


LAND AS A COMMON RESOURCE: FOSTERING RURAL SOCIAL SUSTAINABILITY IN THE FACE OF FRAGMENTATION AND RURAL SOCIAL SUSTAINABILITY IN BADE, YOBE STATE, NIGERIA


**TERRA COMO UM RECURSO COMUM:
FOMENTANDO A SUSTENTABILIDADE SOCIAL RURAL
DIANTE DA FRAGMENTAÇÃO E DA SUSTENTABILIDADE SOCIAL
RURAL EM BADE, ESTADO DE YOBE, NIGÉRIA**

**LA TERRE COMME RESSOURCE COMMUNE:
PROMOUVOIR LA DURABILITÉ SOCIALE RURALE
FACE À LA FRAGMENTATION ET À LA DURABILITÉ SOCIALE
RURALE À BADE, ÉTAT DE YOBE, NIGERIA**

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ABSTRACT: This study examines the impact of land fragmentation on rural sustainability in Bade Local Government Area, Yobe State, Nigeria. The goal of the research is to comprehend the extent and nature of land fragmentation in the area, assess its effects on rural sustainability indicators, and propose sustainable land use strategies. A cross-sectional research design was employed for this study, utilizing a questionnaire survey to gather qualitative and quantitative data. Descriptive statistics and a farm budget model were used to analyze farmers' socio-economic characteristics, land fragmentation patterns, and indicators of rural sustainability. The study discover that a significant number of farmers possess land sizes between 2 and 4 hectares, indicating a high level of land fragmentation. The majority of farmers acquired land through either inheritance or purchase even though limited access to land is also observed due to rental and government allocation practices. This study highlights the importance of sustainable land use practices for rural sustainability. Addressing land fragmentation requires policy interventions that promote land consolidation and agricultural mechanization. Enhancing access to land and secure land tenure rights can attract investment and improve productivity. The study recommends policy interventions and support mechanisms to mitigate land fragmentation and foster sustainable rural development in the area. In conclusion, this study underscores the significance of sustainable land use practices in enhancing agricultural productivity, reducing poverty, and improving the well-being of rural communities.

Keywords: Land Fragmentation. Rural Sustainability. Agricultural Productivity. Land Ownership. Small Land Size.

RESUMO: Este estudo examina o impacto da fragmentação da terra na sustentabilidade rural na Área de Governo Local de Bade, Estado de Yobe, Nigéria. O objetivo da pesquisa é compreender a extensão e a natureza da fragmentação da terra na área, avaliar seus efeitos nos indicadores de sustentabilidade rural e propor estratégias de uso sustentável da terra. Um desenho de pesquisa transversal foi empregado para este estudo, utilizando um questionário para coletar dados qualitativos e quantitativos. Estatísticas descritivas e um modelo de orçamento agrícola foram usados para analisar as características socioeconômicas dos agricultores, os padrões de fragmentação da terra e os indicadores de sustentabilidade rural. O estudo descobre que um número significativo de agricultores possui tamanhos de terra entre 2 e 4 hectares, indicando um alto nível de fragmentação da terra. A maioria dos agricultores adquiriu terra por meio de herança ou compra, embora também seja observado acesso limitado à terra devido às práticas de aluguel e alocação governamental. Este estudo destaca a importância de práticas sustentáveis de uso da terra para a sustentabilidade rural. Abordar a fragmentação da terra requer intervenções políticas que promovam a consolidação da terra e a mecanização agrícola. Melhorar o acesso à terra e os direitos de posse segura da terra pode atrair investimentos e melhorar a produtividade. O estudo recomenda intervenções políticas e mecanismos de apoio para mitigar a fragmentação da terra e fomentar o desenvolvimento rural sustentável na área. Em conclusão, este estudo ressalta a importância de práticas sustentáveis de uso da terra na melhoria da produtividade agrícola, redução da pobreza e melhoria do bem-estar das comunidades rurais.

Palavras-chave: Fragmentação da Terra. Sustentabilidade Rural. Produtividade Agrícola. Propriedade da Terra. Pequeno Tamanho da Terra.

