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Faculty of Tropical AgriSciences



**Farmland abandonment and its drivers on the
urban-rural fringes of Ghana**

MASTER'S THESIS

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Declaration

I hereby declare that I have done this thesis entitled “*Farmland abandonment and its drivers on the urban-rural fringes of Ghana*” independently, all texts in this thesis are original, and all the sources have been quoted and acknowledged by means of complete references and according to Citation rules of the FTA.

In Prague 20/04/2022



.....

Dominic Nyendu

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Abstract

Farmland has suffered significant losses in many emerging countries because of rapid urbanization, industrialization, and economic expansion. Farmers are also diversifying their livelihood and becoming less reliant on farming and hence resulting in farmland abandonment. This phenomenon would result in the possibility of food insecurity, and a low level of living standard due to farmers' low income. Hence this study investigates the determinants of abandonment of farmland in the rapidly urbanizing metropolis of Shai-Osudoku District in Ghana. About 142 semi-structured questionnaires were administered to farm household heads in five communities in the Shai-Osudoku District. Multiple linear regression was used to examine the effect of household, institution, farm, and location characteristics on farmland abandonment. The results revealed five key factors that had influence on farmland abandonment: off-farm income (0.018) $p < 0.05$, access to labour (0.040) $p < 0.05$, farmland size (0.003) $p < 0.01$, land disputes (0.063) $p < 0.10$, and distance from the farmhouse to the nearest urban area (0.038) $p < 0.05$. Based on the findings, the study recommended that Ghana implement an urban development policy to mitigate the harmful consequences of land-use changes on urban ecosystems in the Shai-Osudoku District and throughout Ghana. The purpose of such policies should be to maintain a reasonable balance between urban infrastructure growth, ecological sustainability, and agricultural productivity.

Keywords: Farmland abandonment, urban agriculture, land tenure, land-use change, questionnaire survey

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List of the abbreviations used in the thesis

UNCTAD	The United Nations Conference on Trade and Development
CAB	Commonwealth Agricultural Bureaux
MLR	Multiple Linear Regression
SOD	Shai-Osudoku District
USD	United State Dollar
LAP	Land Administration Project
VIF	Variance Inflation Factor

1 Introduction

The bedrock for human survival and agricultural progress is farmland. However, farmland has suffered significant losses in many emerging countries as a result of fast urbanization, industrialisation, and economic expansion (Wang et al. 2021). Furthermore, farmers are diversifying their livelihoods and becoming less reliant on farming (Burnham & Ma 2017). This is especially true for China, where a significant flow of rural-urban migration has occurred during the urbanization process (Du et al. 2019). According to the seventh population census of 2020, around 63.9 % of China's population lived in cities by 2020. In recent decades, the rate of urbanization in China has gradually increased. The increase in urban population between 2000 and 2018 was 459.06 and 83.37 million while the rural population had fallen from 808.37 million to 564.01 million. This led to problems such as rural depopulation, exodus, and the widespread abandonment of farmland.

The loss of farmland was largely seen in peri-urban environments, where population density leads to increase in land values which promote transformation into industrialized uses. This is a global tendency, with urban land areas expanding at a rate faster than urban population density (Kuntz et al. 2018). “Farmers' decisions to sell their farmland can be explained in part by market factors, such as net returns from urban growth often exceed those from farming, in other words, off-farm income exceed farm revenues” (Yan et al. 2016). Non-economic factors, such as place connection and social capital, have been demonstrated to influence land-use change decisions. Decisions on abandonment of peri-urban farms are closely related to those far away from urban centres: Most of the decisions are mainly financial. In general, rural farmlands are less likely to change land-use by increasing their income from other uses; rather, they are motivated by a reduction in net returns (Kuntz et al. 2018).

According to the World Resources Institute (2014) to meet the demands of the predicted population of Africa - 1.5 billion by 2050, the future food production in sub-Saharan Africa would have to be tripled. Smallholder farmers dominate the food production sector occupying approximately 30 % of farmland and providing more than half of global food, as well as 70 % of food in smallholder-dominated developing countries. Most smallholder farmers in sub-Saharan Africa mostly practice low-input/low-yield subsistence agriculture because assets are limited, including finances,

labour, and land constraints. This limits their ability to access markets or compete with market prices, because of both demand and supply-side factors. Consequently, this leads to food insecurities in many regions and households (Blair et al. 2018).

It is critical to support smallholder businesses in reducing food insecurity, poverty, and household vulnerability while also improving regional or national food production, finances, and sustainable land use. Sub-Saharan Africa has enormous potential to improve smallholder farming yields because most farmland has realized potential productivity (Thomson 2011), and smallholder productivity would need to double by 2030 to meet the United Nations Sustainable Development Goals for poverty, food security, and environmental sustainability (UNCTAD 2015). Despite the obvious need for greater agricultural activity and productivity, farmland abandonment is rising both globally and within sub-Saharan Africa (Blair et al. 2018).

Farmland abandonment definitions differ depending on the methodology (e.g., social, administrative), or whether qualitative (e.g., land condition) or quantitative (e.g., number of years abandoned) data are employed (Pointereau et al. 2008). Bryceson's (1996) 'deagrarianization' refers to the whole process of changing employment, reorienting income-earning, identifying socially and spatially removing rural people from exclusively agricultural lives. The problems of identifying the abandonment of farmlands speak of the inter-linkage between the ecological, economic, and social elements of agriculture. Essentially, the discontinuation of agricultural activity is agricultural abandonment, although this is a complicated process that can occur concurrently with the clearance of farmland or intermittent and brief cultivation periods (Blair et al. 2018). Farmland abandonment as a component of deagrarianization should not be confused with rotational systems of farmland fallow, effected to restore soil fertility or temporary withdrawal from agricultural production due to adverse conditions such a drought or temporary lack of labour or inputs. Here, we define 'farmland abandonment' as land that is no longer cultivated for economic, social, or other reasons for at least one year.

1.1 Research problem

According to Appiah et al. (2014), agriculture is a key source of employment for close to 60 % of Ghana's population. As a result, depriving the sector of land in any section of the country causes an increase in unemployment and its eventual food crisis. The study's research problem is that farmlands, which are the primary source of income for most residents in the Shai Osudoku District Assembly (SOD), have been experiencing abandonment. These result in a lack of prime farmlands and a drop in agricultural productivity. This development could have a significant impact on crops grown in large quantities, particularly those grown for export and consumption in the country. Apart from the potential threat of food insecurity looming over food crop producers due to rapid loss of farmland to government and private estate developers in the study area, there is also the possibility of suspected food insecurity soon in the study area. Food insecurity would result in a low level of living standard due to farmers' low income. Affected farmers would have to change their livelihoods in this instance by diversifying their livelihoods.

Farmland abandonment is a global issue, however, most recent research on falling agricultural intensities and farmland abandonment on the urban-rural fringe have been conducted in Europe and the United States, thus understanding the reasons for urban-rural farmland abandonment in Ghana is particularly fascinating. As a result, it is uncertain if the reasons provided for these examples apply to Ghana's economic, geographical, social, and institutional circumstances. One of the most noticeable contrasts is that land on the urban outskirts of Ghana is owned by rural households and controlled by traditional leaders.

To fill this gap, we examined the driving forces of farmland abandonment in the urban-rural fringes of Ghana. In this study, we examined the variables that influence farming households on urban-rural outskirts of Greater Accra's fast urbanizing metropolis to pull their farmland out of agricultural production. Accra is the capital city of Ghana and is an important commercial hub situated in the Greater Accra region of Ghana. Greater Accra has expanded over time, mainly because of migrants arriving from other parts of the country and competing with the limited housing available in the city. This has resulted in a reduction in the quantity of arable land on the outskirts, which has had a variety of effects on households.

2 Literature Review

Farmland abandonment is becoming a more common global land-cover change event, with serious consequences for the environment (e.g., biodiversity, carbon sequestration, new ecosystems, wildfires) and societal well-being (livelihood, farm landscapes). Farmland abandonment is commonly defined as ceasing farming and releasing land for natural successions, such as grasses, bushes, and trees on former agricultural fields, although it can also result in soil degradation. Farmland abandonment can be a more complex land-change transition, including the cessation of agricultural activity in favour of land uses other than agricultural ones, such as forestry, construction of dwellings, game reserves, and tourism. Studies have shown that farmland abandonment often is driven by rational decision-making and profit maximization, including weighing up opportunity costs and alternative livelihood strategies. However, the conditions of organizations that are supposed to oversee land usage, as well as the personal traits of persons involved in agricultural activities, play a significant effect in the choice to abandon. It should also be highlighted that the decision to abandon or continue farming can be highly complex and influenced by non-economic factors such as personal predisposition for farming, education, ethnicity, religion, age, and the availability of successors.

Farmland abandonment is sometimes referred to as the process of ceasing farming activities, both intentionally and unintentionally handing over land for natural encroachment, such as natural afforestation caused by seed dispersal from surrounding forest patches. However, abandonment may also refer to bare and degraded regions with little vegetation succession. Other land-change trajectories, such as intentional reforestation (e.g., tree plantations in European countries, the United States, and South Africa), the establishment of game and nature reserves (Europe and Africa-Tanzania), and the sprawl of residential areas in urban-rural fringes, may also occur on abandoned lands (for example, Bucharest). The Munroe et al. (2013) opinion paper touches on various pathways of abandonment and repurposing of abandoned lands. Farmland abandonment is usually transitional rather than a final process. At the same time, abandonment is different from fallowing as a crop rotation method, as well as slash-and-burn agriculture, or shifting farming in areas dominated by both forest and grassland. Farmland abandonment was thought to be a prevalent land-change process in

industrialized and transition economies, such as the European Union and former Soviet bloc countries, but research reveals, it is also common in other parts of the world including China, Iran, Nepal, and South Korea. The study of Alcantara et al. (2013) and Hatna & Bakker (2011) provided significant insights into widespread farmland abandonment in Europe, notably in post-Soviet and post-socialist Central and Eastern European countries. Multiple studies, however, imply that farmland abandonment is a widespread land-change process around the world, and a literature review by Li and Li (2017), as well as research by Yin et al. (2020), corroborated this. In general, certain places, such as the hilly and Mediterranean regions of Europe, Africa, and the Middle East, maybe particularly vulnerable to abandonment.

Farmland abandonment happens widely throughout the world, in both developed and developing countries. The physical phenomenon of abandonment of farmland is predominant in developed nations, such as Europe, the United States, Australia, and Japan. However, farmland abandonment in developing nations has also taken place in recent years. For example, 12–15 % of rural farmland was abandoned in China, the world's largest developing country, from 2013 to 2015 (Zhou et al. 2020).

