potentially fragment able as the growing population intensified its agricultural practices (Benly,1987). Some of the major causes of land fragmentation in Nigeria were identified as traditional land tenure system coupled with increasing population, land markets (land sales), and historical cultural perspectives which affect agricultural productivity and commercialization. While research revealed the existence of land fragmentation in Nigeria, but there is no comparable data on land fragmentation. This inadequacy makes it difficult to identify the extent



at which land fragmentation reached its limits (Demetriou *et al.*, 2013; Obayelu *et al.*, 2019; Okezie *et al.*, 2012). While Olanire and Omonona (2018) revealed the main causes of land fragmentation in Nigeria may be a result of partial inheritance and land shortage.

Effect of Land Fragmentation

There are conflicting views on whether land fragmentation is problematic or not. The advantages and disadvantages in this view point are seen as the beneficial and non-beneficial effect of land fragmentation.

As for the beneficial effect of land fragmentation, the acknowledged advantages of land fragmentation in this standpoint are closely related to the demand-side causes of fragmentation. One of the benefits associated with land fragmentation is the variety of soil and growing conditions that reduce the risk of total crop failure by giving the farmer variety of soil and growing conditions. Many different plots allow farmers' access to land of different qualities in terms of soil, slope, micro climatic variations etc. Fields with high yields in one year may generate much lower yields the following year; thus, several plots of the same crop also spread out the risk. Furthermore, a holding with several plots facilitates crop rotation and the ability to leave some land fallows (Kadigi *et al.* 2017). Spatially separated farmland lowers the risk that the entire crop is affected by the disaster and/ or disease in the same growing season (Li, 2010). Growing crops in different locations may reduce the risk of losing output due to perils such as floods, fires and destruction of crops by herds. Land fragmentation may also enable the growing of a variety of crops that mature and ripen at different times thereby allowing concentration of labor on different farms at different times (Shuhao, 2005). Bentley 1987 noted that land fragmentation allows farmers with scattered plot benefit from risk management, crop scheduling and use of multiple Eco zone. Land



fragmentation enhances the production risk by increasing the product diversity, in the fragmentation situation, the agriculture product diversity may be increased because when the households have several plots which differ in micro-climatic and environmental conditions, there is possibility of growing more type of crops or plant a certain (Heston & Kumar, 1983). Sanjak *et al.* (1998) conclude that “the advantages of fragmentation in Macedonia are related to the ability of farmers to disperse risk by cultivating a diverse variety of crops on numerous plots, each with diverse characteristics”. High production diversification in Macedonia is possible due to the wide variety of microclimates and just because of these variations the farmers may gain benefits. In Rwanda farmers used fragmentation as a coping mechanism to deal with problems of land scarcity and to capture advantages of regional agro-climatic differences (Marara and Takeuchi, 2003).

Mathias (2010) reviewed that it is believed that land is not homogeneous with respect to soil type, water retention capability, slope, altitude and agro-climatic location. Farmers will freely choose to operate many plots in different locations to enable them reduce variance in total output and hence final consumption. Scattering of plots reduces the risk of total loss of output due to perils such as floods, fires and droughts, which are so common in Africa. His study further revealed that land fragmentation (defined in terms of the number of plots per household) had a significant negative effect on the productivity and technical efficiency of smallholder maize. The study conclude that land fragmentation affects the productivity and technical efficiency of farms but the various dimensions of land fragmentation affect productivity and efficiency differently. The number of plots negatively affected the productivity and technical efficiency of farms; Distance to plots and size of the plot had no significant effect on technical efficiency of farms. Dhaka and Khanal