RÉSUMÉ: Cette étude examine l'impact de la fragmentation des terres sur la durabilité rurale dans la zone de gouvernement local de Bade, État de Yobe, au Nigéria. L'objectif de la recherche est de comprendre l'étendue et la nature de la fragmentation des terres dans la région, d'évaluer ses effets sur les indicateurs de durabilité rurale et de proposer des stratégies d'utilisation durable des terres. Une conception de recherche transversale a été utilisée pour cette étude, en utilisant une enquête par questionnaire pour recueillir des données qualitatives et quantitatives. Des statistiques descriptives et un modèle de budget agricole ont été utilisés pour analyser les caractéristiques socio-économiques des agriculteurs, les schémas de fragmentation des terres et les indicateurs de durabilité rurale. L'étude a découvert qu'un nombre significatif d'agriculteurs possèdent des surfaces de terres entre 2 et 4 hectares, indiquant un niveau élevé de fragmentation des terres. La majorité des agriculteurs ont acquis des terres soit par héritage soit par achat, bien que l'accès limité aux terres soit également observé en raison des pratiques de location et d'allocation gouvernementale. Cette étude met en évidence l'importance des pratiques durables d'utilisation des terres pour la durabilité rurale. La résolution de la fragmentation des terres nécessite des interventions politiques visant à promouvoir la consolidation des terres et la mécanisation agricole. Améliorer l'accès aux terres et les droits fonciers sécurisés peut attirer des investissements et améliorer la productivité. L'étude recommande des interventions politiques et des mécanismes de soutien pour atténuer la fragmentation des terres et favoriser un développement rural durable dans la région. En conclusion, cette étude souligne l'importance des pratiques durables d'utilisation des terres pour améliorer la productivité agricole, réduire la pauvreté et améliorer le bien-être des communautés rurales.

Mots-clés: Fragmentation Des Terres. Durabilité Rurale. Productivité Agricole. Propriété Foncière. Petite Taille Des Terres.

INTRODUCTION

Globally, land as a resource, is one of the significant factors of production, whereas on the other hand worlds population is increasing at an alarming rate thereby impacting on the acquisition and processes of land use which subsequently results in a phenomenon called land fragmentation. Fragmentation of land is noted to be a worldwide phenomenon (Demetriou, Stillwell, See, 2012; Iheke, Amaechi, 2015; Reuben *et al.*, 2017). Therefore, achieving countryside sustainability which encompasses the three major components known as environmental sustainability, social sustainability and economic sustainability requires endless efforts to mitigate all sorts of unsustainable practices such as land fragmentation (Nigerian National Population Commission, 2010; Reuben *et al.*, 2017; Sangeda *et al.*, 2014). In a nutshell, land fragmentation leads to low productivity thereby causing poverty

whereas sustainability is a continuous effort to meet the present-day requirement without jeopardising the future requirement need of the yet unborn generations.

Agriculture has been positioned as a more environmentally sustainable alternative to industrial monocultures (Kremen *et al.*, 2012). Agricultural practices and landscapes that intentionally include functional biodiversity at multiple spatial and/or temporal scales in order to maintain ecosystem services that provide critical inputs to agriculture, such as soil fertility, pest and disease control, water use efficiency, and pollination” (Kremen *et al.*, 2012). These have been greatly affected by land fragmentation in Yobe state (Saleh, 2019). The occurrence of fragmented farmland holdings is one of the distinctive characteristic of less developed nations through their cultivation practices Nigeria inclusive. It is, therefore, a substantial impediment to the mechanisation of agriculture, causing various agricultural productivity inefficiencies and requires a substantial cost to improve its effects (Alemu, Ayele, Berhanu, 2017; Balogun, Akinyemi, Adam, 2017). Reuben *et al.* (2017) and Sikk and Maasikamäe (2015) asserted that globally, land fragmentation poses numerous detrimental effects on agricultural mechanisation efficiency and productivity subsequently leading to abject poverty thereby affecting rural sustainability.