According to Zhou et al. (2020), farmland abandonment deserves more attention since it is linked to food and environmental security. Farmland abandonment may jeopardize food security and ecological security in the following ways. To begin with, farmland generates the majority of human food and is essential to global food security (Zhang et al. 2014). China has only 7 % of the world's farmland yet feeds about 22 % of the world's people. As a result, farmland abandonment is critical to resolving food security issues in China and throughout the world. Secondly, farmland abandonment might jeopardize ecological security by (1) decreasing farm landscapes and biodiversity (2) resulting in soil deterioration in abandoned farmlands, and (3) increasing the likelihood of forest fires. Consequently, the economic, spatial, and ecological drivers and processes of agricultural abandonment have become hotspots of research (Du et al. 2019). Previous research has looked at the environmental and social factors that contribute to abandonment. On the one hand, farmland has been abandoned owing to a reduction in benefits caused by natural environmental constraints. Deng et al. (2018) discovered a link between landslides and farmland abandonment; Du et al. (2019) discovered that unfavourable topography e.g. remote areas, hilly areas, and so on were a key cause of

farmland abandonment; Bezu and Holden (2014) believed that lack of farmland caused rural youth to abandon farming, and Deng et al. (2018) discovered that farmland fragmentation was a key cause of the abandonment of farmland. On the other hand, when the social economy develops, off-farm employment of rural labour causes a scarcity of agricultural labour, which leads to farmland abandonment (Ustaoglu & Collier 2018).

Farmland abandonment has an impact on both the earth's eco-environmental components as well as local and global socio-economic processes. The mix of factors may change across time and space (Benayas et al. 2007a). Farmers have been represented as rational agents in the majority of the examined literature, striving to maximize their revenue or minimize their loss (Zhou et al. 2020). This means that farmland cultivation ends only when agricultural earnings fall to zero or when a greater income can be earned elsewhere. Farmers, according to reports, continue to use conventional farming techniques until the returns are negative and/or the cultivation expenditures result in significant financial losses (Rai et al. 2019). While low-intensity farming and land abandonment are frequently associated with marginal land conditions in remote locations, these phenomena can also be found on the urban-rural fringes in urbanizing and industrializing regions, where farming conditions are not necessarily marginal and certainly do not suffer from being remote. Sinclair (1967) was the first to create an explanatory model for reduced land-use intensity near cities, arguing against the traditional theories of Von Thünen who proposed that land-use intensities are highest near cities (Marketplaces) and decrease as one moves away from them due to transportation cost limitations. One possible explanation for the low-intensity usage of farmland on the urban-rural fringes is that acreage near cities has become too costly for agricultural uses. Due to increased demand for land for urban expansion, farmland prices near cities are growing (Ustaoglu & Collier 2018). Furthermore, peri-urban farmland owners may favour temporary agricultural techniques with less investment until they have the opportunity to sell their property or bet on growing land values at the moment when they can sell for their preferred price (Zhou et al. 2020).

To account for low farm intensities, short parcel dimensions, inconvenient parcel forms, and parcel fragmentation or the advent of recreation farmers have been suggested (Sklenicka et al. 2014). Surprisingly, this small-scale kind of farming is becoming more popular in cities, as it allows residents to see crop cultivation and harvesting, observe tiny

farm animals, and learn agricultural expertise. This new surge in urban agriculture has the potential to maintain farmland in peri-urban regions in production. However, it is not obvious if farmers can afford to pay higher rents on properties near cities in the long term by the revenues created by these activities (Zhou et al. 2020).

This is influenced not just by farmers' expectations for land take-over for urban expansion but also by more indirect changes in farmers' behaviour, such as the pursuit of alternative income generation and decreased capital investment effort in agriculture. A deeper knowledge of the underlying reasons for the abandonment of agricultural property on the urban/rural frontier can guide policymakers in establishing policies to encourage sustainable use of farmland in cities. One of the noteworthy distinctions is that in Ghana land is owned by household heads and traditional leaders on the urban-rural fringes.

2.1 Theoretical framework

Farmland abandonment affects both the earth's eco-environmental components and the gradual socioeconomic processes of local and global systems, resulting in unfavourable changes in the farm landscape, biodiversity ecosystem services, and sociocultural landscape (Chaudhary et al. 2020). Several studies (Benayas et al. 2007; Campbell et al. 2008; MacDonald et al. 2000) have identified a set of components that commonly act to transfer land and cause farmland abandonment. These are categorized as follows:

- (i) environmental factors that limit agricultural production, such as soil quality, slope, elevation, fertility, soil depth, seasonal climate, and so on;
- (ii) a socioeconomic situation that is expressed as a lack of economic and demographic viability and stability, such as farm size, household work, farmers' ages, productivity levels, market facility, agricultural investment, farm industrialization, trade etc;
- (iii) the regional or nearby context that measures the level of access to infrastructures, services, and markets, such as the distance to markets, roads, major settings, forests etc.;
- (iv) policy tools, urbanization and distribution of population, and migration; and soil and water resource management practices that cause land degradation, soil

erosion, overexploitation of groundwater resources resulting in water scarcity, and salinization of croplands.

The terms "drivers," "driving forces," "(spatial) determinants," and "factors," as well as verbs like "causing," "influencing," and "affecting," are frequently used to explain farmland abandonment. Causes are frequently found in simple combinations with other variables that have a high probability of explaining an outcome (Mahoney 2008). The term "causes" is insufficient in social and terrain systems to describe a "contributory" or "combinatory" outcome (Ummenhofer et al. 2009). "In many recent analyses that explain the abandonment of land, the terms 'driver' and 'driving force' have been widely employed. These are applicable and relevant to environmental or social change processes brought about by socio-ecological or land system processes" (Chaudhary et al. 2020).

The study adopted Geist & Lambin's (2002) theoretical framework that established the link between proximate and the underlying causes of farmland abandonment. Even though Geist & Lambin deal with deforestation, their analysis technique serves as an excellent model for our study. In our study, a similar graphic was created to describe the causes of farmland abandonment. The framework is particularly important for this study as it seeks to understand the various drivers of farmland abandonment. From the framework, several factors play a role in farmland abandonment at both the regional and national levels. (See Fig. 1).

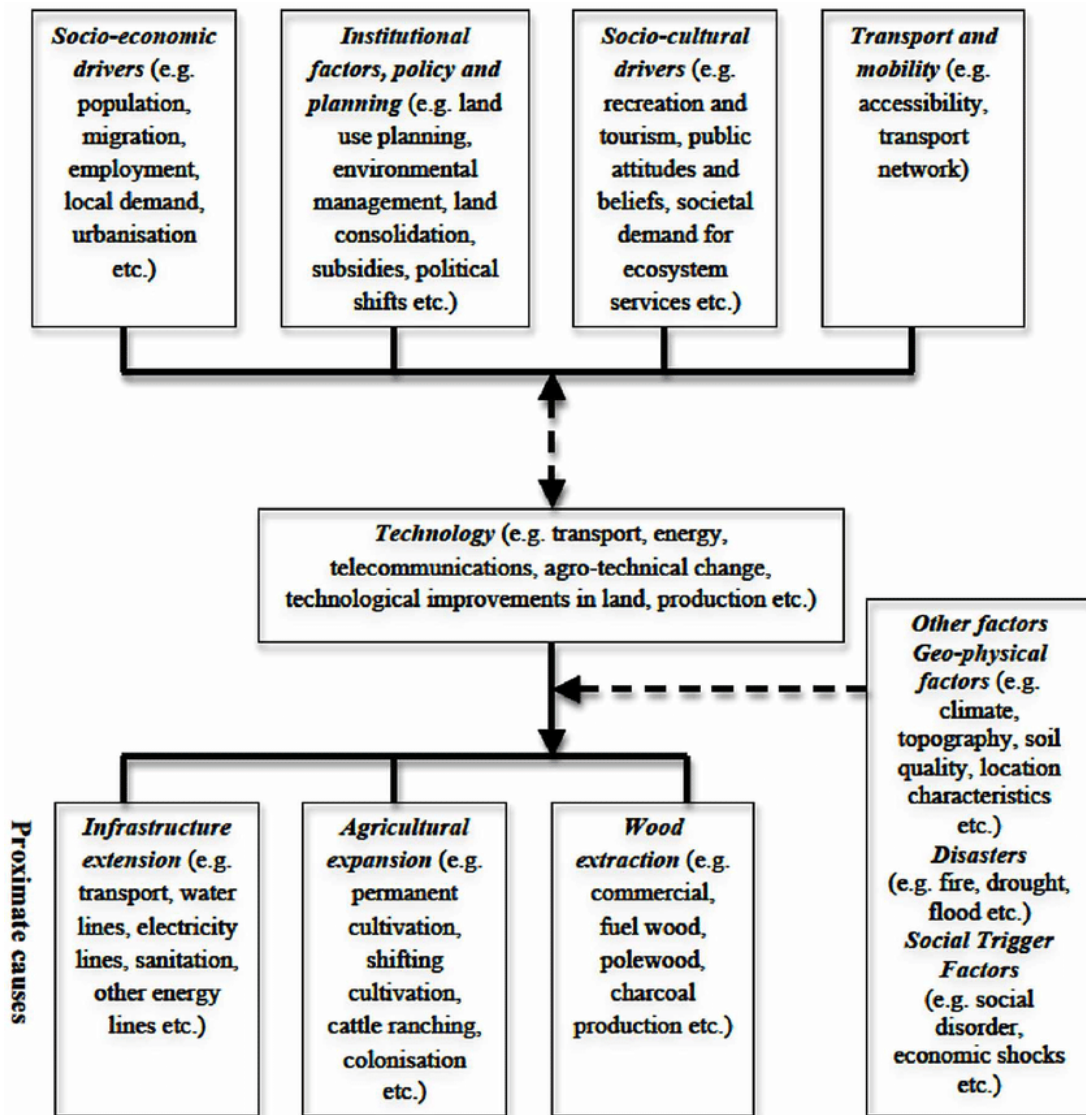


Figure 1 Frameworks for the causes of farmland abandonment and the underlying driving forces, adapted from Reference (Geist & Lambin 2002)

Farmland use and changes are influenced by biophysical and social factors such as topographical and geomorphic processes, weather and climate variations, demographic changes, and their effects on geo-environmental and natural ecosystems such as biodiversity, water sources, surface run-off, and solar radiation. Farmland uses and change are based on changes and their consequences on geo-environmental and natural ecosystems, such as biodiversity, water sources, surface run-off, and solar radiation (Chaudhary et al. 2020). Similarly, fundamental drivers of farmland abandonment include complexities of technological, political, institutional, and urbanization variables that work indirectly from afar and/or function on a regional or even global scale.

Larger farms can save money on production and are more competitive in terms of farming practices such as the use of machinery or a better input use efficiency. They are more typically connected with innovation and, in most cases, are more competitive and economically viable (Bojnec & Latruffe 2013). Small farmers are more likely to have challenges in obtaining loans and other institutional services necessary to improve their competitiveness. This makes it impossible to rebuild effective farming units through land consolidation. Farmers can adapt to changing economic conditions and ensure the integration of various agricultural operations at the farm level through training and information exchange. Land tenure and land prices play a supporting role because they express property rights or demand for land. A weak land market, on the other hand, frequently corresponds to low transaction prices (selling or renting) and is a good predictor of land abandonment (Sikor et al. 2009). This is relevant in both the regional and national contexts, as well as according to regional regulations and local use. In such circumstances, the transition period faces challenges related to land ownership (registration), poorly defined property rights, and the absence of functioning land sales markets (Muller et al. 2009).

2.2 Factors influencing farmland abandonment

According to Benayas et al. (2007), the scientific literature indicates three primary categories of drivers of farmland abandonment. The first category applies to environmental forces, but under different labels (sometimes called geo-bio-physical, physiographic, or abiotic drivers). In terms of elements that limit agricultural production, it includes elevation, geological substrate, slope, fertility, soil depth, soil erosion, and climate change. Soil erosion is frequently seen because of overexploitation (i.e., the true driver), as it is often the precondition for soil erosion. The second type is socio-economic drivers. Market incentives, migration, rural depopulation, technology, industrialization, land tenure systems and security, farm characteristics, farmer age, accessibility (e.g., roads), and proximity to cities are a few examples. Typically, some of these drivers act as intermediaries between large-scale or macro-driving forces of change, resulting in new economic possibilities.

