



# Formal sector workers' participation in urban agriculture in Ghana: perspectives from the Wa Municipality

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## ABSTRACT

This paper assesses the participation of formal sector employees in urban agriculture and their contributions to food supply in the Wa Municipality, north-western Ghana. A cross-sectional research design was employed with survey as the data collection method. Respondents were randomly selected from various public sector agencies within the Municipality. Logistic regression was employed to identify the factors influencing participation in agriculture. The findings revealed that majority (62.1%) of the respondents were not participating in agriculture. Respondents who participate in urban agriculture practice food crop farming or animal rearing or both. The probability of a formal sector worker participating in agriculture is influenced by sex, age, education, household size, finance and formal workload. Participation in agriculture contributes to household food supply through physical availability of food, income earning and savings. Providing formal sector workers with information about the significance of urban agriculture could be a way of encouraging their participation.

## 1. Introduction

Urban agriculture contributes greatly to African economies in several areas especially the provision of food for its increasing population in cities and towns (Nchuchuwe et al., 2012). It is estimated by the United Nations (UN, 2017) that the world's population will increase from 7.5 billion in 2017 to 9.8 billion in 2050. Africa is one of the places earmarked for this population increase especially in the urban areas. Though increase in population may be beneficial, its impact on urban food security is unpredictable. For this reason, it is expected that agricultural production will grow by 70% to feed the increasing urban population (UN, 2017). However, ensuring food security of the urban population in sub-Saharan Africa (SSA), where rural food production is limited by marginal soil fertility and low incomes to buy necessary inputs, has become a special challenge (Cofie et al., 2003).

In Africa, the agricultural sector remains the largest single source of employment, and its development is crucial to ensuring food security (Guillaume-Gentil, 2014). A study by Salami and Aramowo (2013) has noted that an efficient agricultural sector has the potential to enable a country to feed its growing population. Over 45% of the population in developing countries depends on agriculture for their livelihood (World Bank, 2007; FAO, 2012a). It is further seen that agriculture in Africa

remains largely traditional and heavily dependent on smallholders and pastoralists (Nchuchuwe et al., 2012). Smallholder farmers are, therefore, the main engine of growth in terms of agricultural production and employment in Africa (FAO, 2012a; Darfour and Kurt, 2016). This has implications for food security since they are responsible for 70% of the food that is produced (United Nations Conference on Trade and Development [UNCTAD], 2015) though the fact remains that they cultivate less than two hectares per head (Darfour and Kurt, 2016).

One main strategy used by governments in reducing the investment gap in agriculture is the strengthening of both public and private capital (Desai, 2006). This is because investment bears a close relationship with economic growth, and any neglect of long-term agricultural credit would turn out to be very important for any agricultural growth in years to come (Chavan, 2013). Investment in the agricultural sector on the part of the private sector is driven by the prospects of rising agriculture commodity prices and higher returns on investment, whereas public investment has been motivated by concerns about food and energy security (UNCTAD, 2015).

In today's agriculture, finance and access to inputs are considered as important investment streams that can lead to sustainable production. Agricultural financing plays an important role in increasing production and encouraging small and medium scale enterprises to overcome the

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initial financial barriers for purchasing inputs such as seeds and fertilizers (Norman et al., 2016). Besides, smallholder farmers need finance to allow them to expand and increase agricultural production in the area of investing in improved seeds, chemicals and compost fertilizers, farm machines and equipment (Desai, 2006; Ruete, 2015).

Donor and government efforts are biased towards the export-crop sub-sector. Smallholders mostly are unable to meet collateral requirements to secure mainstream bank loans, as they are perceived to be high risk, having poor financial management and offering modest returns on the investment in agriculture (Thorp, 2014). The result of this is low productivity in agriculture, especially food crops, as smallholder farmers are unable to invest in improved seeds, improved technology, acquisition of farm machines and equipment, irrigation, and storage facilities among others. This leaves an estimated 5% of the population food insecure and over two million becoming vulnerable to hunger (Darfour and Kurt, 2016). The hardest hit places in Ghana are the three northern regions, namely Upper West, Upper East and the Northern Regions (Nkegbe et al., 2017). In the Upper West Region in particular, smallholders are hampered by low soil fertility, low level of fertilizer usage, over-reliance on rain-fed agriculture, limited operation and access to market (Ministry of Food and Agriculture [MoFA], 2015).