According to Balogun *et al.* (2017) and Emeka and Chinemeze (2017), countries with traditional agricultural structures like Nigeria where 73 per cent of its arable land is fragmented land and has a significant impact on agricultural productivity and the country’s overall economic development at large. However, an in-depth study of the relationship between land fragmentation and the rural sustainability of the rural communities in Nigeria is neither determined nor fully documented. The study by Iheke and Amaechi (2015) and Osuji (2017) highlights that, while Nigeria is embarking on the journey of transformation of her traditional agricultural practices and eradicating abject poverty as spelt out by goal number one of SDGs. This initiative and the overall reforms in the agricultural sector are not adequately informed by research findings, especially on existing land tenure issues and land fragmentation. Noteworthy is the fact that in the generic term, over 80 percent of the population of Yobe State depends on agriculture for their daily sustenance. However, the north-eastern states of Nigeria, such as Yobe, are located in a fragile environment where poverty is higher than the national average. Protracted under-development, food insecurity as well as general poverty, illiteracy and unemployment characterise the social and economic fabric of this State (WFP, 2016).

Furthermore, a proper and in-depth situation analysis of the rural sustainability of the state is facing acute shortage of critical data. It is worthy of notice that the land tenure system that encourages land fragmentation does not encourage mechanization of agriculture, and subsequently, the use of the traditional method of production leads to low productivity, low income and make farming becoming unattractive to young people (Emeka, Chinemeze, 2017; Eze, Konkwo, Orebiyi, Kadiri, 2011; Nwankpa, 2017; Yobe State Government, Draft, 2016; Zemba *et al.*, 2018). Therefore it is pertinent to extending the boundary of knowledge beyond the impact of land fragmentation on agricultural productivity by examining the impacts of land fragmentation as it affects the rural sustainability in Yobe State.

The land constitutes one of the significant resources of the Yobe State initiative towards transforming the agricultural sector from small scale to medium and large scales. While there is some empirical evidence on the influence of land fragmentation on the rural economic sustainability which increases rural poverty in various part of the world especially in the rural areas such literatures are not readily available in Yobe state (Kurylo, Pantalienenko, Bogdanets, Ovcharuk, 2017; Ndirangu, Mbogoh, Mbatia, 2017; Niukkanen, Niukkanen, 2015; Sikk, Maasikamäe, 2015). In Nigeria also, the evidence provided by these studies contain negative impacts of land fragmentation on rural economic sustainability (Abbas, 2016; Afolayan, Tunde, 2014; Iheke, Amaechi, 2015; Johnson, 2014; Manjunatha, Anik, Speelman, Nuppenau, 2013; Reuben *et al.*, 2017; United Nations, 2017b).

Conversely, despite the significant accomplishment of the land reform process, land fragmentation occurred as a side effect with adverse effects for public and private investments, sustainable economic development and social improvement. Less-favoured and least-developed regions with economies that still depend on agriculture are witnessing undesirable growth rates, soaring unemployment, mounting rural poverty and, as a result of severe socio-economic disintegration and widespread disappointment among local actors and stakeholders. Yobe States average farm size for over 70 percent of the farmers is between 1hactres and 2hactres and is among the lowest in the country. There is no current literature on the effect of land fragmentation on rural sustainability, in other words, rural sustainability is not research in respect of land fragmentation or characterised in any study conducted in the study area (Campus, Campus, 2010; Tan, Heerink, Kuyvenhoven, Qu, 2010a). The nature and level of land fragmentation are therefore an outcome of combined rather than isolated influences of supply and demand-driven factors. Therefore, the study evaluates the nature of land fragmentation and its impact on rural sustainability since fragmentation affects agricultural productivity while agriculture is the primary occupation of the people of Yobe state (Djurfeldt *et al.*, 2017; WFP, 2016).

CONCEPTUAL CLARIFICATIONS

Sustainability

The United Nations defines sustainability as the capacity to satisfy the present-day demand without compromising the capacity of the upcoming generations to satisfy their demands. Although the sustainability definition forwarded by the United Nations World Commission on Environment and Development is not generally accepted. Noteworthy, the UN's definition remains the standard by encompassing viewpoints on human needs and welfare (including non-economic variables, such as clean air and water, and the protection of natural beauty as well as education and health). It is clear that the potential of the future viability and wellbeing of the earth largely depends on the ability of the present-day generation to conserve the natural world and its natural resources (Amin-Salem, El-Maghrabi, Osorio-Rodarte, Verbeek, 2018; United Nations, 2017b).