To determine the relative relevance of the primary driving types, Benayas et al. (2007) conducted an electronic search in the CAB Direct database of scientific literature

using target keywords in the reference study's title or abstract. A search for the terms 'land abandonment' and 'drivers' yielded relatively few results. Searching for 'land' and 'change' yielded 45 papers dealing with the reasons for farmland abandonment, which were deemed a representative sample for concluding the examined phenomena. Their research revealed 10 papers that reported ecological drivers and 33 studies that reported socioeconomic drivers, but only eight studies reported land management as a driver of land abandonment. In several of these investigations, two drivers were reported at the same time. Based on these findings, Benayas et al. (2007) concluded that farmland abandonment is a global phenomenon primarily driven by rural–urban migration, where new economic possibilities are available to rural people, with ecological and managerial factors playing a minor role. The abandonment of farmland is also influenced by socio-economic, ecological, and farming practices.

Gender

In terms of gender composition, males may be more inclined than women to move or seek off-farm activities because men have more financial responsibilities as household heads than women (Deng et al. 2018; Xu et al. 2019). Off-farm labour, on the other hand, may have a detrimental impact on agriculture intensification since it requires time, concentration, and energy that might otherwise be spent on farm activities (Du et al. 2019). As a result, women, especially in rural regions, who are less likely to participate in off-farm jobs and focus on agricultural activity, may be more efficient than men. This suggests that finance may have a stronger impact on reducing field abandonment for female farmers than for male farmers (Xu et al. 2019).

Education

According to Rajpar et al. (2019) who carried out research on agricultural land abandonment in Pakistan, they found that the odds ratio of education coefficient reveals that for every year that the respondents' education level rises, the likelihood of abandoning agricultural land rises by 4 %. This could be because, well-educated persons are more likely to work in the non-agricultural sector. Furthermore, increasing enrolment rates contribute to the loss of prospective labour in the agriculture sector, resulting in farmland abandonment.

Age

The age of the household head plays a very important role on how long the farmland will be in cultivation. When the farmer demographic is older (close to retirement), farmland abandonment is more common. There would not be enough labour to work on the farms if there are no successors and this will eventually lead to the abandonment of the farmlands (Koomen & Ke 2020).

Access to credit

Deng et al. (2018) discovered an inverted U-shaped relationship between farmland abandonment behaviour and farmland abandonment area, whereas (Xu et al. 2019) discovered that farmland abandonment increased by 4 % and 5 %, respectively, for every 10 % increase in off-farm full and part-time employment. Meanwhile, agricultural output in developing countries rural areas sometimes lacks appropriate personnel and financial support. In many developing nations, failures of rural financial markets have rendered them inefficient, resulting in significant credit limits for farmers. Credit constraints, according to some studies, cause farmers to fail to reach the ideal investment level required for profit maximization. As a result, reducing financing limits for farmers can benefit agricultural production (Ankrah et al. 2021). For example, Du et al. (2019) discovered that removing credit limits could boost agricultural productivity and household income, whereas (Ankrah et al. 2021) discovered that households without credit constraints had higher agricultural productivity than those who were.

Remoteness

Farmland abandonment is more frequent in rural locations with limited access to basic services (such as healthcare, schools, and other services) and marketing opportunities. Remoteness is determined by the time it takes to go from a rural area to a city was the measure of distance.

Farm income

Farm income plays an important role in keeping farms in production. When farmland ceases to yield a significant revenue, it is more likely to be abandoned as an economic resource. The income of farmers is negatively related to farmland abandonment according to economic theory (Benayas et al. 2007a).

Farm sizes

The size of a farmer's landholding has a considerable negative impact on his or her ability to abandon their farmland. As a result, small farm sizes farmers are more likely to sell their agricultural lands and seek income from non-agricultural sources. Due to high transportation and labour costs, small parcels that are far (distance) from the farm are more likely to be abandoned than large plots that are easily accessible. Farmers with small or medium-sized plots of land are more likely to face challenges obtaining specific agricultural inputs, formal loans, and other institutional services needed to boost their competitiveness (Benayas et al. 2007b). Extreme land fragmentation is also a sign of an inefficient farm structure linked to greater cost management. The ability to adapt may be hampered by small parcel sizes. Finally, if a long-term perspective is not guaranteed, land tenure may have an impact on investment and land holding dynamism. The presence of a substantial percentage of tenant-farmed agricultural land can indicate a risk of instability (Muller & Munroe 2008).

2.2.1 Land tenure system in Ghana

In Ghana, there are two types of land tenure: traditional and public land tenure. According to Quansah (2012), traditional land tenure systems account for around 80 % of Ghana's land. Customary tenure arrangements are guaranteed by the Ghanaian government. To administer land rights, customary land secretariats have been established, although only a few are operational. The Land Administration Project (LAP) produced Customary Land Secretariats, which have a significant impact on local land administration through basic record keeping, awareness raising, documentation of customary land rights and their protection, and conflict settlement (Heegde et al. 2011). The following are the many types of land tenure that exist in Ghana, according to Quansah (2012):

1. **Allodial title:** Quansah (2012) defined this as "the place where the highest interest in customary law is held or vested in stools or skins." This right can be obtained by being the first to cultivate the land or by inheriting it from the first set of landowners. Stool/skin ownership refers to collective ownership rather than ownership granted by an individual ruler. Except for those imposed by Ghanaian

legislation, allodial owners hold their interest under customary law and are not subject to any restrictions on their user rights or obligations.

2. ***Free hold (which is divided into customary law and common law freeholds):***

Usufructuary title, or customary law free hold, is an interest held by subgroups and people in land that is recognized as being owned allodially by a larger community. The sub-stool, lineage, and family may have a customary law free hold on a corporate or individual basis. It is eternal and will endure as long as the stool's greater rank is recognised.

Common law free hold, on the other hand, is an interest in land acquired through a free hold grant made by the allodial owner, either through sale or transfer of his interest to another person. The parties must agree that their obligations and rights will be controlled under this grant.

3. ***Sharecropping:*** This is also known as abunu (half share) and abusa (sharecropping) (a third share). It is a sharecropping arrangement in which the tenant tills the land and gives the landlord a piece of the crop at harvest. The recipient must also acknowledge the stool's superior authority and undertake any customary services owed to the stool/skin by the subject grantor. Holders of the usufruct also have the option to sell, lease, mortgage, or pledge their stake, as well as grant agricultural tenancies or shareholder agreements (Quansah 2012)

4. ***Leaseholds:*** are rights granted to a person to occupy a certain piece of land for a specific period of time that are derived from common law rather than customary law. A lease may be awarded by the allodial title holder or by a customary freeholder. Subject to the lessor's approval, the lessee may create a sublet or assign the lease's remaining term (Heegde et al. 2011).

The sophisticated institutional and administrative machinery constructed by the state to manage land tenure and land administration has not been effective, according to Quansah (2012)'s literature on land tenure types. Among some of the institutions, there is a lack of complementarity, networking, and occasional disagreements. Land transactions may be conducted by customary authority without informing or consulting current land users or the land commission. Those whose livelihood asset is land, particularly crop farmers, are the most susceptible when this happens.

2.2.2 Conceptual framework

The Figure 2 shows the conceptual framework of farmland abandonment. The framework's components are linked together. Several factors contribute to farmland abandonment. The figure shows that household and institution characteristics (gender, education, age, household size, farm income, farm succession, access to agricultural credit and subsidies, and off-farm income influences farmland abandonment. It also shows that according to our literature farm and location characteristics like (farm size, access to labor, land tenure, terrain e.g., slope, stony terrain, farm location, remoteness, number of parcels, and land dispute influence the decision of farmers to an abandoned portion of their lands.

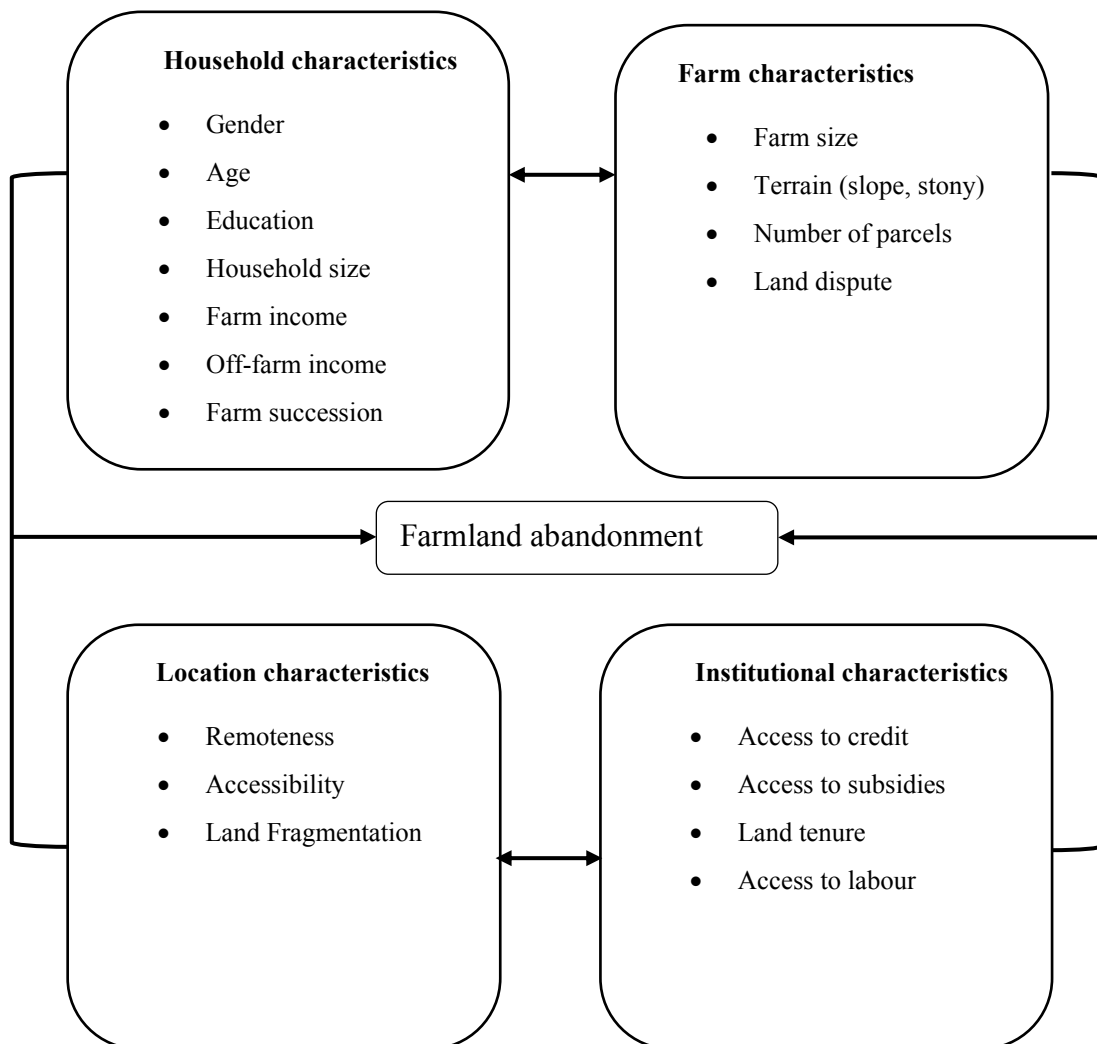


Figure 2 Conceptual framework of farmland abandonment

2.2.3 Consequences of farmland abandonment on agriculture

Land abandonment has been linked to decreased landscape heterogeneity (Uchida & Ushimaru 2015) and increased vegetation homogenization, which has been linked to increased fire frequency, soil erosion, desertification, reduced water availability, loss of biodiversity, and loss of biodiversity (Uchida & Ushimaru 2015). Another line of research suggested that abandoned landscapes provide a variety of ecosystem services by restoring natural processes through rewilding (Ustaoglu & Collier 2018). Forest removal to make way for farmland has been followed by agricultural abandonment and forest recovery, all of which have had a significant impact on habitat sustainability and ecological richness. Rural depopulation and the resultant abandonment of forestland farming, on the other hand, have resulted in a recovery of forest biomass because of reduced wood extraction and animal grazing in the woods. Carbon sequestration, biodiversity protection, improvements in water quality and supply, soil recovery and nutrient availability, and an increased attraction for eco-tourism and hunting activities are all key benefits of forest regrowth and natural regeneration (Navarro & Pereira 2015).

