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Factors Affecting the Adoption of Agricultural Mechanization Technologies by Women Farmers in the Karaga District of Ghana

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Abstract

Labour-saving or mechanization technologies have become the driving force behind modern agriculture, yet adoption of these technologies remains low in many parts of the developing world, particularly among female farmers in Ghana. This study aims to investigate the factors that hinder the adoption of agricultural mechanization technologies by female farmers in the Karaga District of the Northern Region of Ghana. This region is known for its large agricultural lands and significant role in commercial farming. The research was conducted using qualitative research methodology and involved interviewing 60 female farmers using an interview guide. The principle of sample saturation was used, meaning that further interviews were deemed unnecessary after the 60th interview. The results showed that low adoption of agricultural mechanization technologies is due to poor access to commercial lands, gender biases, lack of access to credit, and poor awareness about the benefits of these technologies. In conclusion, the low adoption of agricultural mechanization technologies is preventing women farmers in the Karaga District and elsewhere in Ghana from fully participating in commercial agricultural production. It is recommended that gender biases and cultural stereotypes be addressed to improve women farmers' access to lands and credit, which will facilitate the adoption of mechanization technologies and lead to improved agricultural production.

Keywords

Adoption, Agricultural Mechanization, Women Farmers, Ghana, Karaga District

1. Introduction

Owing to agricultural labour shortages and the rising gap between the demand and supply of food, automation of agriculture is the way to go [1]. Globally, the face of agriculture is female [2]. About 50% - 85% of women in Africa farm without mechanization support [3], as they contribute about 43% of agricultural manpower worldwide [4]. According to USAID (2012), by granting women farmers the same access to capital, land, and new agricultural technologies as men, agricultural production can increase by 30 percent, which will be critical in feeding the rising global population [5]. Agricultural mechanization is therefore a key strategy that can be used to increase food production and lower the drudgery of agricultural activities globally [6]. Mechanization reduces labour, time, and drudgery of agricultural production thereby enhancing the standard of living. However, the adoption of agricultural mechanization technologies by women farmers is inhibited by a myriad of barriers such as negative cultural perceptions linked to women using agricultural machines, technology design, access to land, credit, and information that would aid the purchase, access, as well as the use of the technology [2].

FAO and ECOWAS (2018) assert that the adoption of agricultural technologies by women is hindered by challenges such as inadequate financing and agricultural training, cultural norms, and issues of gender [2]. In sub-Saharan Africa, women farmers are bedeviled by challenges such as lack of agricultural education and training, inability to access land and other resources, and lack of involvement in agricultural decision-making [2]. The situation is not different in Ghana where women produce about 70 percent of food stock. Therefore, enhancing their adoption of agricultural mechanization can significantly improve crop production and their livelihoods [2]. This means that there is the need to ensure that agricultural mechanization technologies are gender-sensitive so that their operations are not only mainly done by men as currently pertains [2].

FAO (2018) defines agricultural mechanization as implements, tools, and machinery that are used to enhance the productivity of a farm. According to Cuddihy (2019), agricultural mechanization is the adoption of mobile or immobile machines in land tillage, irrigation, harvesting, and thrashing. It entails trucks that haulage farm produce, dairy appliances, processing machines, cotton ginning machines, and rice hulling [7]. Studies have raised concerns over complex dynamics revolving around the introduction of agricultural technologies and the resulting gender implications [6]. Most of the economically active women in developing nations work in the agricultural sector [2]. The rising active involvement of women in agriculture globally necessitates the development of agricultural tools that are gender-friendly [8]. According to WBG (2019), the adoption of agricultural technologies by women is hindered by inadequate access to agricultural training and technical skills. This explains why only 16 percent of women are in the machine operators and assembler's profession [9]. FAO (2018) reinforces this assertion by pointing out that addressing the gender gap in women

farmers' access to agricultural machines is a critical strategy for economically empowering women in rural areas. Agyei-Holmes (2016) further reinforces this assertion by observing that agricultural mechanization can greatly enhance productivity in the agricultural sector [1]. Research, however, indicates that women farmers encounter challenges in adopting agricultural mechanization and consequently leading to lower adoption rates in comparison to men [2].