Another definition of Sustainability by the International Union for Conservation of Nature (IUCN) defines it as the ability to improve the quality of human life while living within the carrying extents of the Earths supporting eco-systems. The fact is that the global production and consumption of the resources today are destroying nature at continuously and hazardously at higher rates. An environmentalist David Suzuki stated that the sacred balance of nature has changed as a result of the increase in exploitation of the earth's natural resources such as minerals, petroleum, coal and thereby posing a negative impact on both humans and other living systems. As the world populations are increasing so does the rate of exploitation of natural resources (Junker *et al.*, 2015). Furthermore, Paul Hawken stated that sustainability is concern about stabilizing the existing disruptive relationship between earths two most complex systems known as the human culture and the living environment. The realization and the science behind it, that exploitation and use of the earth's natural resources more rapidly beyond replenishment by man is a central focus on sustainability (Brown, 2010; McLennan, Garvin, 2012).

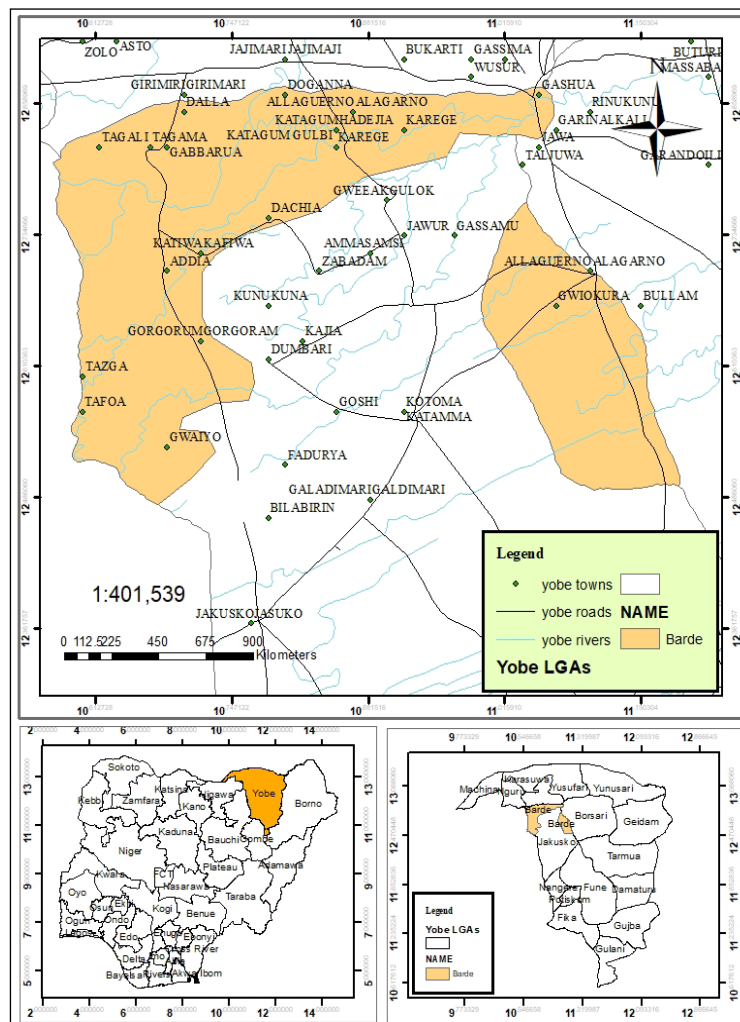
MATERIALS AND METHOD

The present study employed a cross-sectional research design which enabled the researcher to collect data at a single point in time using a questionnaire survey. The adoption of a cross-sectional research design is with the view to get qualitative and quantitative information. The study drew samples from Bade Local Government Area which suffers severe land fragmentation due to it is a relative location along the river Yobe from which the state obtained its name. Bade Local Government is located next to those local government that are severely hit by the recurrent drought and desertification thus attracting most people form these nearby local governments for their livelihood. The 30 sampled population constituted households undertaking agricultural activities in the six randomly selected villages were selected for this study. The study used the list of households undertaking agricultural activities in 2019/2020 cropping season as was provided by the village leaders, and the selection of the sample households from the village registers was conducted randomly. Household as a unit of analysis of household refers to a person or group of individuals who live, eat together and share common living arrangements. The analytical techniques employed in the study include descriptive statistics, such as frequency tables, percentages means and standard deviations and farm budget model to analyse farmers socio-economic characteristics, land fragmentation and rural sustainability indicators.