As a response of the urban population to inadequate or costly food supply, food (crop and livestock) production in urban backyards and in and around cities and towns has become a common feature (Cofie et al., 2003). In 2012, FAO (2012b) estimated that 800 million people are engaged in urban agriculture in Africa. Of these, 200 million are considered to be market producers employing 150 million people on full-time basis. In 2014, urban agriculture contributed 15% of food production in Africa and this is expected to grow to 30% by 2020 (FAO, 2012b). Urban and peri-urban agriculture provides food products from different types of crops (grains, root crops, vegetables, mushrooms, fruits, animals (poultry, rabbits, goats, sheep, cattle, pigs, guinea pigs, etc.) as well as non-food products (e.g., aromatic and medicinal herbs, ornamental plants, tree products).

In dealing with the challenge of investment in agriculture to boost production to reduce food insecurity in urban areas, the contribution of formal sector workers needs to be considered since they constitute a sizeable proportion of the urban population – about 35% in Ghana (Ghana Statistical Service [GSS], 2014). According to Satish (2007), funds for agriculture require a second tier refinancing arrangement which the smallholder in the informal sector cannot access from the credit market. Employees in the formal sector, therefore, have access to investment capital from all kinds of credit markets due to their regular source of income that can be used to guarantee credit from the money market (Heintz, 2005). Formal sector employees, both private and public, have been participating in agriculture (Nelson, 2007; Ogbonna and Okoroafor, 2014; Obele, 2017). This study thus seeks to establish the factors that influence formal sector employees' participation in agriculture and their contribution to urban food supply in the Wa Municipality of Ghana. This study makes a significant contribution to the body of literature on urban agriculture by highlighting their role and contributions.

### 1.1. Empirical and conceptual overview

There is evidence that urban agriculture is contributing to low income working class and urban poor households' food needs, self-employment and income generation (Moyo and Yeros, 2013). The predominant agricultural-based livelihood activities in most African cities include; crop farming, livestock farming, fish farming, fuel wood gathering and sales, farm labour services, and agricultural products processing (Obele, 2017). This suggests that there is diversity in urban agricultural production since different kinds of crops are cultivated or farm animals are kept. Ghana is classified as an agricultural country, partly due to the large proportion of the labour force engaged in agricultural-related enterprises, particularly, food crops farming (Seini and Nyanteng, 2003). In

Ghana, urban agriculture plays an important role in ensuring food security and socio-economic development (FAO, 2012a). The agricultural sector has particularly attracted greater rural Ghanaians but is increasing gaining importance in urban areas as well.

Urban and peri-urban agriculture has become an important component of Ghana's agricultural program (Constance, 2009). MoFA (2015) articulated that peri-urban agriculture made a significant contribution to a variety of foods in urban markets to an extent that in Kumasi 90% of all lettuce and spring onions consumed were produced from open space vegetable farming in the city, 80% in Tamale and 10% in Accra. According to Ogbonna and Okoroafor (2014), almost all low income formal sector workers are trying to increase their incomes and survive, resulting in more and more urban families turning to crop and livestock production. Meanwhile, Stiftung (2015) indicated that the formal sector workforce engaged in urban agriculture lacks the vision and the awareness of opportunities for entrepreneurship within the sector and therefore does not unlock its employment or economic growth generation potentials.

Women account for 70–80% of household food production in SSA countries (Ogbonna and Okoroafor, 2014). It is also estimated that about 43% of agricultural workers and workforce in developing countries are women (Gautam et al., 2013). But their contribution to urban agriculture and food production is not well known. Women are becoming the economic lifelines for their families in realizing ways to generate income to sustain their livelihood (Narayan, 2011). This recognition is as a result of economic upturn of the agricultural sector and there is the call for mainstreaming of women in agriculture for sustainable food production (Ogbonna and Okoroafor, 2014). Narayan (2011) and Team and Doss (2011) found that more women participate in the informal sector than the formal sector. However, they have been confronted with complex institutional barriers and laws which prevent their active participation in agricultural production (Ogbonna and Okoroafor, 2014). Again, according to Team and Doss (2011), though women's participation in rural labour markets shows much heterogeneity at the regional level, they are over-represented in unpaid, seasonal and part time work in urban areas and they are often less paid than their male counterparts.

Age influences participation in agricultural activities in different areas of Africa including cities. Young people see agriculture to have an image problem, characterized by laborious and low income, that does not equate with their aspiration or offer an attractive future (Guillaume-Gentil, 2014). Even those that go into agriculture use it as a temporary measure rather than as source of income in adulthood (Becker et al., 2009). Also, Mwamakamba (2013) argues that, most farmers in SSA are usually the aged who often lack the physical strength and the technical know-how.

