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Meeting productive capacity of agro-processors in Ghana: What are the drivers?

Portia Adade Williams *, Mavis Akuffobea, Justina Adwoa Onumah, George Owusu Essegbey

CSIR - Science and Technology Policy Research Institute, P.O. Box CT 519 Cantonments, Accra, Ghana

Abstract

Strengthening agricultural processing may be among the most effective ways of improving the agricultural sector which would ensure food security and economic development as well as address global poverty. Productivity in agro processing is limited by several factors that affect ability of processors to meet maximum production levels. This paper sought to identify and assess the determinants of Ghana's agro-processing productivity. A two-stage sampling approach was employed to collect cross sectional data from about 1,615 agro-processing entrepreneurs from 49 districts and municipalities across the 10 regions of Ghana through interviews, focus group discussions and with the aid of a structured questionnaire. Results of the Binary Logistic Regression model employed in the analysis revealed training opportunities, access to R&D support, access to finance, years of experience in the agro-processing industry and ownership of equipment/tools influenced maximum productive capacity positively. On the other hand, education, group membership and market availability, contrary to expectation influenced productivity negatively. It is therefore recommended that, the right support (finance and R&D) and initiatives should be provided and made readily accessible to agribusiness entrepreneurs in Ghana to maximize their productive capacity.

Keywords: Agro-Processing, Productivity, Entrepreneurs, Ghana

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* Corresponding author. *E-mail address:* adadeposh@yahoo.com

1. Introduction

Food and agricultural markets are rapidly growing at both global and regional levels, providing opportunity for agricultural development across developing countries. According to Yumkella et al. (2011), countries like Ghana, Kenya, Côte d'Ivoire, Cameroon, Ethiopia, and Malawi have the potential for good growth in productivity and competitiveness as they have performed relatively well in tapping markets in Africa. With an evolving market where urban population require more and higher quality agricultural commodities thereby increasing demand for processed agricultural products, there exist greater potentials and profits for smallholder farmers and processors (Babu et al., 2016; Yumkella et al., 2011).

In Ghana, agriculture is a key sector of the economy, accounting for about 22 percent of the national GDP in 2014 (ISSER, 2015). Processing of agricultural produce is critical for food security, income security and sustained agricultural development for the overall economic growth of the country. The main processed agro products in the country include maize, rice, oil palm, groundnut, cassava, cocoa, fruits (pineapple, mango, papaya, coconut, passion fruits etc.) and animal products. It is however estimated that about 80% of Ghana's agricultural produce is sold unprocessed with only about 20% processed. The high levels of unprocessed agricultural produce again offer clear entrepreneurial developments opportunities for the agro-processing sector in Ghana (Quartey and Darkwah, 2015).

The Food and Agricultural Organization (FAO, 1997) defines agro-processing to involve transforming products originating from agriculture, forestry and fisheries. It is important to note that, the industry in Ghana is mostly characterized by informal micro, small and medium scale family-owned businesses with very few large scale manufacturing companies (Quartey and Darkwah, 2015). The small-scale food processing industries are private sector businesses which are mostly rural based and supply local markets with low-cost consumer goods, add value to produce, contribute to economic growth through diversification, contribute to import substitution and foreign exchange earnings (as non-traditional export products). Agricultural food processing in effect reduces post-harvest losses, increases food availability, improves access to food, expand marketing opportunities and improve livelihoods of people (Owusu–Sekyere, 2011). Enterprises within agro-processing industries rely on outputs from agriculture as raw materials for their industries.

According to Byerlee et al. (2013), if more attention is focused on production agriculture, a country will not achieve its developmental goals in isolation from agribusinesses unless developments of downstream agribusiness activities such as processing and upstream activities such as supplying inputs are considered concurrently. That is, successful agribusiness investments in turn stimulate agricultural growth through the provision of new markets and the development of a vibrant input supply sector. Ghana as a country has gone through some policy revolution aimed at pushing for the growth of agribusiness in the country. For example, Quartey and Darkwah (2015) have indicated that national economic policy programmes since independence have regarded the creation of a strong and robust agribusiness and agro-industrial sector. Development policy programmes and policies such as the Food and Agriculture Sector Development Policy (FASDEP I & II), National Trade Policy and Growth and Poverty Reduction Strategy (GPRS I & II) have over the past years consistently formulated various strategies on improving the agribusiness and agroindustry sectors of Ghana.

In addition, the Millennium Challenge Account (MCA), which was a five-year approximately $547 million anti-poverty programme signed between the Millennium Challenge Corporation (MCC) and the Republic of Ghana in August 2006, also provided some policy framework for the development of agro-processing and agriculture as a whole (Ampadu-Ameyaw and Omari, 2015).