Study Area

The study was conducted in Bade LGA of Yobe State which is made up of 5 political wards. It is within latitude 11° north and longitude 13.5° East with a total land area of 47,153 km² (Yobe State Government, 2016; Zemba *et al.*, 2018). To the east and south-east shares

common boundaries with Borno state, while Jigawa state to the northwest, whereas to the south-west it is bounded by Bauchi and Gombe states. To the north that stretches over 323km, it also shares a common international border with the Niger Republic. The population of Yobe state according to the National Headcount conducted in 2006 is 2.321 million while the population estimate in 2011 reveals that there are 2,757,000 million people in the state (National Population Commission, 2010). Yobe state is multi-ethnic, thus, comprising the following ethnic groups: Kanuri/Manga, Bade, Ngizim, Fulani, Bolawa, Ngamo, Kare-Kare, Babur/Maga and Hausa constituting the main ethnic groups in the state. Hausa is the generally spoken language in the state.



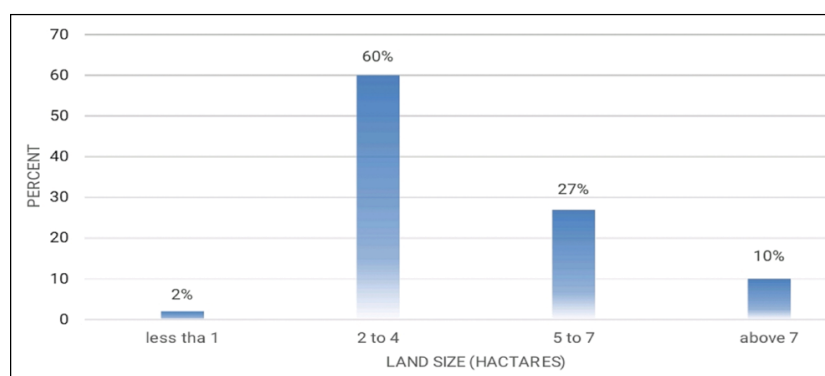
Source: Adapted from Administrative map.
Figure 1. Map of Nigeria Showing the Study Area.

The official language of communication in schools in the State is English. The blend of all these features makes Yobe state a multicultural with diverse ethnic composition. The most colourful celebrations in the state include the Bade annual fishing festival which occurs annually at Alkamaram River in Gogoram District of Bade Emirate Council in

Bade Local Government Area. The Machina annual Cultural Festival in Machina Local Government Area, Barakau Festival, Durbars and installation ceremonies. These cultural events contribute immensely to attracting both local and international tourists which significantly contribute to the economic activities of the state (Abbas, 2016; WFP, 2016; Yobe State Government, 2016).

RESULT AND DISCUSSION

Land size in agriculture can be measured in a number of different ways, even once the “land” itself has been defined as an entity. Much analysis focuses on the amount of agricultural land that is managed by the farmer. Land size here only refers to the land been put into farming of crops with the exception of rearing of livestock. The distribution of land size in the study area was attempted and the result presented in Figure 2.

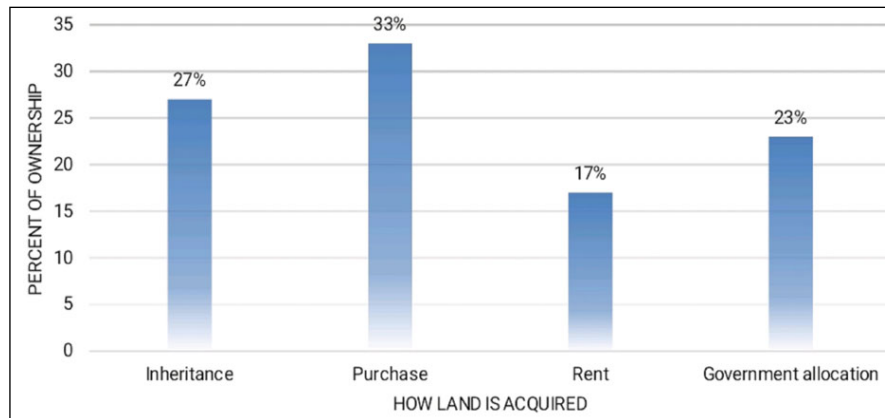


Source: Field survey (2019).