The inability of the agricultural sector to attract people with higher education has led the sector's activities to be done in a subsistence manner (GSS, 2014). Aryeetey and Boateng (2015) agreed that education that culminates in high skilled, innovative and knowledgeable workforce is a key variable for economic transformation and, for that matter, the agricultural sector. Wamuthenya (2010) also identifies education as a major factor determining participation in modern wage employment. Similarly, Ohene (2015) discovered education to be among the determinant factors of farmers' participation in the youth in agriculture program (YIAP) in the Eastern Region of Ghana. Poor and inadequate education limits productivity and the acquisition of skills as well as insufficient access to information and can hinder the development of agricultural ventures (FAO, 2014). It is acknowledged that majority of people among the poor in SSA economies have low education levels and derive their income from the informal sector (Wamuthenya, 2010). According to the GSS (2014), though agriculture is the backbone of the country's economy, it does not attract people with higher education.

According to Thorp (2014), communication is very important for the enhancement of agricultural activities. To him, information regarding funding sources, availability, conditional requirements, new technology, methods and availability of free extension services are important mechanisms for achieving agricultural transformation.

Credit is an input in agriculture that unlocks potentials in agrarian economies (Akudugu, 2012). Access to credit, according to Ohene (2015), is the main determinant of participation in agricultural production. However, FAO (2012a) reports that, the main source of credit for Ghanaian farmers is that provided by friends. Credit from formal sources in Ghana is limited and come with huge collateral and banks are unwilling to lend to smallholder farmers who lack these collateral and operate in risky ventures (GSS, 2008; Quartey et al., 2012). This suggests that one main characteristic of participation in agriculture, especially in urban areas, is limited access to formal credit.

The principal goal of Ghana's agricultural development policy is the establishment of a modern, robust and diversified sector that ensures national food security, poverty reduction and adequate supply of agricultural raw materials at competitive prices for industrial production (FAO, 2012a). Aside that, extension services is one area that has received policy support. It is designed to provide equal access to information for both sexes and to ensure a holistic improvement in all facets of life of farmers (Annan, 2012).

This study adopts the High Payoff Input Model (HPIM) (Udemezue and Osegbue, 2018). This model is based on the principle of a new prospect that the key to transforming a traditional agricultural sector into a productive source of economic growth is investment (Fig. 1). Investment is designed to make modern high payoff technology in capital equipment and other inputs available to farmers in poor countries.

High payoff inputs, as identified by Schultz (1964), can be classified into three categories:

- a. The capacity of public and private sector research institutions to produce new technical knowledge;
- b. The capacity of the industrial sector to develop, produce, and market new technical inputs; and
- c. The capacity of farmers to acquire new knowledge and use new inputs effectively.

The enthusiasm with which the HPIM has been accepted and translated into an economic doctrine is due to substantial success it has made to develop new high-productivity grain varieties suitable for the tropics (Getaneh, 2013). The model advocates for high use of farm investment resources in an efficient manner (Udemezue and Osegbue, 2018). Such resources include land, fertilizers, insecticides, and herbicides. This means that the use of modern technology is mostly recommended. The high returns associated with the adoption of the new varieties and the associated technical inputs and management practices have led to rapid diffusion of the new varieties among farmers in several countries in Asia, Africa, and Latin America. The impact on farm production and income has been sufficiently dramatic to be herald as a 'green revolution'. The

significance of the HPIM is that policies based on the model appear capable of generating a sufficiently high rate of agricultural growth to provide a basis for overall economic development consistent with modern population and income growth requirements. The unique implications of the model for agricultural policy are the emphasis placed on accelerating the process of development and propagation of new inputs or techniques through public investment in scientific research and education.

## 2. Materials and methods

### 2.1. The study area

The Wa Municipality lies within latitudes 1°40'N to 2°45'N and longitudes 9°32'W to 10°20'W. Its capital is Wa, which also serve as the regional capital of the Upper West Region. It has a landmass area of approximately 234.74 km<sup>2</sup>. The vegetation is one of the Guinea Savannah grassland type, made up of short trees with little or no canopy, shrubs of varying heights, and grass ground cover in the wet season. The Municipality has two dominant seasons namely, the wet and dry seasons. The mean annual rainfall varies between 840mm and 1400mm with most of the rainfall occurring between June and September and it is not unusual to have very high rainfall concentrated in a few rainy days. One feature of the rainfall pattern is that it tends to occur in heavy downpours, encouraging run-off rather than soil moisture retention. The erratic rainfall period is clearly shown in the water balance, which is a reflection of the poor soil moisture condition in the area. The soil moisture condition is only adequate for the cultivation of crops such as maize, millet, guinea corn, yam, groundnuts and beans.