In contrast to the favourable effects on habitat restoration, abandoning farmland raises the risk of fire in abandoned forests due to the homogenization of woody plants. Vegetation on abandoned land initiates the succession process, in which natural or semi-natural plants and/or animals from neighbouring ecosystems colonize the area. Biodiversity and abandoned farmland post-management methods are important factors in the dynamics of the secondary habitat that emerges after the land is abandoned (Jackson 2008). As a result, biodiversity on abandoned land will be determined by the habitat's structural and functional recovery (Ustaoglu & Collier 2018). A dense herbaceous cover can develop on the land in a short amount of time (3–5 years), depending on soil quality and temperature, generating grazing and pasture meadows. This land might be used for animal grazing, but grazing pressure would hinder the emergence of new vegetation in the form of woodland and forests on the abandoned land. When limited grazing is present, successional vegetation development dynamics are aided even more by the presence of a variety of successional species that can quickly colonize the abandoned land. In places with a lengthy history of cultivation, species that are sensitive to perturbations are likely to disappear from the flora.

According to (Cramer et al. 2008,p. 107), “when a small number of invasive species require management or if the introduction of new species with low colonization capacity is required,” unsupported regeneration of old fields is achievable. By enhancing seed dissemination into the abandoned land, restoration can speed up or modify the plant community, exotic species, or reduce competitive ability (Cramer et al. 2008). Based on the pace of recovery of the old field, the newly generated vegetation integrates with natural conditions, and depending on climate and soil conditions, may result in woodland or forest. The density and spread of biomass grow as a result of this process (Ustaoglu & Collier 2018). “Scrubland and grassland are two types of vegetation that have great production value for cow husbandry. Natural restoration procedures based on local circumstances, the use of natural materials and energy sources, and the tracking of climatic and spatiotemporal changes in the ecosystem are all environmentally sustainable” (Meli et al. 2014). There are counterarguments in the literature that revegetation of abandoned land is unsustainable because it results in vegetation homogenization and decreases landscape heterogeneity. Increased disturbance distribution and, as a result, increased fire frequency are two consequences of vegetation homogenization (Groen et al. 2017).

Fire is not a prominent natural disturbance in the forests of Northern Europe. Wildfires, on the other hand, are common in abandoned pastures in the Mediterranean basin, and they constitute a serious impediment to the regeneration of woody vegetation and forests. According to Schelhaas et al. (2003), Spain and Portugal accounted for around 45 % of Europe's total forest fire area between 1960 and 2000. With France excluded, the overall Mediterranean area accounts for 88 %; with France included, the proportion rises to around 94 % (Schelhaas et al. 2003). In comparison to the rest of Europe, Northern and Scandinavian countries saw relatively few fires, according to these numbers. It is also claimed that freshly established vegetation causes greater water consumption, less infiltration capacity, and a decrease in water production. Reforestation may result in a reduction in low flows and a drop in water supply (Yao et al. 2015). The increased interception of precipitation and transpiration from trees compared to crops and grasslands results in reduced run-off. Another effect of abandonment is irrigation system abandonment, which can result in waterlogging and (or) soil salinization (Ustaoglu & Collier 2018).

Table 1 Summary of the impacts of land abandonment on ecosystems services.

Positive impacts

- Restoration of a natural habitat after secondary succession helps to compensate for the loss of large forest area (Cocca et al. 2012).
- Large-scale restoration of non-agricultural habitat (e.g.,rewilding) (Robinson et al. 2003; Navarro & Pereira 2015).
- Increase in soil carbon storage (Schröter et al. 2008)
- Increase of biodiversity in the short term (Otto et al. 2006).
- Better hydrological regulation, flooding mitigation (García-Ruiz & Lana-Renault 2011).
- Increase in soil fertility (Robinson et al. 2003).
- Soil recovery and reduction in soil erosion through regeneration of forests (Bakker et al. 2008; García-Ruiz & Lana-Renault 2011).
- Reduction in pollution resulting from agricultural chemicals that were used intensively on the marginalized farmland (Milenov et al. 2011)
- Bio-and renewable energy potential (Abolina & Luzadis 2014).

Negative impacts

- Higher fire risk resulting from increased plant biomass from plant succession (Oliver et al. 2010).
- Vegetation homogenization and a reduction in landscape heterogeneity (Sitzia et al. 2010).
- Loss of arable land and pastures that are linked with sustainable development for the mountain communities (Angelstam et al. 2003).
- The increasing threat to semi-natural habitat and associated ecosystem services of nature conservation (Milenov et al. 2014; Cocca et al. 2012).
- Loss of cultural landscapes and aesthetic values (Pardini et al. 2004).

Variable impact

- Forestry production and woodland may stimulate economic development and indirectly maintain biodiversity in some cases (Cocca et al. 2012; Navarro & Pereira 2015).

- Rewilding is valued positively (reduction in erosion risk, soil recovery and nutrient availability, recovery of natural landscape, and biodiversity) in some cases (Navarro & Pereira 2015), whereas in others it causes a loss of cultural landscape, particularly the European mountains (Schaich et al. 2010).
 - An increase in the size of patches and landscape fragmentation may result in an increase in biodiversity or a decrease in biodiversity depending on the number and composition of species (Lasanta et al. 2015).
-

3 Aims of the Thesis

The main objective of this study is to understand the core reasons contributing to farmlands' abandonment in the urban-rural fringes of Ghana.

The specific objectives of this study include:

1. To describe the factors influencing farmland abandonment in the Shai-Osudoku District in Ghana.
2. To identify the farmers' opinions on the factors that affect their decision on farmland abandonment.
3. To determine the effect of house hold, farm, location and institutional characteristics on farmland abandonment.

3.1 Research questions

Based on the literature review and the existing gaps in research, the research will focus on answering the following research question.

1. What are the factors influencing farmland abandonment in the Shai-Osudoku District in Ghana?
2. What are farmers opinions on the factors that affect their decision on farmland abandonment?
3. What are the effects of household, farm, location and institutional characteristics on farmland abandonment?

3.2 Research hypothesis

From the above research question and based on existing literature, the study proposed the following hypothesis:

1. H₁: Access to agricultural credit reduces farmland abandonment (Ankrah 2021).
2. H₂: An increase in off-farm income (for example, employment in the city), increase farmland abandonment (Zhou et al 2020).
3. H₃: There is a significant impact of farm size per household on farmland abandonment (Du et al. 2019).

4 Methodology

4.1 Study area

The Shai-Osudoku district is located at the southeastern part of Ghana in the Greater Accra Region. The Shai-Osudoku district was carved out of the former Dangme West district in March 2012 because of a re-demarcation exercise undertaken in the context of decentralization reforms in Ghana. North Tongu district to the north-east, Yilo Krobo municipality, Upper Manya district to the north-west, Akwapim North municipality to the west, Kpone Katamanso municipality to the south-west, Ningo-Prampram district to the south, and Ada West district to the east form the district's boundaries.

Agriculture is the district's backbone economy, employing 58.6 % of the working population. The district is predominantly rural with 76.7 % of the populace living in rural communities with only (23.3 %) residing in urban and peri-urban settings. The district has about 250 communities/settlements some of which are rapidly getting urbanized because of their proximity to Accra, the national capital. Dodowa is the administrative capital of the district. The district can boast of 4 town/area councils (i.e., Sub-Governance Structures) and 2 traditional areas: Shai and Osudoku. Figure 3 shows the location of the study area (Ghana statistical service 2010)¹.

¹ Ghana statistical service is the sole body in charge of population and census, and other statistical related issues.