(2018) also revealed that some respondents reported that there have some advantages of land degradation in agriculture. They have the possibility of growing different type of crops in different plots in the same season which helps them to minimize risk of food insecurity. As for non-beneficial effect of land fragmentation, according to Shuhao (2005) and Jha *et al.*, (2005), land fragmentation leads to increased travelling time between fields, hence the impact is the lower labour productivity and higher transport cost for inputs and outputs. The studies noted that fragmentation also involves negative externalities such as reduced scope for irrigation, soil conservation investments and loss of land for boundaries and access routes. Rahman and Rahman (2008) reported that land fragmentation has a significant detrimental effect on productivity and efficiency and can leads to inefficient farm management (Sundquist, 1988) as revised by (Dhaka and Khanal, 2018). Land fragmentation may also affect the farmers' production decisions and management practices, and therefore may affect farming performance (Shuhao, 2005). Disputes among farmers usually occur as a result of land fragmentation and this arise specifically when farmers do not agree with the current farm demarcations especially because they believe that their neighbors have cheated them by taking some land from their respective farms. Farmers owning scattered plots that are quite far away from their homes may lose output due to perils such as destruction of crops by herds, fires, floods, theft and droughts Shuhao (2005). As cited by Hristov (2009) "In the study of small-scale private agricultural sector in Macedonia, the most common and frequently cited disadvantages of land fragmentation include increased labor costs, increased transportation time and cost, land lost to border markings and access roads, and difficulty in accessing the parcels" (Sanjak *et al.*, 1998). They further added that Land fragmentation may also affect the access to



irrigation networks as well as efficient use of modern agricultural technologies which on long run may cause less efficient production.

Raghbendra *et al.* (2005) investigated the impact of land fragmentation on technical efficiency of rice farms in India and confirms that there was a significant positive relationship between farm size and yield while the number of plots and yield were inversely related. Therefore, land fragmentation measured in terms of number of farms per household had a negative impact on yield. In a similar study Shuhao (2005), investigated the impact of land fragmentation on rice production in China and found out that land fragmentation played an important role in explaining technical efficiency. Given the number of plots, increase in average plot size had a significant positive impact on technical efficiency. Distance to the plots, however, had no significant impact on technical efficiency. This implied that farm households with large average distances to the plots were as efficient as farm households with small average distances to the plots. Van *et al.*, (2007) indicated that variation across farms were due to difference in productivity which is influenced by farm size, ecological zone and socio-economic factor like gender, age, education access credit among others.

Bizimana *et al.* (2004) investigate the effect of land fragmentation on economic efficiency of farms in Rwanda's Butare district. They concluded that land fragmentation reduced the economic efficiency of farms. Dhaka and Khanal (2018) revealed that land fragmentation has many consequences in agricultural development. Out of 93 households surveyed, 78.5 % of the households have reported that land fragmentation led to increasing time and cost of input use such as labour, fertilizers and pesticides. Similarly, productivity of crops is decreasing due to having increased numbers of small patches of lands and also problem of mechanization due to the small size and scattered land patches hence the opportunity of increasing the benefit from



agriculture is declining. Chukwukere *et al.* (2012) in the study on Exploring the Link between Land Fragmentation and Agricultural Productivity reveals that farm size was statistically significant and by implication negatively affected productivity. Land has remained the single most important factor of agricultural production. Large households result in excessive fragmentation as a result of the need to allocate plots to male descendants in the study area. As expected fragmentation index negatively affects agricultural productivity and is significant meaning it has impact on crop production. Bizimana *et al.* (2004) in the study on Farm Size, Land Fragmentation and Economic Efficiency in Southern Rwanda revealed that the number of plots per household negatively affected economic efficiency while plot size positively affected economics efficiency. The study stated that land consolidation be adopted as it could help increase the economic efficiency of farms. These studies however did not capture the various dimensions of land fragmentation (plot size, distance to the plot and number of plots per household).

Iheke and Amaechi (2015) revealed that the greater the degree of land fragmentation the lesser the productivity. Obayelu *et al.* (2019) conducted a study in Ikenne Agricultural zone of Ogun State, Nigeria revealed that majority of respondents in the study area own fragmented, geographically dispersed farms. The study also found that the average annual household income and the share of labor force members in a household are important determinant for both the number of plots and the average plot size. The regression result from the study suggests that households with a higher average annual income, adequate labor force, higher education level and larger area of own land tend to reduce the degree of land fragmentation in the study area.



Conclusion

From the review, it can be deduced and concluded that economic, social and cultural status of people determines the degree of fragmentation of land for agricultural production. People with a higher average annual income, adequate labor force, higher education level and larger area of own land tend to reduce the degree of land fragmentation and vice-versa. Land fragmentation is of positive effect at a lower extend and negative for higher extend. The greater the degree of land fragmentation the higher the negative effect.

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