Increasing food production is critical given that the world population is projected to be 9.1 billion by the year 2050 [10]. The number of women entering the farming arena is on the rise, and this is good news because women are community-oriented [2]. This is in agreement with the saying that, "If you teach a man to farm, his family will eat. If you teach a woman to farm, the community will eat." And, as FAO asserts, if lady farmers can access the same agricultural resources as male farmers, the whole world will eat [4]. The biggest bottleneck as far as women and agricultural mechanization are concerned is land rights. The situation is so bad that only 10 to 20 percent of landowners are women in developing nations [2]. Ghana's agricultural mechanization potential is high. Diao *et al.* (2014) carried out a study that revealed that the majority of smallholders in Ghana opt to hire tractors than own one due to a lack of capital [11].

In some countries, culturally, women are not allowed to own or control land. In a case where female farmers are not allowed to make land-related decisions, they cannot enter into farming contracts that may provide high income [4]. Gender-specific barriers and roles may hinder women in developing countries from participating in agricultural mechanization and taking their crops to market. Agricultural persistent gender bias may also prevent women farmers from leaving their rural homes without the consent of their husbands. Cultural gender bias experienced in agriculture hinders women from accessing credit; hence, they are less likely to buy modern farming tools that increase crop production. Doing away with gender-specific barriers in agriculture, the FAO reports, can help women exploit their economic potential, enhance the adoption of mechanized farming by women, and feed a hungry world [2]. Additionally, about 820 million people globally who live in developing countries are undernourished, and women play a key role in food production in these countries [4]. Mehta and Badegaonkar [8] opine that farm women should be subjected to demonstrations and training on how to use various modern agricultural equipment. The researchers further accentuate that improved tools and equipment should be adequately supplied in rural areas to boost agriculture. An investigation by FAO and ECOWAS [2] in Ghana pointed out that machines are not gender-sensitive and that machine operation training is mainly done for men. This implies that ladies were not able to get involved in mechanized occupations. As a result, they are not able to get involved in mechanized agriculture. A study by Sumner *et al.* [12] in Cambodia indicated that culturally, women are not involved in farming decisions hence hampering agricultural technology adoption. Additionally, Theis *et al.* [13] observed that Bangladesh culture does not allow women to engage in

paid agricultural work outside the home. The research further found that women who operate agricultural machines are socially unacceptable. The researcher goes on to say that women who managed both the farm and household owing to the out-migration of men gain from farmers offering mechanized seed planting, seedling transplanting, as well as harvesting services. Mehta, Gite, & Khadatkar [14] conducted an investigation on the empowerment of women through agricultural automation in India. The study showed that demonstrations and training for women farmers on how to operate modern agricultural tools should be done on a regular basis. Research conducted by FAO [4] on approaches that can be adapted to include gender in mechanized agriculture in Burkina Faso revealed that whenever an agricultural machine is introduced, men use it while women are made to carry out tasks that are more laborious. The investigation further revealed that 95 percent of women in Burkina Faso in the rural setup carry out farming by the use of non-mechanized instruments.

The AU member countries (Ghana inclusive) have been urged to ensure that developments in agricultural mechanization and technological innovation are women-inclusive [2]. Ghana has about 8 million hectares of land that are suitable for mechanization. However, only 20 percent of this agricultural land has been mechanized. The high agricultural mechanization potential in Ghana calls for the involvement of women in agriculture automation. However, according to FAO and ECOWAS [2], Ghana lags behind in gender empowerment and agriculture mechanization and the country has no agriculture-based gender policy.

It is important to state that there are many empirical studies with a focus on agricultural mechanization but not from the gender perspective (see, for example, Akter *et al.* [15]; Benin [16]; Diao *et al.* [11]; Houssou *et al.* [17]; Houssou & Chapoto [18]; Takeshima [19]; Alkire *et al.* [20]; Bayissa *et al.* [21]; Bishop [22]; Cornwall [23]; FAO [2]; Sharaunga & Mudhara [24]), thus this research. This research is therefore different from past studies as it focuses on factors affecting the adoption of agricultural mechanization technologies by women not in connection with its impact on the farms or its use by small-scale farmers. The point here is that understanding the factors affecting the adoption of agricultural mechanization by women can help in crafting strategies for increasing the number of women practicing mechanized farming, hence increasing agricultural productivity. This research therefore fills the gaps in the literature.