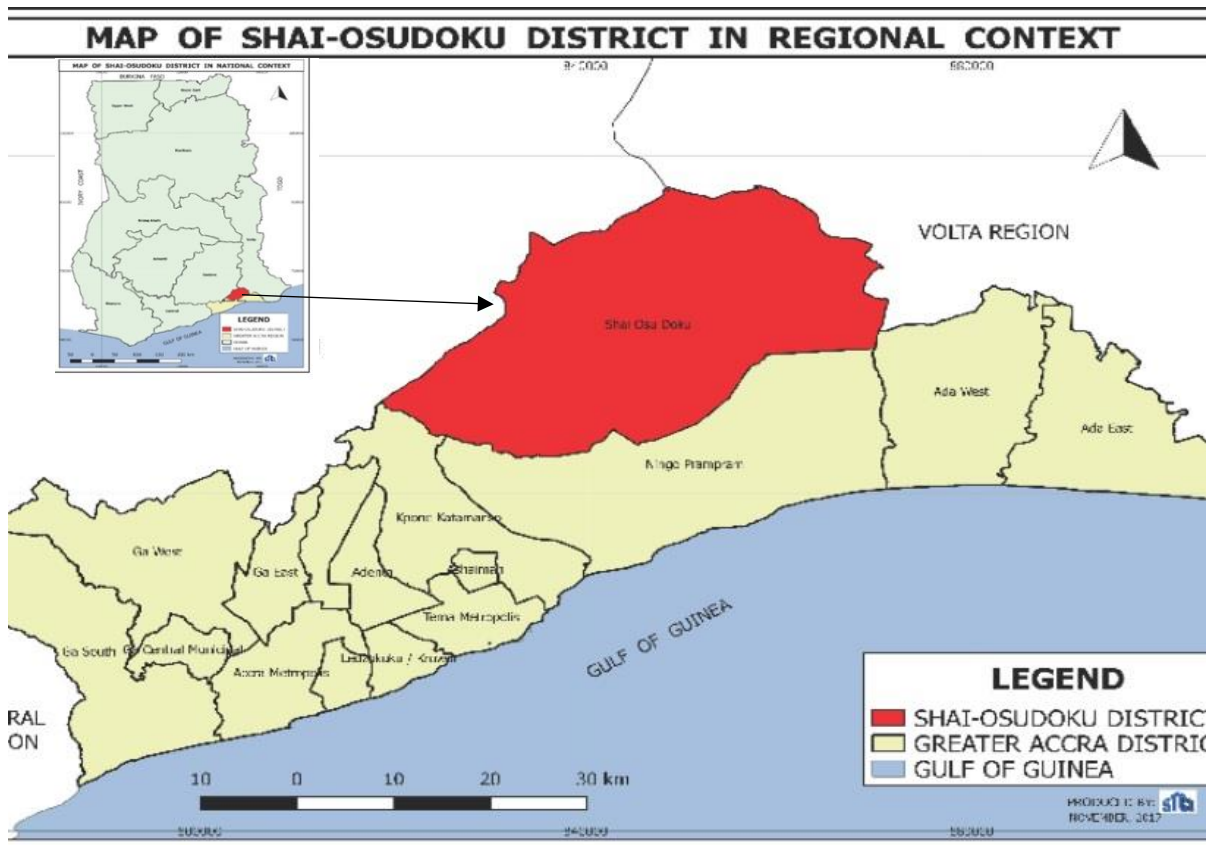


Figure 3 Study area

Source: SOD Assembly, 2022

4.2 Data collection

To investigate the variables that impact farmland abandonment, we conducted a large-scale field survey among local farmers in the Shai-Osudoku District's numerous agricultural communities. From the 28th of November to the 24th of December 2021, approximately 151 semi-structured field surveys were administered to farm households along the urban-rural fringe to capture household and institutional characteristics, the characteristics of their parcels of lands and farm location characteristics, and the factors influencing their land management decisions. In this study, farmland was characterized as abandoned if agricultural operations or farming had ceased entirely and no monetary, labour, or other input had been used for agricultural output in the previous 12 months. However, agricultural land with trees was abandoned if the trees or their products were not used for commercial reasons, no financial advantages were obtained from the land, and no agricultural input, such as labour, was required.

At each farmhouse, we first explained our research objectives and reiterated that the information collected would be used solely for academic purposes. We then conducted a 15-minute face-to-face and pen-and-paper interview with one of the family members, during which we presented a set of predefined questions. The responder was either the head of the household or, if the head of the home was absent, the next in command, i.e., the person with the greatest knowledge of the household and farming issues. 142 (94 %) of the 151 responses were found to be complete and valid for further research.

4.3 Questionnaire design

The questionnaire was designed to encompass the most important reported determinants of agricultural abandonment on the urban-rural nexus. The questionnaire was divided into three parts. Primarily, the first section of the questionnaire collected data on the households and institutional characteristics of the respondents i.e., gender, age, marital status, years of schooling, number of household members, farming income, source of labour, number of economic dependent household members, access to credit and subsidies among other factors. The second set of driving forces included questions on farm and location related characteristics e.g., the farm size, number of parcels, and location characteristics of the farmers' parcels, the land tenure system as well as the land dispute problems. Farmers were also asked to rank their opinion on the reasons why their farmlands are being abandoned and not used. Finally, questions were asked on the further expectations of the farm futures i.e., how they imagine the future of their farms in the next 5 years. In total, the questionnaire (see Appendix 1) consisted of 25 questions which were of different kinds (Likert scale, continuous, categorical, etc.).

4.4 Sampling strategy

In this study, a multi-stage sampling technique was used to collect the data. In the first stage, we used a convenient sampling technique to select the Greater Accra region since we are interested in the farming communities around urban-rural fringes. Then the second stage, a district from the identified region was chosen using convenient sampling, Shai-Osudoku district was selected as our study area. During the third step, we chose five farming communities using a purposive sampling. Purposive sampling was chosen because the study aims to learn from respondents who work in a certain occupational domain, that is farmers who are directly involved in farming activities in urban-rural settlement. In the fourth and final stage, snow-ball sampling technique was used to select the respondents in the chosen study area. Table 2 below shows the number of respondents from each of the 5 sampled communities before data cleaning was performed.

Table 2 Communities and number of respondents

Community	No. of Respondents
Dodowa	40
Doryumu	30
Asutsuare	30
Ayikuma	25
Shai Hills	26

4.5 Data analysis

Descriptive statistics, charts and inferential statistics were employed to analyse the data collected. The IBM SPSS Statistics statistical software and Microsoft Excel were used to analyse the survey data collected from the field. First the data was entered into excel and data cleaning was performed to remove incomplete data. To determine the farmland abandonment and the observed levels of farming intensity with the household, farm, location and institutional characteristics (e.g. parcel size, terrain, land tenure, and distance to the urban area from the farm), we applied the Multiple Linear Regression

(MLR) as employed in the research work of Du et al. (2019). We applied MLR to analyze the effects of various determinants on the share of abandoned parcels per household.

4.5.1 Definition of model variables

Farmland abandonment is defined as farmland that did not receive any input or is left uncultivated for at least 12 months. Thus, in this study, the dependent variable is Farmland abandonment, which is specified as the share of abandoned farmland area to total farmland area (%), and is calculated as:

$$\text{Farmland abandonment} = \frac{\text{Abandoned area of farmland}}{\text{Total area of farmland}} \times 100\% \quad (1)$$

where the abandoned area of farmland is the total area of farmland that received no input from the household or was left uncultivated for at least 12 months and the total area of farmland owned by the household. The variables were obtained from cross-sectional data that was collected from the field survey.

For independent variables, the study included household, institutional characteristics, farm, and location characteristics hypothesized to influence farmland abandonment, based on previous scientific research. For example, Zeng and Jiang (2019) and Li et al. (2011) investigated the drivers of credit availability by controlling for household characteristics (e.g., gender, age, education level of household head, jobs) and institutional factors (e.g., access to credit, access to subsidies, land tenure). According to Ankrah et al. (2021), household characteristics (e.g., gender, age, education level, occupations) and socioeconomic characteristics (e.g., income, household size) influences farmland abandonment.

4.5.2 Model specification

The dependent variable for the multiple linear regression analysis is the share of farmland abandoned per household. The model was specified as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \quad (2)$$

Where:

Y_i represents the dependent variable i.e., Farmland abandonment (share of farmland abandoned per household),

β_0 represents the intercept of the population y ,

β_1 population slope coefficient,

X_i is the independent variable: Household, institution, farm, and location characteristics

ε_i represents the random error term.

Table 3 below shows the descriptions of the various variables used in the model and their measurement type.

Table 3: Description of variables in the model

Variable	Description	Measurement Type	Expected sign
Gender	Gender of respondents (Male=0, Female=1)	Dummy	+/-
Age	Age of respondents in years	Continuous	+
Education	Years of schooling	Continuous	+
Household size	Number of members living in one household	Dummy	-
Off-farm income	Whether a farm earn income from off-farm opportunity (Yes=1, No=0)	Dummy	+
Farming income	The total income earned from the farm (in cedis) 1= (Below 500), 2= (500-999), 3= (1000-1499), 4= (1500+)	Categorical	-
Source of labour	Whether the farmer uses family or hired labour (Family labour=1, Hired/mixed labour=0)	Dummy	+/-
Farm succession	Whether any family member willing to inherit the farm (Yes=1, No=0)	Dummy	-
Access to labour	Whether the farmer has difficulties recruiting labour (1=Yes,0=No)	Dummy	-
Number of parcels	Number of parcels of land owned by the farmer	Continuous	-
Farmland size	Total area of parcel used for agricultural production in hectares	Continuous	+
Terrain	The terrain of the largest farmland (1=Flat; 0=Slope)	Dummy	+/-
Land dispute	Whether at least one parcel is under dispute (1=Yes; 0=No)	Dummy	+/-
Distance to the farthest farmland	Distance from farmhouse to the farthest parcel (km)	Continuous	+/-
Distance to a major road	Distance from the farthest farm to a major road (km)	Continuous	+/-
Distance to nearest urban area	Distance from farmhouse to the main urban area (km)	Continuous	-
Access to credit	Whether the farmer received credit for the past 2 years (1=Yes; 0=No)	Dummy	-
Access to subsidies	Whether the farmer received subsidies for the past 2 years (1=Yes; 0=No)	Dummy	-
Land ownership	Whether the farmer is the legal owner of the land (1=Yes; 0=No)	Dummy	-

5 Results

5.1 Descriptive analysis

Table 4 shows the descriptive statistics summary of the variables included in the study. This indicated that on average 49 % of the respondents were females and the rest 51 % were men. On average 39.78 % share of the total farmland area per household is abandoned which indicated that farmland abandonment is widespread phenomenon in the study area. The average age of the respondents was 38.6 years and out of the total respondents, the average year of schooling is 7.7 years, which means that, on average, the respondents have completed at least primary education. Regarding the household size of the respondents, there is an average of 6 members of the households and out of this, there is an average of two (2) economical dependents in each household.

Concerning off-farm income, the result showed that about 38 % of the surveyed farmers had earned income from off-farm opportunities and 62 % expressed that farming is their only source of income. This indicated that most farmers depend on their farm for daily livelihood. 38 % have other alternative sources of income and will not depend too much on farm income. Off-farm income can lead to farmland abandonment as Ankrah et al. (2021) documented for Ghana, but this relationship is not always straightforward. In terms of farm income, the surveyed household have an average monthly farm income ranging between 1000-1499 cedis. It is assumed that a higher income generated by farming activities will provide an incentive to continue farming.

Regarding the community connection, i.e., whether the farmers have network of other farmers in the local community with whom they interact in social activities such as sharing food and agricultural knowledge or providing unpaid labour. This measure is derived on Lovell (2010)'s concept to describing the social function of farmland, which assumes that persons who have a local community connection are more inclined to continue farming. According to the findings, 61 % of respondents have community ties on average.

During the harvest season, farmers typically use a combination of hired and family labour, about 44 % of farmers use family labour. This variable is supplemented in some ways by the farm size variable, as the average farm size found in this study was 4.9

hectares. The largest parcels in the sample were 20 hectares and the smallest was 0.5 hectare. 68 % of the respondents indicated that they have difficulties getting access to labour for their farms. When it comes to land tenure, we found 74 % of farmers are legal landowners, with about 26 % having a different type of tenure. 10 % of these were customary land, 5 % were leasehold or rented the land, 6 % were occupants, and 5 % were working the land in collaboration with the legal owners locally referred to as “Abunu Abusa”. When farmers were asked on whether they have dispute with their lands, 48 % of the surveyed farmers indicated that they have land dispute with one of their parcels of farmlands.

On average, farmers have 4.9 hectares of each parcel, but the largest farm is 20 hectares. While the sampled farms have 1.92 parcels on average. The distance from the farmhouse to the farthest parcel is also reflected in the fragmentation, which the lowest distance was 3 km and on average 11.86 kilometres but can range up to 47 kilometres describe the farm's location, we asked three questions related to distance variables that express proximity to the city of main urban, road infrastructure. The average distance from the farmhouse to the nearest urban districts is 21 kilometres, with some farms located right on the city suburbs and others located in more rural areas 47 kilometres from the main urban districts. The distance to the nearest major road ranges from being right next to the roadside to an average distance of around 11 kilometres. We also asked about the terrain of the largest farmland and about 58 % of the surveyed farms have a flat topography and 42 % are slopy. According to table 4, on average the percentage of farmers with access to credit over the past two years is 40 %, indicating that access to credit is not common among farmers in the study area. As for access to subsidies, 49 % of the surveyed farmers got access to subsidies over the past 2 years.