However, these policies were sometimes criticized for its failure to induce higher levels of value addition and processing of agricultural outputs. Rather, these initiatives generally focused on increasing raw agricultural commodities to the international market, with little emphasis on processing (Quartey and Darkwah, 2015). The various entrepreneurship programs launched within the policies for entrepreneurs of agro-processing industries are still confronted by a number of challenges for establishing economically sustainable industries. Also, agro-processing enterprises operate on small to medium scale and face problems such as complex, bureaucratic, legal regulatory and administrative issues because of their limited scale of operations compared to those shouldered by large firms (Ayakwah, 2011).

It has been suggested by World Bank (2013) that, strengthening agricultural processing may be among the most effective ways to address global poverty. They further indicated that, agriculture and agribusiness should be at the top of the agenda for economic transformation and development as urban food markets are set to increase fourfold and exceed US$ 400 billion by 2030 requiring major agribusiness investments in processing and marketing. To realize this unprecedented market opportunity for increased growth and food security, factors that affect agro-processing entrepreneurs' from realizing their full productive potentials and which limits development of the sector needs to be addressed. It is against this background that this paper seeks to assess the determinants of agro-processors productivity in Ghana. Specifically, it identifies the socio-economic characteristics of agro-processors in Ghana, determines support services available and accessed by the processors and analyzes the factors that drive their productivity.

2. Methodology

2.1. Data, sampling and source

The study relied on a survey conducted in all the 10 regions of Ghana (Ashanti, Brong Ahafo, Eastern, Greater Accra, Northern, Upper East, Upper West, Volta and Western). A two-stage sampling approach was employed to collect cross sectional data from a total of 1,615 respondents. The first stage was to purposively select entrepreneurs who were involved in the main agro-processing activities in Ghana (specifically cassava, oil palm, fruits and fish). The second stage was the employment of random sampling technique to select the respondents and data taken with the aid of a structured questionnaire. These agro processors interviewed were mainly Small and Medium scale Entrepreneurs (SMEs). Both qualitative and quantitative data were taken for the purpose of the analyses. Data was taken mainly on socio-economic/demographic characteristics, determinants of success and growth of their enterprises, challenges facing the enterprises, access to service providers, ability to meet production levels (which was the proxy for productivity measure), among others.

Some focus group discussions and key informant interviews were conducted to get an in-depth understanding of the agro-processing enterprises in Ghana.

2.2. Data analysis

The first two objectives were analyzed using descriptive statistics and the results presented in the form of tables and charts. The last objective, which is the core of this paper, was however analyzed using the binary logistic regression model.

2.2.1. Analytical model

Entrepreneurial productivity is influenced by a myriad of internal and external factors. In this study we want to ascertain which among the factors have significant influence on entrepreneurial productivity in Ghana among agro-processing industries and of what magnitude. To model this, we treat entrepreneurial productivity as a binary or dichotomous dependent variable and it is then regressed against a vector of explanatory variables. A linear relationship can be assumed between the probabilities and the vector of explanatory variables and the model estimated using ordinary least squares (OLS) method – often called the linear probability model (LPM).

Nonetheless, this study employed the Logit Model because it properly describes the relationship involving a dichotomous outcome (Nkonki-Mandleni and Anim, 2014). In this framework, the probability that an agro-processing firm meets its maximum production is non-linear. As such, estimating the model using the traditional OLS technique would be inappropriate (Peng et al., 2002). Moreover, the errors in the LPM are non – normal and heteroskedastic. This is because the outcome variable is dichotomous and so the errors are dichotomous and variance of the error is non – constant as it depends on the explanatory variables as well as on the coefficients, thus violating the normality and homoskedasticity assumptions respectively. Lastly, the LPM yields probability values outside the [0, 1] range for the outcome variable because of the strict linearity assumption between explanatory variables and probabilities. The Logit model overcomes these challenges by correctly predicting the probability values over the [0, 1] range. In addition, the Logit model is selected over probit because the former is simple to use and easy to interpret (Adeogun et al., 2008). From here onwards the [0, 1] range or values are replaced with [No, Yes] responses respectively.

The Logit model explicitly states the relationship between a binary dependent variable and a vector of explanatory variables (Abukari and Salifu, 2015). It predicts the logit of the dependent variable from the explanatory variables. The Logit model is specified explicitly in favour of the probability that a firm meets maximum production as:

$$P(y_i = Yes | x_i) = \frac{e^{\beta_0 + \sum_{i=1}^{N} \beta_j x_{ji}}}{1 + e^{\beta_0 + \sum_{i=1}^{N} \beta_j x_{ji}}} \quad (1)$$