The Wa Municipality has a population of 107,214 persons made up of 66.3% urban/peri-urban dwellers and 33.7% rural dwellers (GSS, 2012). The economic structure of the Municipality was dominated by the agriculture sector until 2010 when the service sector took the lead employing about 51.3% of the working population, followed by agriculture with 30.2% and industry 18.4% (GSS, 2014). Other key sectors of the economy are transport, tourism, communication and energy.

### 2.2. Data collection

The study adopted a cross-sectional design with survey as the specific method for data collection from formal sector employees comprising Wa Municipal Assembly staff, Teachers and Educational Offices Staff, Regional Agricultural Directorate (RAD) staff, and Staff of the Regional Coordination Council (RCC). The choice of this category of formal sector employees was that they are classified as non-essential service providers and so do not respond to emergencies or time demand. Also, they have

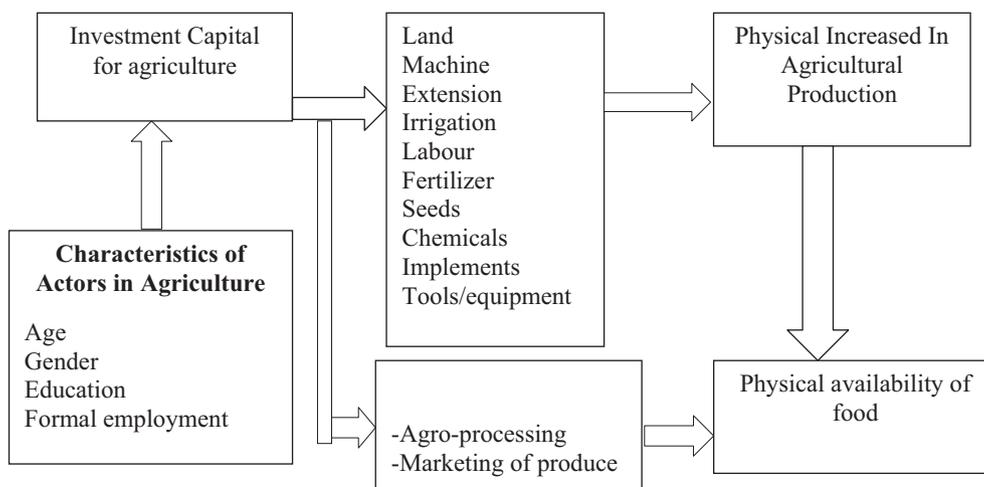


Fig. 1. A conceptual Framework. Source: Authors.

huge numbers in the Municipality, and are credit wealthy; hence can access investment capital from both formal and informal sources for agricultural production. The sampling frame was 3,980 workers (Table 1).

The sample size for the study was estimated using the statistical procedure proposed by Yamane (1967: 886) as in Eq. (1):

$$n = \frac{N}{1 + N(e)^2} \tag{1}$$

Where n is the sample size; N is the sampling frame and e is the margin of error. In this study, N is 3980, and e is 5%. Therefore (equation 2),

$$n = \frac{3980}{1 + 3980(0.05)^2} \quad n = 363.47032 \text{ approximately } 364 \tag{2}$$

This number was proportionally distributed among the various categories of employees as shown in Table 2.

From each category of workers, a simple random sampling technique was used to select the desired sample size. Personal records of each selected employee were used to contact them at their respective work places and their consent sought (including assurances of confidentiality) before questionnaires were administered to them. In addition, the questionnaire, which has been attached as supplementary material, was approved by the University for Development Studies Ethics Committee.

### 2.3. Data analysis

The data were analysed using descriptive module (cross tabulations). The focus of this was mainly to describe background characteristics of respondents, and the proportion of formal sector employees participating in agriculture. The factors that determine formal sector employees' participation in agriculture were analysed using a regression framework. This identified participation or non-participation in urban agriculture, which is a binary response variable (i.e., yes or no). Hence, the response variable assumed only two values; 1 if an *i*th respondent answered yes and 0 if otherwise. Logistic regression model (Gujarati, 2004; Greene, 2003; Wooldridge, 2006) was used to identify the factors that explain formal sector employees' participation. The cumulative logistic distribution function is specified as in Eq. (3) (the variables specification is provided in Table 3):

$$P_i = \frac{1}{1 + e^{-Z_i}} = \frac{e^{Z_i}}{1 + e^{Z_i}} \tag{3}$$

Where:  $P_i$  = the probability of an individual participating in agriculture. This means that the probability of non-participation is  $1 - P_i$  (equation 4).

$$Z_i = \beta_0 + \beta_i X_i \tag{4}$$

Where:  $X_i$  = Vector of explanatory variables.  $\beta_0$  = Vector of constant term.  $\beta_i$  = Vector of logistic regression coefficient.