Table 4 Descriptive statistics - drivers of farmland abandonment

	Min.	Max.	Mean	Std. Deviation
Farmland abandonment (%)	0	100	39.78	26.30
Gender	0	1	0.49	0.50
Age (years)	19	65	38.60	12.58
Education (years)	0	15	7.75	4.49
Household size	2	10	5.97	2.61
Off-farm income	0	1	0.62	0.49
Farming income (cedis) ²	1	5	3.19	1.24
Source of labour	0	1	0.44	0.50
Farm succession	0	1	0.54	0.50
Community connections	0	1	0.61	0.49
Access to labour	0	1	0.68	0.47
Number of parcels	1	6	1.92	0.95
Farmland size (hectares)	0.5	20	4.89	3.10
Terrain	0	1	0.58	0.50
Land dispute	0	1	0.48	0.50
Distance to farthest parcel (km)	3	25	9.70	3.97
Distance to a major road (km)	2	39	11.86	5.66
Distance to nearest urban area (km)	7	47	21.23	8.13
Access to credit	0	1	0.40	0.49
Access to subsidies	0	1	0.49	0.50
Legal land ownership	0	1	0.74	0.48

N=142

² Cedis is the currency used in Ghana, 1 USD=7.20 Ghana cedis on 20.02.2022

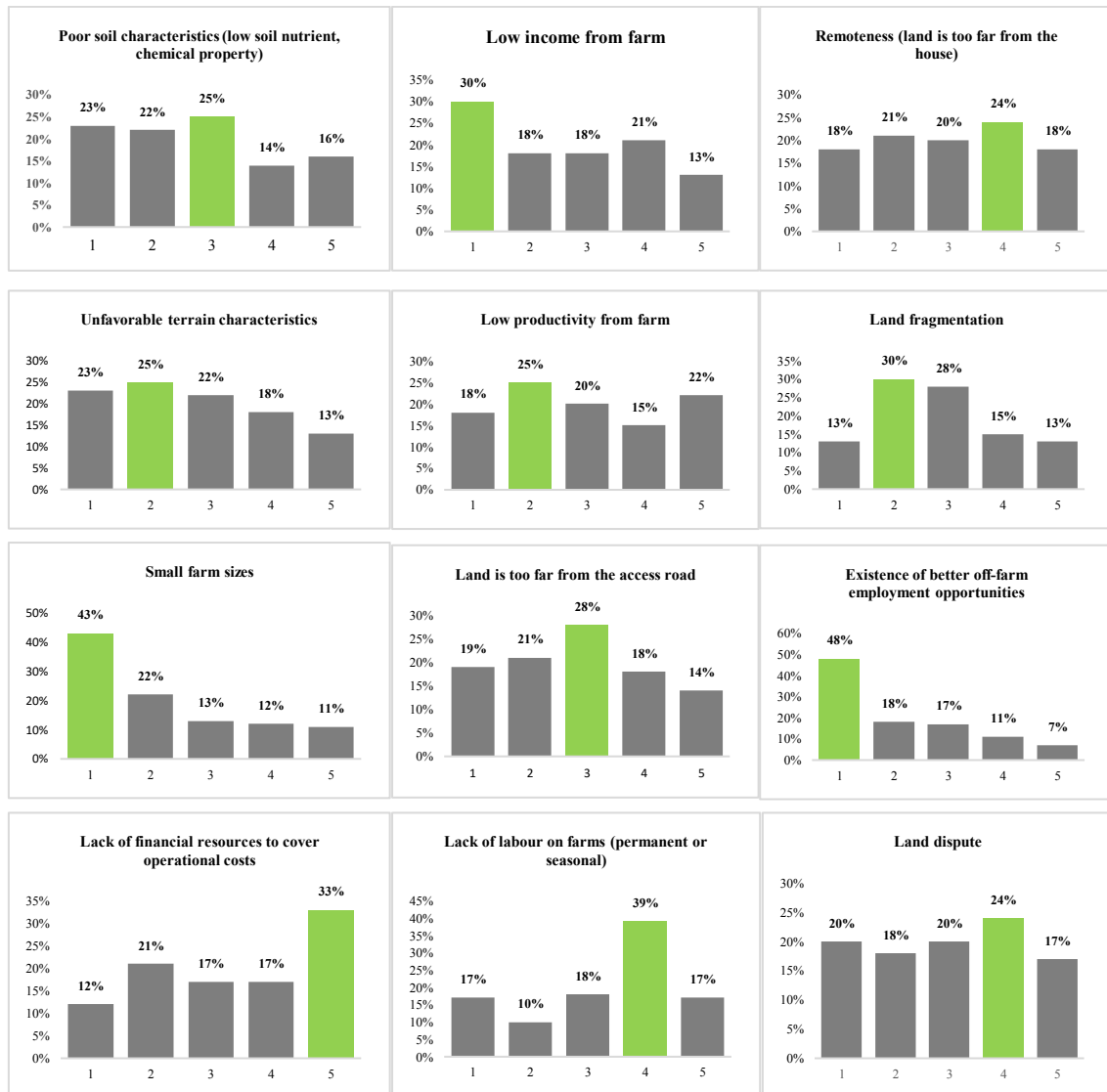
5.2 Farmer's opinion on factors influencing farmland abandonment

To answer the research question on the farmers opinion on the factors that influence their decision on farmland abandonment, the respondents were asked “*What are the factors influencing why your farmlands being abandoned/left uncultivated and not used? What are the general reasons in your opinion?*” The respondents had the opportunity to rate the factors that affect or influence the farmland abandoned on a 5 Likert scale. The results are presented in Figure 4.

Figure 4 indicated that existence of better off-farm opportunity (48 %), small farm sizes (40 %) and low income from farm (30 %) were ranked as very important factors that influenced their decision to abandoned portion of their farmlands. According to (Sikor et al. 2009) when farms are fragmented into several small parcels that are spatially dispersed and vary in distance from the farmhouse, it impedes agricultural development in a variety of ways, resulting in high operational costs and low productivity. This phenomenon influences the decisions of the farmers to abandon those parcels.

Unfavourable terrain characteristics i.e., slope/stone (25 %), low productivity from farm (25 %) and land fragmentations (30 %) were ranked as important factors that affect their decision to leave their farmlands uncultivated. When it comes to factors that are somehow important on their decisions to abandoned part of their parcel of farmland, land is too far from access road was ranked at 28 %. Lack of labour on farms (permanent and seasonal) 39 % and dispute (24 %) were ranked as less important influential factor on farmland abandonment. 34 % of the surveyed farmers ranked lack of financial resources to cover operational cost the not important factor to leave portion or all their farmlands uncultivated.

Figure 4 Farmers opinion on factors affecting farmland abandonment

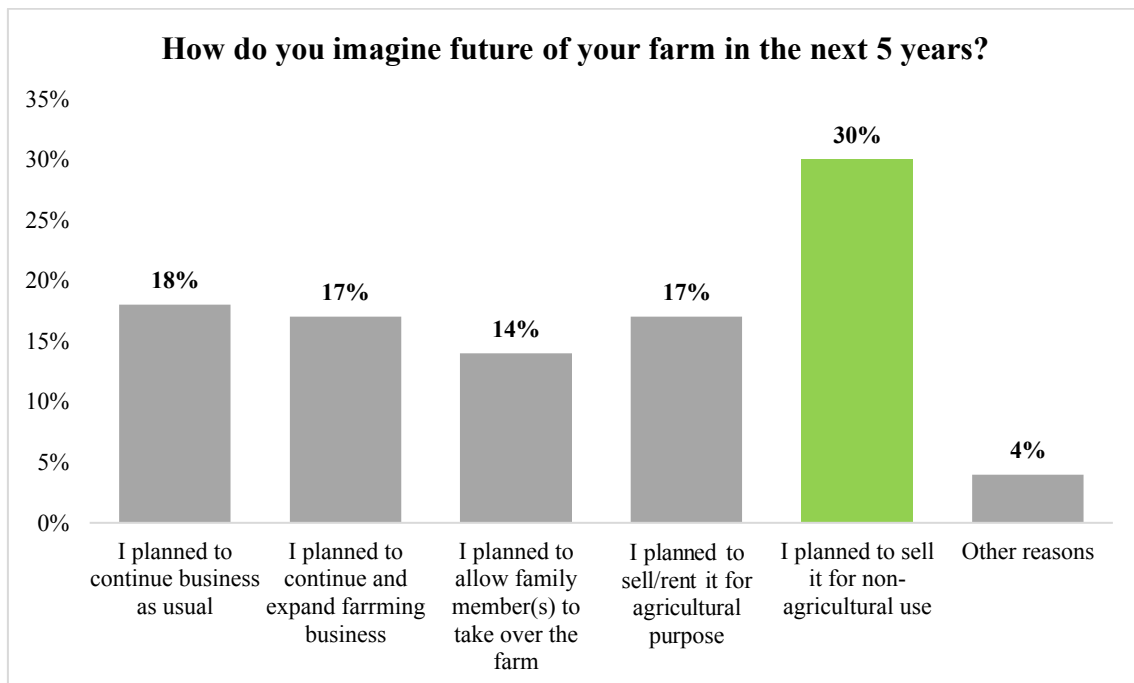


Key: 1. Very important 2. Important 3. Somehow important 4. Less important 5. Not important

A question was posed to the surveyed household heads on the future development of their farms “How do you imagine the future of your farm in the next 5 years?” and farmers had the opportunity to give their opinion on the future of their farms. The figure 6 shows the results. It was evident from the results in figure 5 below, that 30 % of the surveyed household heads planned to sell their farmlands for non-agricultural use. Some of the farmers interviewed expressed that “There are real estate companies willing to buy our farmlands for housing projects and are offering huge sums of money, since we do not earn enough from cultivation, we plan to sell it and invest the money into other non-agricultural ventures that gives good returns”. Out of the sample only 18 % of the

farmers planned to continue farming business in the next 5 years and expressed that farming is their lifestyle and cannot stop even if the conditions are not favourable. 17 % of the surveyed farmers planned to continue and expand their farming business, 14 % planned to allow other family members take over the farm, 17 % planned to sell or rent it for agricultural purposes. Only 4 % expressed other plans when asked to specify: One farmer expressed that *“I planned to totally abandon my farm and look for other off-farm opportunities in the next 5 years”*.

Figure 5 Future prospect of farms in the next 5 years.



5.3 Drivers of farmland abandonment – Multiple Linear Regression

A multiple regression analysis was performed to check the effect of the factors influencing farmland abandonment. To access if the model is fit to explain the effect of the predictors on the dependent variable, ANOVA test was performed. From the Table 5 below the p-value $0.000 < 0.05$, which means that, the model has an explanatory power. In other words, one or more of the predictors help to predict the effect on farmland abandonment, therefore we reject the null hypothesis. In terms of the normal distribution of the residual, the model has again passed the normality test as we can see from the figure 8 below, the residuals are normally distributed.

Table 5: ANOVA Results

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
5	Regression	84.421	20	4.271	3.368	0.000 ^b
	Residual	153.452	121	1.268		
	Total	238.873	141			

a. Dependent Variable: Farmland abandonment

b. Predictors: (Constant)

Table 6: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
5	0.598	0.358	0.251	1.1261	2.103

From the Table 6 is the model's overall performance on how well the regression model fits the observed data is satisfactory, with an R^2 of 0.36 (adjusted $R^2 = 0.25$). This means that, the variability between the dependent variable and the independent variables is 36 %. The Durbin-Watson statistics (2.1) shows that there is no autocorrelation detected in the sample.