The rest of the paper is organized into three main sections. The next section is the methodology employed in investigating the factors that influence the adoption of agricultural mechanization technologies by women farmers in the Karaga District of Ghana. Following that is the presentation and discussion of the results. The conclusion and implications for policy and practice end the paper.

2. Methodology

2.1. Study Site

The Karaga District where the research took place is in the Northern region of

Ghana. According to the 2021 Population and Housing Census conducted by the Ghana Statistical Service (GSS), the District has a population of 114,225 persons comprising 55,677 males (49%) and 58,548 females (51%) [25]. Farming is the major economic activity in the District. Crops cultivated in the area include rice, sorghum, maize, millet, beans, soybeans, cowpea, groundnuts, and cassava [5]. The District was chosen because of its vast lands for commercial farming [17]. Gain [26] affirms this assertion by stating that the agricultural commercialization and modernization in the District are phenomenal, and it is a key player in Ghana's food basket. The District has many commercial farmers as well as agricultural traders [27], largely because of the active local markets and a good transport network. Karaga is prioritized in terms of government-driven agricultural programs [17]. Three communities in the District, namely Tamalgu, Maligunayili, and Nyong, were selected for the research. The communities were chosen because they have many female farmers and significant valleys and uplands for commercial farming of maize, groundnuts, rice, and soybeans [17]. **Figure 1** below shows the Karaga District map sourced from the Karaga District Analytical report of the 2010 Population and Census of the Ghana Statistical Service [28].

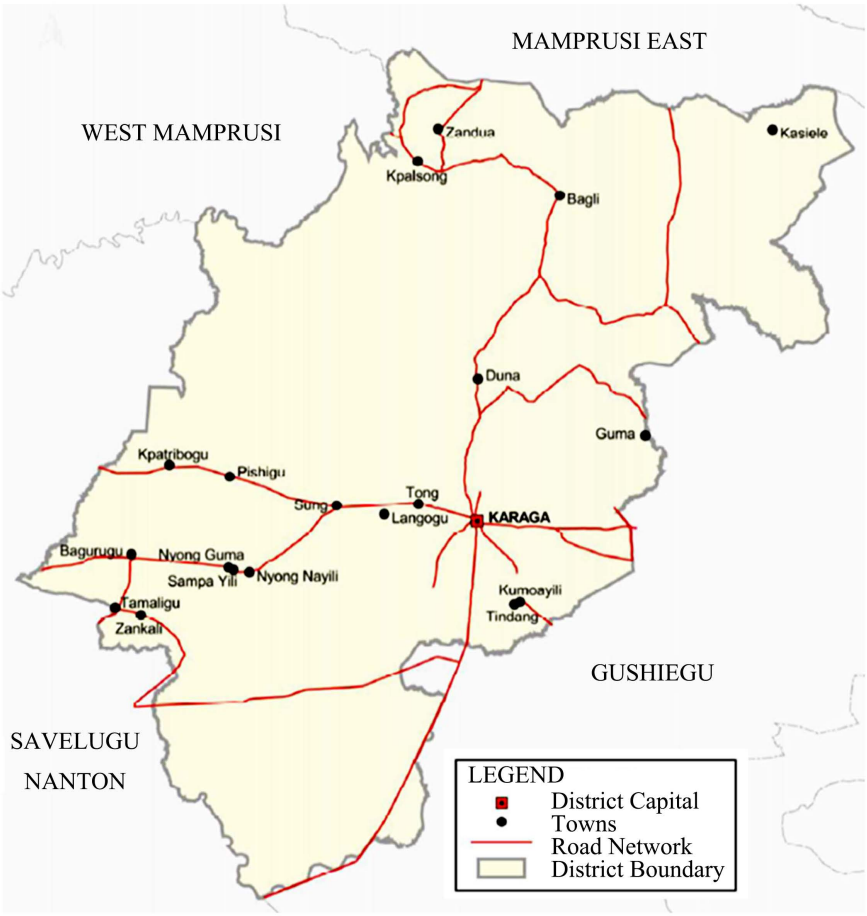

Figure 1. Map of Karaga district in Ghana [28].