As Z ranges from  $-\infty$  to  $\infty$ ,  $P_i$  ranges from 0 to 1.

The relative effect of each explanatory variable on the likelihood that an individual will participate in agriculture is given by the marginal effect as in Eq. (5):

**Table 1**  
Distribution of respondents by sector.

Department	Raw number
RCC	104
Municipal Assembly	179
RAD	86
School/Education	3611
<b>Total</b>	<b>3980</b>

Source: Authors.

**Table 2**  
Proportionate distribution of respondents according sectors.

Department	Raw number	Proportion	Number selected
RCC	104	$\frac{104}{3980} \times 364$	10
Municipal Assembly	179	$\frac{179}{3980} \times 364$	16
RAD	86	$\frac{86}{3980} \times 364$	8
School/Education	3611	$\frac{3611}{3980} \times 364$	330
<b>Total</b>	<b>3980</b>		<b>364</b>

Source: Authors

**Table 3**  
Variables labeling, measurement and expected outcomes.

Variable Name	Label	Measurement	Expected Outcome
Sex	Sex	1 = male; 0 = female	+
Age	Age of respondents	Number of years	-/+
Edu	Level of education	Years of schooling	-/+
HHsize	Household Size	Number of people	+
HHINCOME	Income level	Monthly earnings	+
EASE_TO_GET	Ease to get land	1 = easy; 0 = otherwise	+
INFOR	Access to Agric information	1 = have access; 0 = otherwise	+
FMAL_WRK	Formal job load	1 = Working weekends; 0 = otherwise	-
Credit	Access to credit	1 = have access; 0 = otherwise	+

Source: Authors.

$$\frac{\partial(P_i)}{\partial(X_i)} = \beta_i [\bar{P}(1 - \bar{P})] \tag{5}$$

Where  $\bar{P}$  is the mean of the dependent variable. The empirical estimation of the model for participation or non-participation is specified as in Eq. (6):

$$\ln\left(\frac{P_i}{1 - P_i}\right) = \beta_0 + \beta_1 \text{Sex} + \beta_2 \text{Age} + \beta_3 \text{Edu} + \beta_4 \text{HH\_Size} \tag{6}$$

## 3. Results

### 3.1. Formal sector workers' participation in urban agriculture

The results (Table 4) indicate that majority (62.1%) of the respondents were not participating in agriculture. Males participate more in agriculture than their female counterparts, which is a reflection of male dominance in formal sector employment in the Municipality. It further shows that majority (78%) of those who do not participate in agriculture were below 35 years of age. The educational level of re-

**Table 4**  
Sex and participation in any urban agricultural activity.

Sex	Participate in any agricultural activity		Total
	No	Yes	
Female	83 (76.9%)	25 (23.1%)	108 (100%)
Male	143 (55.9%)	113 (44.1%)	256 (100%)
Total	226 (62.1%)	138 (37.9%)	364 (100%)

Source: Field survey, 2017.

spondents shows that 92.2% of them had attained tertiary education.

**Table 5**  
Reasons for non-participation in urban agriculture.

Reason	Frequency	Percentage
Formal work Load	11	4.9
Difficulty in getting land	29	12.8
Transfer	10	4.4
Weekend Commitment	121	53.5
Limited Credit	62	27.4
Production Risk	204	90.3

Source: Field Survey (2017) (Multiple responses were considered)

This was expected as the study targeted only formal sector employees. The respondents have an average monthly income of GH¢1,300.00 or US\$ 288.89<sup>1</sup>, which translates into about US\$ 9.63 per day. The income distribution further revealed that 6.3% of the respondents earn monthly incomes between GH¢200.00 and GH¢500 (US\$44.44 and US\$111.11), which may have implications for acquiring investment credit from financial institutions in order to effectively participate in agriculture. The survey result further indicates that respondents have been in their current occupation for nine years on the average. At this stage of their occupation, they may be attaining stability and adopting supplementary occupations like agriculture.