Figure 2. Distribution of Land Size.

Figure 2 revealed that most accounting for only 60 percent of the respondent had a land size that ranges from 2 to 4 hectares while a minority accounting for about 3 percent had less than 1 hectare of land. This agrees with the finding of Kanu *et al.* (2014) who highlighted that the average land size for agriculture in Africa is about 2.5 hectares which are way smaller when compared to other continents with North America having an average land size of 121 hectares, Latin America having 67 hectares and Europe having an average land size of 27 hectares. The size of the land in the study area is evidence of the accumulative effect of land fragmentation. This denotes that there will be a negative change in production as stated by Sheng, Ding and Huang (2019) who postulated that small land size has a negative effect on crop production. Hossian and Hussain (1977) disagreed with Sheng *et al.* (2019) thus stating that both total resource use per unit of land and output may be higher on farms which are better endowed with labour than those which are better gifted with enormous land size. Hossian and Hussain (1977) implied that bigger land size does not automatically connote bigger harvest but small-sized farm endowed with labour, fertilizer/manure, weeding and application of pesticide might be the determinant factor for high crop production.

Land ownership is the state/person/group who have exclusive rights and control over a particular land. It also involves multiple rights, collectively referred to as title, which may be separated and held by different parties. The process and mechanics of land ownership are fairly complex: one can gain, transfer, and lose ownership of property in a number of ways. To acquire land one can purchase it with money, trade it for other property, win it in a bet, receive it as a gift, inherit it, find it, receive it as damages, earn it by doing work or performing services, make it, or homestead it. The distribution of land ownership in the study area was attempted as shown in Figure 3.



Source: Field survey (2019).

Figure 3. Distribution of Land Ownership.

Land ownership is an important factor in agriculture as it determines who has control over the land, resources, and benefits derived from it. In this discussion, we will analyze the distribution of land ownership in a specific study area and its implications for resource access and rural livelihoods. Figure 3 presents the frequency and percentage distribution of land ownership by inheritance, purchase, rent, and government allocation. The data shows that purchase is the most common form of land ownership in the study area, accounting for 33 percent of total land ownership. This is followed by inheritance (27%), government allocation (23%), and rent (17%). This pattern of land ownership can be attributed to various factors such as historical, social, economic, and political contexts.

The dominance of purchase as a form of land ownership may be indicative of an economic system that values private property and the ability to invest in land. This may create challenges for smallholders who have limited access to capital and may struggle to compete with larger landowners. In contrast, government allocation may provide opportunities for landless farmers to access land, but the quality and security of the land may be uncertain. The mode of land ownership also affects resource access and utilization. Smallholders with limited land ownership may face challenges in accessing credit, markets, and other resources necessary for agricultural production. Renting land may provide a flexible option for land access but may also create a sense of insecurity as the tenure is not guaranteed in the long run. Inheritance may also be a viable option

for securing land, but it may be associated with traditional practices that can marginalize certain groups, such as women.

The economic and social implications of land ownership distribution are significant. Land ownership determines the ability to generate income, ensure food security, and access rural employment opportunities. Inequitable distribution of land ownership can exacerbate poverty, inequality, and social exclusion. Therefore, policies that promote equitable land distribution are crucial for sustainable rural development.

The political and institutional factors that shape land ownership distribution are complex. State policies, legal frameworks, and institutional arrangements play a critical role in determining land access and ownership. Power relations and conflicts over land ownership and resource control may also affect who has access to land and its benefits. Customary practices and cultural norms may also shape land ownership patterns. In conclusion, analyzing land ownership distribution provides insights into the social, economic, and political factors influencing rural livelihoods. Equitable distribution of land ownership is critical for sustainable rural development. Policymakers, practitioners, and researchers should continue to explore strategies that promote equitable land distribution and ensure that rural communities have access to resources necessary for livelihoods and well-being.

Table 1 displays the cost of farming by farm size. The cost of farming here refers to the net expenditure of the farmer per farming season. The expenditure here refers to the amount spent on labour, fertilizer, insecticide, seedlings and among others.