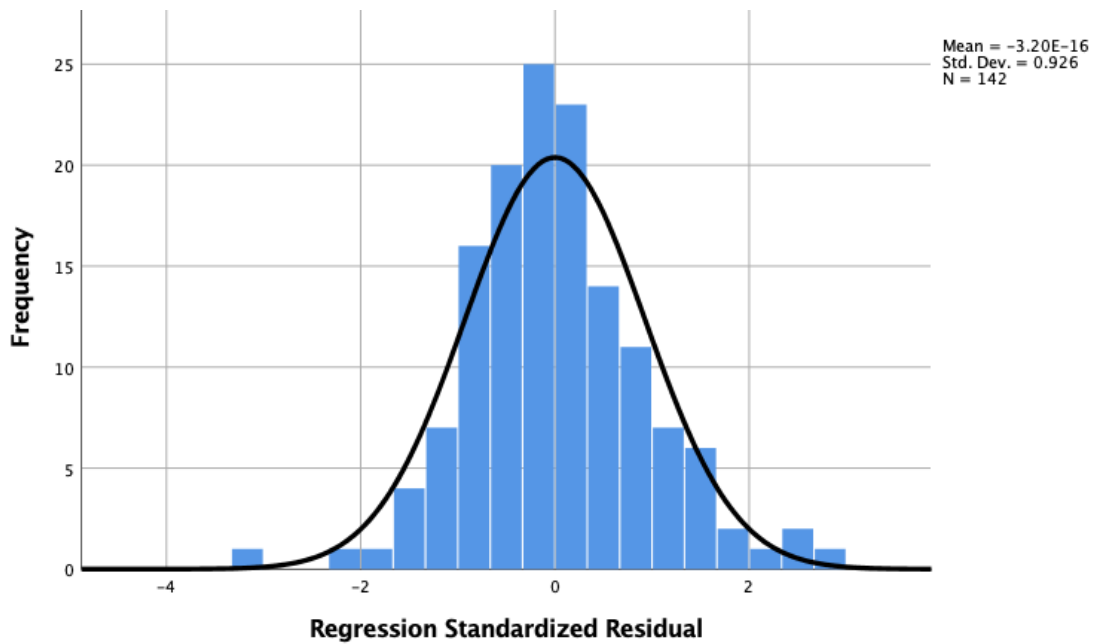


Figure 6 Normality test

In a regression model, multicollinearity often occurs when two or more independent variables are significantly associated with one another. This suggests that one independent variable may be predicted based on another. Therefore, to avoid this statistical problem, multicollinearity was checked in the model using the VIF (Variance Inflation Factor). The strength of the correlation between the independent variables is determined by the VIF. It is predicted by regressing one variable against every other variable. An independent variable's VIF score indicates how well it is explained by other independent variables.

- VIF begins at 1 and has no limit.
- There is no association between the independent variable and the other variables when the VIF value is 1.
- When the VIF is greater than 5 or 10, there is a lot of multicollinearity between one independent variable and the others.

The result shows the model met the VIF criterion, which shows that there is no correlation between the independent variables and the other variables. Therefore, we can proceed to look at the MLR.

5.4 The effect of households and institutional characteristics on farmland abandonment

The results in the Table 7 shows that access to labour is statistically significant and has a positive relationship with farmland abandonment. This means that increase in the difficulties of farmers in recruiting labour for their farms increases farmland abandonment, which is in line with Du et al. (2019) who also found a positive relationship between access to labour and farmland abandonment. The result also indicated that off-farm income is statistically significant and has positive effect on farmland abandonment. This is in line with what Zhou et al (2020) found in their research. This means that when all other variables are left unchanged and off-farm income increases by 1 %, the share of farmland abandonment will increase by 0.033 %.

Surprisingly gender of the respondents, education of household head and size of the household are all statistically insignificant, hence do not play any major role in understanding farmland abandonment in the study area. Farm income is surprisingly also not statistically significant and did not have any effect on farmland abandonment. The degree to which households are integrated into the local community did not have any impact on farmland abandonment. The findings indicate that some of the household and institutional variables tested are not statistically significant and are not relevant in explaining farmland abandonment except access to labour and off-farm income.

5.5 The effect of farm and location characteristics on farmland abandonment

The important farm and location characteristics according to our models are farmland size and distance to the nearest urban area, which are all statistically significant at 5 % significant level. Land dispute is also significant at 10 % significant level. First, the size of farmland per household is an important variable in explaining the farmland abandonment: the results indicate that a 1 % increase in the farmland size per households, will lead to a decrease in share of farmland abandonment by 2.388 % per household, all other things being equal. This means that farm size has a negative relationship or effect on farmland abandonment. Small farm sizes make it difficult to replace manpower with farm machinery, resulting in higher production costs and lower output, and encouraging small farmers to pursue off-farm activities (Rajpar et al. 2019), however, large farms absolutely allow for mechanization resulting in high yields and increase in farm income reducing farmland abandonment. However, land dispute also plays a role in explaining farmland abandonment. Land dispute has positive effect on farmland abandonment, meaning a 1 % increase in land dispute increases farmland abandonment by 0.129 %.

In the study area, accessibility to farmlands did not appear to be a key differentiator, distance to the major road surprisingly do not have any significant effect on the farmland abandonment. The only significant effect was found for distance to the nearest urban area. The results shows that a 1km increase in the distance from the farmhouse to the nearest urban area will lead to an increase in the share of farmland abandonment by 0.027 %. This means that increase in the distance from the farmhouse to the urban area will lead to an increase in the share of abandonment of farmland. Therefore, distance from the farmhouse to the urban area has a positive effect on farmland abandonment.

The terrain at the farm location did not appear to have an impact on the percentage of households abandoning their farmlands, which could be because the terrain is rather uniform throughout the surveyed area. Farmland fragmentation expressed as the number of parcels owned per household and the distance between those parcels is also not associated with farm abandonment and therefore did not have any effect on farmland abandonment.

Table 7: Factors influencing farmland abandonment

	Coef.	Sig.
<i>Constant</i>	-0.229	0.075
<u>Household characteristics</u>		
Gender	-0.006	0.976
Education (years)	0.005	0.834
Household size	0.006	0.885
Farming income (cedis)	-0.002	0.985
Off-farm income	0.033**	0.018
Farm succession	0.258	0.212
Community connection	-0.051	0.819
<u>Farm characteristics</u>		
Number of parcels	-0.103	0.403
Farmland size (hectares)	-2.388 ***	0.003
Terrain	0.297	0.157
Land dispute	0.129 *	0.063
<u>Location characteristics</u>		
Distance to a major road (km)	0.016	0.391
Distance to nearest urban area (km)	0.027 **	0.038
Distance to the farthest parcel (km)	0.008	0.749
<u>Institutional characteristics</u>		
Access to credit	0.142	0.488
Access to subsidies	-0.028	0.890
Land ownership	0.050	0.815
Access to labour	0.181**	0.040

Dependent variable: Farmland abandonment (%)

Significance codes: *** = 0.01, ** = 0.05, * = 0.10

6 Discussion

6.1 Household and institutional characteristics

Farm income is a clear motivator for farmers to keep farming. However, when it comes to the farm income in Ghana, it is usually meagre which makes farmers struggle to make ends meet with the income that is earned from farming. Furthermore, farmers on Ghana's fast increasing urban–rural edge are more inclined to continue farming when their income is relatively high. One farmer noted during an interview with some farmers in the surveyed area that *“We farmers do not earn enough income from farming, we struggle to survive, we planned to continue farming when the conditions are favourable and we can earn enough from our farms, if not we will eventually abandon our farmlands and move to the city for other off-farm opportunities”*. This suggests that increasing farm income can be a good way to keep farmland near cities productive. According to Koomen & Ke (2020) about putting up community-based vegetable gardens in fast urbanizing portions of the Philippines have showed that they assisted participating families to boost their monthly income by roughly 20 %. Shorter supply chains, lower transportation costs, and direct marketing possibilities allow farmers on the urban–rural boundary to potentially increase their farming income due to their proximity to resources and consumers (Appiah et al. 2014). Farmers in this study area may be able to take advantage of proximity to the city and can produce high value-added produce, for which expertise and processing techniques, as well as favourable market conditions, are readily available in and around cities. As a result, the benefits of urbanization for agriculture may outweigh the drawbacks (Koomen & Ke 2020). However, the results indicated that, farm income did not have any effect on the farmland abandonment.

Education level is another factor that could influence the farmland abandonment. Farmers with high educational levels have a higher chance of finding better-paying work elsewhere outside farming and might abandoned their farms and farmers with lower education level tend to specialize on farming, however, surprisingly our results shows that education level is not a significant influence of farmland abandonment in the study area. This finding is contrary to Ankrah et al. (2021)’s claim that in Ghana, farmers with

less education tend to specialize on farming and others with higher education focuses on looking for off-farm opportunities.

Access to credit is an important factor that affects agricultural productivity in Ghana. Some farmers in Ghana do not have access to credit to be able to fund their agricultural operational cost. Surprisingly, our results showed that access to credit is not a significant determinant of farmland abandonment in our study area. The initial hypothesis states that access to agricultural credit reduces farmland abandonment, therefore we reject the (H₁) hypothesis and conclude that access to credit is insignificant determinant of farmland abandonment. This results is contrary to the findings of Ankrah et al. (2021) who found that access to credit actually decrease farmland abandonment in Ghana. However, their research findings emphasized that, Ghanaian culture where farmers have a high level of acquaintance or community connections, obtaining informal credit is easier than formal credit.

We also looked at the impact of the household heads who have off-farm income, and found significant and positive effects on farmland abandonment which is in line with Zhou et al. (2020a) who conducted a similar research in China and found a significant and positive impact of off-farm income on farmland abandonment. Therefore, we fail to reject (H₂) hypothesis that an increase in off-farm income (for example, employment in the city), increase farmland abandonment (Zhou et al 2020). Access to labour is also statistically significant in explaining the farmland abandonment in this study area. Farmers in this area usually plough their land twice or three times a year, cultivate crops, remove weeds, and harvest crops. Due to lack of farm machinery such as tractors, farmers must employ labour to work on these farms. Farming activities rely heavily on household heads and members as a source of labor. When farmers want to plough their field, they need a lot of energetic labourers which is usually not available. However, access to labour is positively related to farmland abandonment.

Land ownership status is an important determinant of abandonment of farmlands and can influence in a positive and significant way. In Ghana, the ownership type of farmland impacts the socio-economic standing of households and access to financing. The results shows that legal ownership of farmlands did not affect farmland abandonment in the surveyed area. Finally, we discovered that households with more local ties or community connections did not affect the probability of the farmers leaving part of their

farmland uncultivated. This influence is not particularly strong, which may indicate that the region has already transitioned to a more urban population, with agriculture playing a reduced role in daily life.