The study reveals several reasons for the high level of formal sector employees' non-participation in agriculture including formal sector employment workload, difficulty in getting land, fear of being transferred from the Municipality, weekend commitments, limited credit and production risk as indicated in Table 5. From the table, 90.3% of the multiple responses raised the issue of production risk associated with agriculture, 53.5% indicated weekend commitments, such as time with nuclear family, visits to see one's extended family, funerals, marriage ceremonies attendance, and the need to rest.

The results point out that 37.9% of formal sector employees participate in a number of agricultural activities including food crop farming (55.1%), animals farming (19.9%) and mixed farming (29.0%). This means that, there is no overconcentration in a single activity. Further analysis of the survey data show that, the activities often carried out include food crop farming in backyard gardening, as well as small-scale, medium and large scale farming in peri-urban areas. From the data, 68.1% of the respondents participate in small-scale food crop farming, while 1.7% engages in either medium or large scale farming. These types of farming are done mainly in the peri-urban areas where large tracks of land can still be found. It was observed from the study that majority (85.8%) of the respondents participating in crop farming cultivated either assorted vegetables or cereals (mainly maize) and leguminous crops (beans and groundnuts), like other urban areas in Ghana (MoFA, 2015). Other crops cultivated are yams and tree crops such as mango and cashew.

The respondents keep poultry (40.3%), goats (38.7%), sheep (14.5%) and pigs (6.5%). Rearing such animals does not require large tracts of land; a small piece of land where a fence can be made is ideal. Caring for the animals, if not on commercial basis, also requires minimal funds for feeding and veterinary services. The method of rearing animals also varies with 53.2% of the respondents keeping their animals in a semi-intensive system (i.e., keeping animals indoors for some time and allowing them some space to roam and feed). The intensive system of keeping animal is expensive as the animals are not allowed to go out to feed on their own; they are fed by the farmer. That is why only 8.1% of the respondents practice that. The extensive (free range) system is practiced by 38.7% of the respondents.

<sup>1</sup> According to the Bank of Ghana, US\$1.00 was equivalent to GH¢4.50 as at September, 2019.

### 3.2. Determinants of participation in agriculture

Participation decision was determined using a logistic regression model on nine explanatory variables – sex (SEX), age (AGE), years of education (EDU), household size (HH\_SIZE), household income (HHINCOME), ease to get land (EASE\_TO\_GET), access to information (INFOR), access to credit (CREDIT), and formal workload (FMAL\_WRK). The logistic regression estimates are shown in Table 6. From the table, the likelihood ratio (LR) chi-square statistics is 269.36 and significant at 1%, suggesting that the independent variables jointly explain participation decision among the respondents. Six out of the nine independent variables were found to have a significant influence on participation in agriculture. The significant variables include sex, age, education, household size, credit, and formal workload. However, household income, ease to get land, and information do not have significant influence on participation decision.

From Table 6, the coefficient of sex is positive and significant. This means that male employees in the formal sector are more likely to participate in agriculture than their female counterparts. The marginal effect of this variable (sex) was found to be 0.2095 and this means that being a male employee in the formal sector is associated with a 20.9% greater probability of participating in agriculture than a female. The coefficient of age is positive and significant, meaning age has a direct influence on participating in agriculture. The table also reveals a marginal effect of age as 0.0529 meaning an additional age of an employee is associated with 5.29% likelihood of participation. Education, measured by the number of years spent at school was included in the model of participation and discovered to have a negative coefficient which is significant as reported by the regression estimates in Table 6. This means that people with higher education are less likely to participate in agricultural activities. The marginal effect suggests that one additional year of schooling will reduce participation by 19.72%.

The logistics regression estimates also reports that household size (measured by the number of people eating from the same pot in the family) has a significant relationship with the decision to participate in agriculture. The results revealed that the coefficient of household size is positive and significant. This means that the number of people in a household has a direct influence on participation in agriculture. The marginal effect (0.0496) explains that an addition of one person to the household will attract 4.96% probability of participation in agriculture. Moreover, access to investment capital (measured by whether respondents have obtained finance/credit from any financial institutions or elsewhere) was included in the model predicting participation in agriculture and is observed to be positive and significant. This means that access to investment capital is directly related to participation in agriculture. Table 6 reports that having access to finance/credit is associated