We denote the probability of an agro-processing firm to meet maximum production (*Yes* response) as P and $1-P$ as the probability of an agro-processing firm's failure to meet maximum production (*No* response). Taking the natural logarithms of the ratios of P to $1-P$ gives the odds of y_i, thus in favour of the outcome that a firm meets maximum production, or $y_i = Yes$, given as:

$$\ln\left(\frac{p}{1-p}\right) = \log(odds) \tag{2}$$

Therefore, the Logit model is the log of the odds of y_i, which are ratios of the probabilities of y_i being a *Yes*, stated expressly as:

$$Logit(y_i) = \ln\left(\frac{p}{1-p}\right) = \log(odds) = \beta_0 + \sum_{i=1}^{N} \beta_j x_{ji} \tag{3}$$

$$i = 1;0$$

Table 1. The variables in the model and their apriori expectations

Variable	Description	Measurement	Aprior sign
X_1	Years in Operation	Years	+/-
X_2	Educational Level	Dummy (Educated=1; otherwise 0)	+/-
X_3	Support from R&D	Dummy (Yes=1; otherwise 0)	+
X_4	Access to Finance	Dummy (Yes=1; otherwise 0)	+
X_5	Membership of Association	Dummy (Member=1; otherwise 0)	+
X_6	Training Opportunity	Dummy (Available=1; otherwise 0)	+
X_7	Availability of Market	Dummy (Yes=1; otherwise 0); Ability to sell all goods used as the proxy	+
X_8	Equipment/Tools	Dummy (Yes=1; otherwise 0); self-owned equipment used as proxy for this variable	+/-

Equation (3) is the linear form of the Logit model, the empirical model to be estimated. y_i is the observation for entrepreneurial productivity proxied by the ability of the firm to meet maximum production; where $i = 1;0$. It is defined as, $y_1 = Yes$ if agro – industry meets maximum production, and $y_0 = No$ if agro – industry does not meet maximum production; x_{ji} represents the *j*th explanatory or independent variables for the *i*th agro-processing firm, where: *p* = the probability that a processor is productive or not; hence p=1 implies productive (ability to meet maximum production level) and p=0= implies nonproductive (inability to

meet maximum production level). β_0= Intercept term; β_1-β_9 are the estimates' coefficients; X_s= independent variable influencing an outcome. Explicitly, the model is expressed as

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \varepsilon$$

3. Results and discussion

3.1. Socio-demographic characteristics of agro-processors in Ghana

Results from the study revealed that, most (92.1%) of the agro-processors in Ghana are females whiles few (7.9%) are males (Table 2). This corroborates the findings of various studies (Ghana Statistical Services, 2012; Ampadu-Ameyaw and Omari, 2015; Quartey and Darkwah, 2015) which indicate that, almost 95% of actors involved in agro-processing are women with the male counterparts assisting in activities such as production, transport, operation and maintenance of agro-processing tools and equipment. In addition, majority (63.2%) of the respondents were between 36-60 years while few (0.6%) were below 18 years. The higher proportion of youth and aged managing agro-processing industries in Ghana is encouraging as it would ensure sustainability and continuous existence of the business. The aged and experienced, all things being equal would transfer their skills and expertise to the youth.

Table 2. Socio-demographic characteristics of entrepreneurs in the agro-processing industries in Ghana

Socio-demographic Characteristics		Frequency	Percentage (%)
Gender	Males	128	7.9
	Females	1487	92.1
	Total	**1615**	**100.0**
Age	Less than 18 years	9	0.6
	18-35 years	435	26.9
	36-60 years	1021	63.2
	Above 60	150	9.3
	Total	**1615**	**100.0**
Educational Level	No formal education	1068	66.1
	Primary	230	14.2
	JHS/MSLC	265	16.4
	SHS/VOC/TECH	35	2.2
	Tertiary	17	1.1
	Total	**1615**	**100.0**
Number of years in operation	Less than 1 year	33	2.0
	1-3 years	187	11.6
	4-6 years	338	20.9
	7-10 years	239	14.8
	More than 10 years	818	50.7
	Total	**1615**	**100.0**

Out of the 1,615 entrepreneurs interviewed, 66% had no formal education while 34% had some level of education out of which only 1% had attained tertiary education. Most agro-processing enterprises are rural based where most people have limited access to formal education. Okorley and Kwaten (2001) also observed that, agro-processing activities in Ghana are mostly dominated by illiterates or semi- illiterate with no formal training and acquire processing skills from within their family or apprenticeship. The generally low level of education is of concern as it implies limited capacity to manage enterprises since low educational level translates to low managerial ability which can affect productivity.

Also, about half (50%) of the agro-processors in Ghana had engaged in agro-processing activities for more than 10 years whereas 36% had been in operation between 4 to 10 years. About 14% of the agro-processors had been in business operation for 3years or less (Table 2). Long years of business engagement provide experience which is an important asset that may contribute to improved performance, if best practices have been learnt over the years. According to Davidson et al. (2006), education and training play a key role in developing the abilities of existing entrepreneurs to grow their business to greater levels of success hence an important factor to consider for improved productivity.