Table 1. Cost of farming by farm size.

Land size (ha)	<20,000	21,000-40,000	41,000-60,000	>Above 60,000
Less than 1	100	0	0	0
2 — 4	13	48	18	21
5 — 7	0	0	50	50
Above 7	0	0	50	50

Source: Field survey (2019).

Table 1 provides an insight into the cost of farming per farming season, by farm size, in a specific study area. The costs are calculated based on the net expenditure of the farmers, including labor, fertilizer, insecticide, seedlings, and other inputs. The data highlights the variations in cost across different farm sizes, indicating the importance of farm size as a determinant of agricultural productivity.

The data shows that the cost of farming per season increases as the farm size increases. In farms less than 1 hectare, the cost of farming per season is 100 percent. For farms between 2 and 4 hectares, the cost of farming per season is distributed more evenly, with 13 percent of farmers spending less than 20,000 per season, 48 percent spending between 21,000 and 40,000 per season, and the remaining 39 percent spending between 41,000 and 60,000 per season. For

farms between 5 and 7 hectares, the costs are split evenly, with 50 percent of farmers spending between 41,000 and 60,000 per season and the other 50 percent spending above 60,000 per season. For farms above 7 hectares, all farmers spent above 60,000 per season.

The variation in the cost of farming by farm size can be attributed to various factors such as economies of scale, access to inputs and services, and market opportunities. Larger farms may benefit from economies of scale, where the cost per unit of output decreases as the scale of production increases. This may lead to lower costs of inputs, labor, and other farm-related expenses, resulting in higher profitability. In contrast, smaller farms may face higher costs due to limited access to inputs and services, lower bargaining power in the market, and higher transaction costs. The data also suggests that the cost of farming is not uniform across different input categories. For example, the cost of fertilizer may be higher for larger farms due to the need for more inputs. In contrast, the cost of labor may be lower for larger farms due to the use of mechanized equipment and higher labor productivity.

The data has important policy implications for the agricultural sector. Policies that promote access to inputs and services, such as credit, extension services, and technology, can help smallholder farmers reduce their costs and improve their productivity. Policies that promote market access and value chain development can help farmers overcome market barriers and increase their profitability. In addition, policies that support land consolidation and secure tenure can help smallholders benefit from economies of scale and increase their competitiveness. It is important to note that the cost of farming varies by farm size and input categories, indicating the importance of scale economies, input access, and market opportunities in determining agricultural productivity and profitability.

Social Sustainability of Land Fragmentation

Social sustainability of land fragmentation in the study area was attempted and the resulted presented in Table 2.

Table 2. Social Sustainability of Land Fragmentation.

Social Indicators	Mean	Std. Deviation
Level of education	1.99	.801
Life expectancy at birth	2.03	.748
Population pressure	1.78	.785
Household dependency ratio	1.80	.716
Access to social amenities	2.20	.794
Rural-Urban migration	1.64	1.000
Land fragmentation	1.73	1.074

Source: Field survey (2019).

The social sustainability of land fragmentation is a critical aspect to examine in order to understand the implications of fragmented land ownership on various social indicators. Table 2 presents the results of an attempt to assess the social sustainability of land fragmentation in the study area. The table includes several social indicators such as the level of education, life expectancy at birth, population pressure, household dependency ratio, access to social amenities, rural-urban migration, and land fragmentation. The mean values of the social indicators provide an overall measure of the social sustainability within the context of land fragmentation. The mean value for the level of education is 1.99, which suggests a moderate level of education among the population. The mean value for life expectancy at birth is 2.03, indicating a relatively average life expectancy in the study area. The population pressure, represented by a mean value of 1.78, suggests that there might be some level of population strain on resources due to high population density.

The household dependency ratio, with a mean value of 1.80, indicates the level of economic burden on households and the ratio of dependent individuals to the working-age population. A higher value suggests a higher dependency ratio and potentially more challenges in providing for the needs of dependents. Access to social amenities, with a mean value of 2.20, suggests that there may be some level of access to basic social services such as healthcare, education, and infrastructure, although improvements could still be made. The rural-urban migration indicator, with a mean value of 1.64, suggests a relatively low level of migration from rural to urban areas. This could indicate limited opportunities or incentives for individuals to move to urban areas, potentially due to a lack of employment prospects or insufficient urban infrastructure.