6.2 Farm and location characteristics

Farm size per households affects farmland abandonment. The results showed that farm sizes are a significant determinant of farmland abandonment; an increase in the farm size of households will lead to a decrease in the farmland abandonment. This can be explained by the fact that larger size farms may be easily mechanised, and this will lead higher yields and increasing their income. This will eventually reduce their probability abandoned portion of their lands. The labour shortage is particularly acute in urban-rural areas, where there is plenty of other work available (Koomen & Ke 2020), therefore mechanization of large size farms will reduced the dependence of manpower. According to the hypothesis, there is a significant impact of farm size of household on farmland abandonment, therefore, we fail to reject the H_3 null hypothesis and conclude that farm size has a significant impact on farmland abandonment, as has been demonstrated in previous studies in China (Du et al. 2019).

The study discovered that distance to the nearest urban areas had an impact on abandonment. The results indicate that an increase in the distance from the farmhouse to the nearest urban city increase the decision for farmers to leave part of their farms uncultivated, this means that distance to the urban city have a positive and significant impact on farmland abandonment. This may be since the area is relatively homogeneous, and that access did not severely constrain farming conditions. We could not discover evidence for Sinclair's (1967) or Pointereau et al.(2008)'s claim that metropolitan proximity has a negative effect on agriculture use intensity. The farmers in the surveyed area argued that high farming income provides them with a strong incentive to continue farming, and they may choose to stop only when the benefits of alternative options are sufficiently significant, farming circumstances are truly unfavourable, or urban development is imminent. It is possible that the latter is the case along small highways, where farms were found to have slightly higher abandonment rates.

The negative effects of roads on farming conditions appear to predominate in our case study's urban–rural periphery situation. For example, easily accessible farmland is more susceptible to urban expansion, giving farmers less motivation to invest in and manage these resources (Zhang et al. 2014). Furthermore, as previous research have revealed, these locations are more susceptible to human disturbance, necessitating additional safeguards like as fencing to prevent trespassing, and theft (Du et al. 2019). However, the results show that distance from the farm to the nearest major road did not have any impact on farmland abandonment.

The distance from the farmhouse to the farthest parcel also did not show any closer relationship to abandoning the farmland. Farm cultivation and management required regular attention, so farmlands far from the residential house cannot be properly maintained and cannot be monitored. Additionally, there are not any defined grazing fields in Ghana, therefore there were incidence of castles grazing on people's farms. Existing farmlands (during the off-season) abandoned farmlands as well as nearby forest areas are normally used for grazing for nomadic herdsmen. In terms of terrain, it was not shown to be significant in explaining farmland abandonment, implying that the conditions are consistent and favourable for farming.

6.3 Limitations of the study

The study has a few limitations that can be solved by future researchers. Due to limited funding, the study's sample size was limited to only one region in Ghana. Researchers in the future can consider a larger sample size by considering the entire country. The COVID-19 worldwide pandemic-related restrictions had a direct impact on data collection by delaying travel to Ghana for the data collections. The use of enumerators to collect primary data was viewed as a limitation of the study. The research site was a multi-dialect community. Some of the respondents were interviewed with the assistance of an interpreters and enumerators. The data could have been corrupted during translation. Another limitation was the results' generalizability. The study's scope was limited to the five major communities (Dodowa, Doryumu, Ayikuma, Asutsuare and Shai Hills) to represent the entire SOD. Generalizing this result for another district(s) may not be the most accurate representation because each district has unique characteristics such as occupation, soil type, climate, and so on.

7 Conclusions

7.1 General remarks

This study investigated the factors that influence farmland abandonment in the urban-rural fringes in Ghana. We sought to answer the research questions: What are the factors that influence farmland abandonment in the Shai-Osudoku district-Ghana? The findings indicated five important factors that influence farmland abandonment in our study area: namely off-farm income, access to labour, farmland size per households, land dispute and distance from farmhouse to the nearest urban area. We also probe about farmers' perceptions of the factors that influence their decision to leave part of their farmlands uncultivated found out that existence of better off-farm opportunity (48 %), small farm sizes (40 %) and low income from farm (30 %) were ranked as very important factors that influence their decision to abandoned portion of their farmlands. In terms of the prospects of their farmlands in the next 5 years, about 30 % of the surveyed households planned to sell their farmland for non-agricultural use, 17 % of the farmers polled expected to keep and grow their farming operations, 14 % wanted to hand over the farm to other family members, and 17 % planned to sell or rent it for agricultural reasons.

Furthermore, overall farming market factors such as demand, supply, and commodity pricing are major predictors of farming alternatives' profitability. We looked at these in the context of our literature review but did not look for any impact on land abandonment on the farms we surveyed. However, it is evident that the region's current farms are typically small and unlikely to provide enough earning to compete with income from off-farm sources. Our study looked at the influence of agricultural credit on keeping farmlands in production and did not find any impact. However, throughout the interviews, some farmers said they think agricultural credits are important factor and had some impact on their farming practices and farmland abandonment. This is in accordance with previous research, which found that agricultural credits have a positive impact on farmland abandonment.

7.2 Recommendations

As the findings of this study reveal some important factors that influence farmland abandonment, several measures are required to address the difficulties that rural farm households confront, such as low income from farming, access to credit to finance operational cost and farmland abandonment. Restoring farmland use on the urban–rural boundary would not only help to secure food production in the region and create more job opportunities for the youth but will also help to improve the provision of environmental services for example, increasing air quality to the nearby urban population. Therefore, this study recommended that, Ghana adopt an urban development policy to reduce the negative effects of land-use changes on urban ecosystems in the Shai-Osudoku District and Ghana as a whole. The maintenance of a reasonable balance between urban infrastructure development, ecological sustainability, and agricultural productivity should be the goal of such policy. Government should implement a land policy that will make it difficult to convert farmlands into real estate developments and reward farmers who keep their farmlands on urban-rural urban fringes in cultivations at the end of every year.

Policymakers should focus on regulations that would allow farmers to keep their farm in cultivation. To support rural farmers, the governments should support high-cost agricultural inputs by providing agricultural subsidies to farmers to reduce their operational cost.

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Appendices

List of the Appendices:

Appendix 1: Questionnaire

Appendix 1: Questionnaire

Questionnaire: Farmland abandonment and its drivers on the Urban-rural fringe of Ghana

I am a student at Czech university of Life Sciences pursuing master's degree in international development and Agricultural Economics. My name is Dominic Nyendu. The purpose of this survey is to determine the various factors or driving forces of agricultural land abandonment in the urban-rural fringes of Ghana. This research would enable me to complete my studies as it is a requirement for the study programme. Your contribution is voluntary and the information you give will be treated confidentially. Your lack of participation or participation itself will not have any adverse consequences on you. The questionnaire will take approximately 15 minute to complete.

PART I: HOUSEHOLD AND SOCIO-ECONOMIC CHARACTERISTICS

1.What's your gender?				
<input type="checkbox"/> Male		<input type="checkbox"/> Female		
2.Please indicate your age				
<input type="text"/>				
3.What is your marital status?				
<input type="checkbox"/> Single	<input type="checkbox"/> Partnership	<input type="checkbox"/> Married	<input type="checkbox"/> Divorced	<input type="checkbox"/> Window
4.How many years of schooling do you have?				
<input type="text"/>				
5. How many family members do you have in your household?				
<input type="text"/>				
6.How many family members dependent on you economically?				
<input type="text"/>				

7. What is the average farming income per month in your household (Cedis)?			
<input type="checkbox"/> Up to 500 cedis	<input type="checkbox"/> 500-999 cedis	<input type="checkbox"/> 1000-1499 cedis	<input type="checkbox"/> more than 1500 cedis
7.Do you earn off-farm Income?			

<input type="checkbox"/> Yes	<input type="checkbox"/> No
If yes, please specify the percentage of the family income from off-farm work	
<input type="checkbox"/> Up to 25 %	<input type="checkbox"/> 51-75 %
<input type="checkbox"/> 26-50 %	<input type="checkbox"/> 76-100 %
8.How many people work on your farm?	
<input type="text"/>	
9.What is the source of labour in your farm?	
<input type="checkbox"/> Mixed Labour (Family and Hired)	<input type="checkbox"/> Family
10.Do you have difficulties in recruiting labour for your farm?	
<input type="checkbox"/> Yes <input type="checkbox"/> No	
11.Is any member of the family willing to inherit your farmland?	
<input type="checkbox"/> Yes <input type="checkbox"/> No	
12. How many people in your local community are you familiar with through joint social activities such as sharing food, agricultural knowledge, and labour?	
<input type="text"/>	

PART II: FARM CHARACTERISTICS

13. How many parcels of farmland do you have in total in your household?
<input type="text"/>
14. What is the total area of your farmland parcels(hectares)?
<input type="text"/>
15. What is the total abandoned area of your farmland (hectares)?
<input type="text"/>

16.How long is your land left uncultivated (in years)?			
<input type="text"/>			
17.Are you the legal owner of the land?			
<input type="checkbox"/> Yes.		No <input type="checkbox"/>	
If you own, which of the following documents do you have?			
<input type="checkbox"/> Written statement	<input type="checkbox"/> Land deed	<input type="checkbox"/> Court Resolution	<input type="checkbox"/> others
If you don't, what is your relationship with the land (Land tenure system)			
<input type="checkbox"/> Customary land tenure		<input type="checkbox"/> Leasehold.	
<input type="checkbox"/> Abunu Abusa		<input type="checkbox"/> Occupier.	<input type="checkbox"/> Others.....
17.Do you have any land dispute?			
<input type="checkbox"/> Yes		<input type="checkbox"/> No	
If yes, how much of land under dispute? (Hectares)			
<input type="text"/>			
18.What is the distance from your residence to the farthest farmland (km)?			
<input type="text"/>			
19.What is the distance from your farthest farmland to a minor road(km)?			
<input type="text"/>			
20.what is the terrain of the location of your largest farmland? Please select one			
<input type="checkbox"/> Slope		<input type="checkbox"/> Flat	
21.What is the distance from your farthest farmland to the nearest Urban area(km)?			
<input type="text"/>			

22. Do you receive credit in the last two (2) years?						
<input type="checkbox"/> Yes			<input type="checkbox"/> No			
23. Do you receive subsidies in the last three 3 years?						
<input type="checkbox"/> Yes			<input type="checkbox"/> No			
24. What are the reasons why your agricultural lands being abandoned and not used? What are the general reasons in your opinion?						
<i>Please rate the following reasons.</i>						
Factors	Ratings	1 very important	2 important	3 somehow important	4 less important	5 not important
Low farm Income from abandoned farm						
Remoteness (land is too far from the house)						
Land is too far from the access road						
Poor soil characteristics (low soil nutrient, Chemical properties)						
Unfavourable Terrain characteristics (slope/stone)						
Low farm productivity from farm						
Land fragmentation						
Small farm sizes						
Lack of financial resources to cover operational costs						
Existence of better off-farm employment opportunities						
Lack of labour on farms (permanent or seasonal)						
Land dispute						

PART III: FURTHER EXPECTATION OF FARM FUTURE

25. How do you imagine the future of your farm in the next 5 years? (Please tick all the box you agree with)	
<input type="checkbox"/> I planned to continue business as usual	<input type="checkbox"/> I planned to sell/rent it for agricultural purpose.
<input type="checkbox"/> I planned to continue and expand farming business	<input type="checkbox"/> I planned to sell it for non-agricultural use.
<input type="checkbox"/> I planned to allow family member(s) to take over the farm	<input type="checkbox"/> Other (please specify)