**Table 6**  
Logistic regression estimates of the factors influencing participation in agriculture.

Variable	Coefficient	Std. Err.	[95% Conf. Interval]	Marginal effects
SEX**	0.9090	0.4242	0.0777 1.7403	0.2095
AGE***	0.2177	0.0379	0.1435 0.2919	0.0529
EDU*	-0.8117	0.4506	-1.6949 0.0715	-0.1972
HH_SIZE***	0.2040	0.0711	0.0647 0.3434	0.0496
HHINCOME	-0.0002	0.0002	-0.0006 0.0002	-0.0001
EASE_TO_GET	0.4958	0.3617	-0.2132 1.2048	0.1189
INFOR	0.5179	0.3627	-0.1929 1.2288	0.1241
CREDIT***	3.4022	0.4535	2.5134 4.2911	0.6742
FMAL_WRK	-1.0733	0.3668	-1.7922 -0.3544	-0.2549
***				
_cons	2.4206	7.2430	-11.7754 16.6167	

Observation = 364, LR chi<sup>2</sup>(9) = 269.36, Prob > chi<sup>2</sup> = 0.000, Log likelihood = -106.88, Pseudo R<sup>2</sup> = 0.55.

\*\*\*, \*\*, \* = significant at 1%, 5% and 10% respectively.

Source: Field Survey, 2017.

with a 67.42% greater probability of participating in agriculture with a marginal effect of 0.6742. Finally, the empirical evidence indicates that the coefficient of formal workload is negative and significant. This suggests that people with more formal workload are less likely to participate in agriculture. The marginal effect, estimated at 0.2549, means that having more formal workload will reduce the probability of participating in agriculture by 25.49%. This finding is therefore, in conformity with the *a priori* expectation of the study.

### 3.3. Contribution of formal sector workers' participation in agriculture to household food supply

The results show a mean of 5173.48m<sup>2</sup> farm size for the respondents. This is due to the fact that some respondents indicated that they were using part of the lands on which their houses are situated to do crop farming. However, the distribution of plot sizes vary with some being as small as 100m<sup>2</sup> and others as large as 22,500m<sup>2</sup>. This means that farm sizes are relatively large enough to contribute to food production in the Municipality.

Formal sector employees' participation in agriculture has led to improvement in the physical availability of food in the Wa Municipality. From the data, 73.9% of the respondents indicated that they are able to feed their families from their own food production. Also, 14.5% of the respondents sell some of their surplus food to their neighbors and, in the process, make food readily available for others. Respondents, who engage in animal rearing, indicated that during festive seasons, their neighbors buy from them. Others further asserted that they do give free food and animals to some extended family members living in the study area as well as some neighbors. The combined effect is that it improves the food supply situation in the Municipality.

Even though respondents could not quantify their farm production (yields), they were able to give estimates of their earnings from participating in agriculture. From the results, 33.3% of the respondents estimated that they earned between GH¢101 to GH¢200 (US\$22.40 to US\$44.40) annually. The issue is that most of them do not do farming throughout the year. It is rain-fed, so when the raining season is over, farming also stops till the next rainy season. Only 9.1% farm throughout the year. In addition to this, respondents indicated that their participation in agriculture enable them to save money which otherwise would have been used to purchase food from the market. For example, 69.7% save between GH¢60.00 and GH¢200.00 (US\$13.30 and US\$44.40) monthly.

## 4. Discussion

The low participation of public sector employees in agriculture in the Wa Municipality is not surprising as it conforms with GSS (2014) that urban dwellers are less (16.8%) employed in the agricultural sector as compared to the rural dwellers who constitute the majority (71.1%) of people employed in the sector. The reasons provided for not participating in agriculture imply that the respondents are aware of the advantages of being involved in agricultural activities and would have been willing to take part had it not been for the constraints they face. This means that there is a potential for encouraging many formal sector workers to get involved in food production if the constraints are removed. The dominance of food crop farming in urban agriculture in the Municipality is expected as food is one of the items in the consumer price index basket that attracts more of household expenditure as compared to the rest. If the household has the opportunity to grow food, it will reduce its expenditure directly. During festive seasons, such as Christmas, Idul Fitri and Idul Adha, animals' prices increase, so rearing animals provides an additional opportunity for households to reduce meat expenditure.