The indicator specifically related to land fragmentation has a mean value of 1.73, indicating the extent of land fragmentation in the study area. Land fragmentation refers to the division of agricultural land into smaller and often irregularly shaped plots. Higher values in this indicator suggest a higher degree of land fragmentation, which can have social implications such as reduced agricultural productivity, limited economies of scale, and challenges in land use planning. The standard deviation values associated with each social indicator provide insights into the degree of variation among the study population. A higher standard deviation suggests a greater diversity or disparity within the given indicator. For instance, a higher standard deviation for rural-urban migration (1.000) indicates a wide variation in migration patterns, potentially reflecting different factors influencing individuals' decisions to migrate.

The presented results offer an initial understanding of the social sustainability aspects associated with land fragmentation in the study area. However, further analysis and interpretation are required to establish more comprehensive insights into the relationships and potential causalities between land fragmentation and the social indicators. Additional research and exploration are necessary to fully grasp the social dynamics and long-term implications of land fragmentation on social sustainability. The examination of social sustainability indicators related to land fragmentation provides valuable insights into the potential social challenges and opportunities faced in the study area. These indicators serve as starting points for understanding the complex interactions between land fragmentation and various social dimensions.

CONCLUSION

Based on the findings and analysis conducted in this study, it can be concluded that land fragmentation has significant negative impacts on rural sustainability in Bade LGA, Yobe state. Bade LGA exhibits a high degree of land fragmentation, with the majority of farmers having small land sizes between 2 to 4 hectares. Moreover, the fragmentation also hinders agricultural productivity, leading to low income and poverty among rural communities. The distribution of land ownership also indicates that a significant portion of farmers in Bade LGA of Yobe state inherited their land, highlighting the complex dynamics of land tenure systems. However, the consequences of land fragmentation on rural sustainability extend beyond economic aspects. It was further observed that the study area faces protracted under-development, food insecurity, illiteracy, and unemployment, contributing to the overall social and economic challenges.

The lack of research and data on land fragmentation and its impact on rural sustainability in Bade LGA in particular and Yobe state in general further exacerbates these issues, hindering informed decision-making and policy formulation. Therefore, to address these challenges and promote rural sustainability, it is crucial to implement comprehensive strategies that tackle land fragmentation and its associated issues. The following recommendations are proposed:

- i. Land consolidation: Efforts should be made to consolidate fragmented land holdings to create larger and more productive farms. This can be achieved through land redistribution programs, where smallholder farmers are encouraged to voluntarily exchange their fragmented plots for consolidated land. The government and relevant stakeholders should provide support and incentives to facilitate this process;
- ii. Agricultural mechanization: Promoting mechanized farming practices can enhance agricultural productivity and reduce the dependence on labor-intensive traditional methods. Providing access to modern farming equipment, training programs, and financial incentives for farmers to invest in mechanization can help overcome the limitations imposed by fragmented land holdings;
- iii. Land tenure reforms: Addressing land tenure issues is crucial for promoting sustainable agriculture and rural development. Implementing clear and secure land rights, improving land registration systems, and promoting equitable access to land can contribute to reducing fragmentation and enhancing rural sustainability;
- iv. Diversification and value-adding: Encouraging diversification of agricultural activities and supporting value-adding initiatives can help rural communities increase their income and resilience. Promoting agro-processing industries, facilitating access to markets, and providing training and resources for value-adding activities can enhance the economic viability of smallholder farmers;
- v. Research and data collection: There is a need for comprehensive research and data collection on land fragmentation and its impacts on rural sustainability in Yobe State. This will help inform evidence-based policies, interventions, and decision-making processes. Collaborative efforts between government institutions, research organizations, and relevant

stakeholders should be initiated to gather accurate and up-to-date data on land fragmentation, agricultural productivity, and socio-economic indicators.

Finally, it is important to note that the implementing these recommendations will require strong commitment and coordination among various stakeholders, including government agencies, agricultural institutions, rural communities, and development partners. It is essential to ensure the active participation and involvement of local communities in the planning and implementation of initiatives to achieve sustainable and inclusive rural development in Bade LGA in particular and Yobe state at large.

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