2.2. Study Approach

The study used a qualitative approach, which mainly relied on qualitative data primarily people's recorded perceptions and judgments concerning a certain subject [15] for the analyses. Therefore, the qualitative data approach enabled the researcher to get the informants' perceptions on factors affecting the adoption of agricultural mechanization technologies by women in the District.

In terms of sampling, the research adopted a 4-stage sampling technique. In stage one (1), the three (3) communities that participated in the research were selected using purposive sampling technique. In stage two (2), farmers in the community were stratified into men farmers and women farmers. In stage 3, the women farmers were stratified into those readily available and willing to participate in the research and those not readily available and/or unwilling to participate in the research. The stratum of women farmers who were readily available and willing to participate in the research constituted the sample frame. In the fourth and final stage, women farmers in the sample frame were randomly selected to be interviewed [17].

Primary data were collected between August and October 2022 by the use of interview schedules. This is because people's aspirations, beliefs, experiences, and behaviors are best captured by the use of interview schedules. The research employed the process suggested by Petrics *et al.* [27] when collecting qualitative data, which involves the researcher explaining the purpose of the research to the respondents, adherence to research ethical procedures, making sure that time and place are convenient for participants, and limiting interview time to not more than 40 minutes. During interviews with women farmers, data on agricultural-related cultural norms, access to land, farming systems, farm sizes, agricultural machinery, the level of mechanization, financial support, and agricultural training were collected with the aim of determining the level of adoption and extent to which the factors influence the adoption of agricultural mechanization by women farmers. Interviews were audio-recorded and transcribed according to the various thematic areas for analyses. The data were analyzed according to the thematic areas and the contents therein.

3. Results and Discussion

The results indicate that the overwhelming majority of the respondents unanimously observed that the rate of agricultural mechanization technologies adoption among women farmers in the three communities is low. The respondents indicated that there is a need to boost agricultural mechanization uptake among female farmers in the district given that the majority of them are involved in farming. According to one farmer, "given the opportunity, women farmers can transform agricultural output through mechanization" [8]. Research participants strongly pointed out that there is unequal access to agricultural resources between men and women in the district. They argued that, unlike men, women are limited when it comes to access to essential resources like land.

These differences have serious implications for the ability of women farmers to embrace and benefit from agricultural mechanization. Owning land is a key empowerment requirement for women farmers. However, accessing land in commercial quantities is a big challenge for women in the district. This implies that women's agricultural potential is not fully tapped. Inheritance systems in Karaga District dictate that females can only access land via their husbands or by renting agricultural land from other males in their communities. This is a serious impediment to the adoption of mechanized farming by women and food security [17].

Most of the women farmers indicated that they access farmlands through their husbands with a few of them renting their farmlands. According to one female farmer, "if we say we own land, then we are dishonest". Upon the death of men, agricultural land is passed on to male children. Interviews revealed that widows can still access their late husbands' agricultural land through their male children. Women reported that when a woman farmer invests in land, there is a risk that the owner will reclaim it when its productivity is enhanced. Unlike men who can access huge tracts of land, in most cases, women are allowed to access small parcels of land. One woman farmer said, "generally, women work on small plots allocated to them by men". All the above land access barriers seriously inhibit the adoption of agricultural mechanization technologies by women farmers.