In the Wa Municipality, farmers often keep small farms of less than two hectare on the average. However, it was expected that formal sector employees may be involved in large-scale farming given the advantage they have in accessing credit and information. The fact that they often

keep small farms implies that managing large farms may seriously impact on their formal work schedule. This finding agrees with Seini and Nyanteng (2003) that Ghana's agricultural sector is predominantly smallholder. This may also be due to the fact that peri-urban lands that were hitherto used for agricultural purposes are now turned into residential facilities for people to dwell in (Osumanu et al., 2018), resulting in land reduction for large scale agriculture. However, Wa is still a growing city, where empty plots and uncompleted houses in residential areas allow people to take advantage of them to do small-scale farming. Also, medium and-large scale farming is possible in the peri-urban areas where there is still some land available. The location of majority of respondents' farms being within the Municipality demonstrates the importance of urban and peri-urban agriculture and agrees with Moyo and Yeros (2013) that urban agriculture contributes significantly to income and urban households' food needs.

The cultivation of vegetables and legumes by many formal sector employees signifies recognition of the importance of these in household diets. Maize is a staple food crop among many Ghanaian tribes. Staple foods, such as *Tuo-Zaafi* (TZ), *Akpele*, and *Banku*, are prepared from maize and this probably motivates a large number of people to engage in its cultivation. Besides, cultivation, harvesting and storage of maize are not difficult when compared to the other cereal crops. There is also a ready market for maize throughout the year. In the Wa Municipality, people keep their livestock at home either under intensive or semi-intensive systems. As a result, they are able to effectively combine animal rearing with their formal sector work. This finding is in agreement with Seini and Nyanteng (2003) who reported that many urban farmers adopt a variety of improved crops such as maize, and vegetables.

Ghana's agricultural sector, which employs a national aggregate of 44.7% of the population, is dominated by males (58.2%). It is therefore not surprising that males also dominate in urban agriculture. Men often turn out to be household heads and hence have more burden regarding household expenditures, sometimes including, extended families. As a result, they often engage in complementary livelihood/income generating activities to support their monthly earnings from formal employment. Females, on the other hand, can support the family financially but are not obliged by the social system to be bread-winners of the family.

Studies, for example Anyidoho et al. (2012) and Ohene (2015), have articulated education as a determinant factor for participation in modern agriculture. However, in this study, only 24% of the respondents with tertiary education participate in agriculture. The observation of an inverse relationship between education and participation in agriculture is not in conformity with the study's *a priori* expectation. The implication is that combinations of factors are required to influence the individual's decision to participate and not education alone.

The positive significant relationship between household size and participation in agriculture is in conformity with the study's *a priori* expectation. Household size was expected to have a direct influence on participation since the head of the household will be compelled by the family burden to consider complementary sources of income and food supply to meet the household's needs. As a result, participation in agriculture augments the household's income directly through access to additional revenue and indirectly through the reduction in expenditures on food.

The study shows that access to investment capital is significant in determining participation and is in conformity with the *a priori* expectation of the study and agrees with the high input model. The daily income of respondents (US\$ 9.63) serves as guarantee for investment capital for agriculture. According to Akudugu (2012), agricultural finance/credit enables the farmer to mobilize the productive resources on time and this motivates the farmer to produce. On the other hand, people without access to investment capital may not be able to overcome their constraints in financing their agricultural production and hence will be discouraged to take part.

Formal sectors workers' participation in urban agriculture has contributed to raising the level of food supply in the Wa Municipality.

The results imply that many participants in agriculture often produce food items which is consumed, sold or shared with their family members and neighbors. In addition, the results revealed that formal sector employees that have been participating in agriculture derive other benefits from their activities. They are able to raise additional incomes from urban agriculture. Larger households, therefore, save themselves a lot of money by reducing their expenditures on purchased food items from the market. Besides, smaller households can sell their surplus yields, which improve the food supply situation in the Municipality.

## 5. Conclusion

The study shows that formal sector workers' participation in urban agriculture in the Wa Municipality is low, implying that a large segment of them are not able to take advantage of the benefits it provide. Different factors (sex, age, education, household size, credit, and formal workload) determine formal sector employees' decision to participate in agriculture. This indicates that demographic and socio-economic variables jointly explain participation in agriculture. Assisting formal sector employees with information about the significance of urban agriculture could be a way of encouraging their participation in food and animal production. Policy options need to be targeted at training formal sector employees to build their capacities for food crops farming and animal rearing. There is also the need for MoFA to encourage formal sector workers to take advantage of on-going government programs, such as the planting for food and jobs, to earn additional incomes by participating in urban agriculture. These can be achieved by supporting them to establish communication channels for knowledge and information sharing through workshops spearheaded by agricultural extension officers of MoFA.

## Declarations

### Author contribution statement

P.D. Bolang: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

I. K. Osumanu: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Competing interest statement

The authors declare no conflict of interest.

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