Many women farmers emphasized the need to have access to capital so as to succeed in farming, provide for their families, and improve their living standards. Furthermore, women lack access to the credit required to adopt agricultural mechanization technologies. Some of them observed that due to land ownership barriers, getting an agricultural loan from banks to mechanize farming is difficult for women because securities like title deeds are required. Most of the respondents said that they have never acquired a bank loan to finance their farming with only a few indicating that they have ever secured an agricultural loan from a bank. According to some of the respondents, even where women have access to land, they lack the capital to acquire inputs such as fertilizer, pesticides, and pay for mechanization services among others. Agricultural mechanization services are expensive and the lack of access to capital by women hinders the adoption of the same. It was pointed out that any female wishing to acquire a bank loan to adopt an agricultural mechanization technology must first get an endorsement from her husband or relatives. This means that adoption decisions are not solely made by the women farmers but rather jointly with their husbands or male relatives, which ultimately affect adoption rates. Interestingly, across the three communities, most women reported that agricultural decisions jointly done by men and women lead to strategic choices leading to an increase in productivity [14].

Negative social norms linked to agricultural machinery ownership and operation hinder women's ability to adopt agricultural mechanization technologies. For example, one of the respondents noted that: "Our men think that modern

agricultural machines are meant for them and that women should restrict themselves to stone age agricultural tools" [6]. However, a few respondents reported that despite the fact that men dominate agricultural decisions, women farmers are actively becoming more engaged in decision-making linked to agricultural machine acquisition hence the future is bright. The research findings revealed that machine operation is believed to be a men's job hence limiting women farmers' technology adoption. These results are consistent with the finding by FAO (2011) that whenever an agricultural machine is introduced, men use it while women are made to carry out tasks that are more laborious [4]. Many women pointed out that the adoption of mechanized farming is critical to food security and that training women in agricultural machine operation should be done as a matter of priority. This is consistent with the finding by Mehta, Gite, & Khadatkar (2018) that demonstrations and training for women farmers on how to operate modern agricultural tools should be done on a regular basis [8].

Many respondents across the three communities asserted that access to agricultural training is a real problem and confessed that they have never attended any agricultural training course or trained in machine operation. One of the women indicated that "in many cases, the training focuses on men farmers". The findings indicate that agricultural field extension services offered by agricultural officers mainly target men farmers. Interviews suggested that men with agricultural machines would rather hire machine operators to work on their farms than train their wives on how to operate them. One of the female farmers shared that, "… many men get shocked when they see women operating tractors and feel intimidated". A woman from the Tamalgu community alluded that she was willing to be trained on how to operate a tractor to reduce the cost incurred by the husband in hiring tractor operators to till his land. One commercial farmer, for example, said that: "… if women farmers have access to agricultural training courses or machine operation training, food production can tremendously increase in Karaga District because women are the engines of the community" [13]. This observation is supported by FAO (2018) which stated that if lady farmers can access the same agricultural resources as male farmers, the whole world will eat. According to most of the respondents, with the political will of the Ghanaian political leaders, more women can get involved in agricultural mechanization [17].

4. Conclusions and Implications for Policy and Practice

It is established that the adoption of agricultural mechanization technologies by women farmers in the Karaga District is low and influenced by inadequate access to land, inadequate access to financial resources, gender stereotypes and lack or limited opportunities in training on agricultural machinery handling. The implications of this for policy and practice are multifold. For policy, there must be deliberate attempt by government and development partners including NGOs to target women farmers for the provision of agricultural mechanization technolo-

gies in order to boost adoption among them. This means that government and development partners should work towards providing subsidized agricultural mechanization technologies such as tractors and combined harvesters to groups of women across the Karaga District and elsewhere in Ghana where agriculture remains the main source of employment and livelihoods, especially for women. Issues of land tenure systems that limit women's ownership of land must continue to be under policy focus.

For practice, many women across the communities suggested that men should end negative stereotypes that depict women as inferior beings hence denying them a chance to own land and practice mechanized farming. The Ministry of Food and Agriculture need to urgently carry out sensitization campaigns to enlighten men on the need to actively involve women in mechanized agriculture and end persistent gender bias. The elites in community should help the advocacy for the end of cultures and norms that discriminate against women thereby hampering their agricultural technology adoption uptake. There should be massive agricultural training on farming and machine operation by the government targeting women farmers to boost productivity. Men farmers who own agricultural mechanization machinery and equipment should be encouraged to train their wives, daughters, relatives, and other women on how to operate them to increase adoption of mechanization. Additionally, financial institutions should eliminate the bureaucracy when it comes to giving agricultural loans to women farmers.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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