3.2. Support services available to agro-processing entrepreneurs

Businesses tend to develop well when access to a range of support networks/services is available. From the study, support networks/services available to agro-processors are depicted in Figure 1. The networks/services available to the agro-processing entrepreneurs provide varied support services to entrepreneurs to assist in enhancing, developing and growing their businesses. Out of the 1615 entrepreneurs, 1190 (74%) had access to these services. The result further revealed that input supply services, training and extension, and market information services were the most accessed by agro-processors and the less accessed support services were transport and quality assurance (1.0%). This results is contrary to that observed by Kayanula and Quartey (2000) which indicated that input supply services were least accessed by agro-processors due to the cost implications. It is however encouraging to observe that training and extension services were one of the most accessed services and support since its role in ensuring increased and sustained productivity cannot be overemphasized. Various studies have identified that, higher frequency of extension contacts and visits are able to increase productivity (Onumah et al., 2014; Onumah et al., 2013 and Nyagaka et al., 2010). This service is mainly provided by the Ministry of Food and Agriculture (MoFA) as well as other Non-Governmental Organizations. Training and extensive services in the agriculture sector proves to be an effective and efficient way of diffusing, assimilating, and absorbing improved agricultural techniques and technologies for increased production, productivity and food security (Byerlee et al., 2013).

It is rather worrying that transport and quality assurance services were not readily available and accessed by the agro-processors. This finding is explained by Ayakwah (2011) who observed that knowledge of specific regulations and legislation governing food safety and hygiene is only evident among processors who market their products through formal outlets. The required costs of meeting the standard association regulations are viewed by the more informal processors as prohibitive. This explains why this support

service was the least accessed by the agro-processors. Ampadu-Ameyaw and Omari (2015) also identified inadequate infrastructural development as a constraining factor for the development of the agro-processing sector. Poor transportation systems existing in most rural areas where majority of agro-processing firms are located may have resulted in the poor access to transport and storage services. Byerlee et al. (2013) postulates that, long-term growth in Ghana's agro-processing sector can only be achieved through a sustained commitment to strengthening the country's infrastructure, through better roads, warehouse space, access to energy and other fundamental resources for doing business. It is therefore important for agro-processing entrepreneurs to be sensitized on seeking quality assurance to improve their market share as well as efforts put in place for infrastructural development.

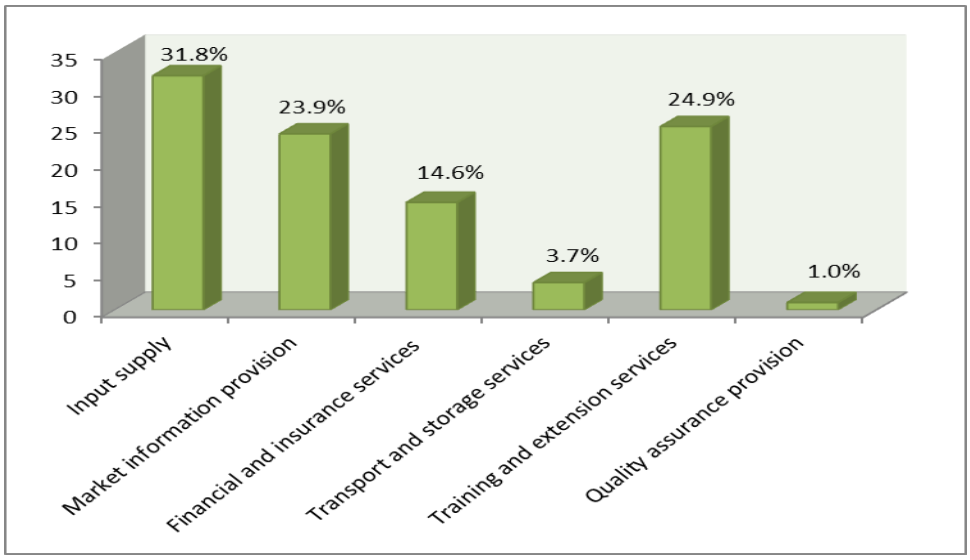

Figure 1. Support services accessed by entrepreneurs in agro-processing industries in Ghana

3.3. Factors influencing agro-processors productivity in Ghana

The results from the logistic regression model as presented in Table 3 indicates that the overall model is significant as the Omnibus Test of Model Coefficients produced a P-value of 0.000<0.001. To look at the individual significance of the variables, the Wald Test was employed and the variables which significantly influenced the predictability of the model and hence productivity of the agro-processors are depicted in Table 3.

All the variables met the aprior expectation except for education, business association membership and market availability. Even though formal education plays a key role in ensuring best practices are adopted and practiced to ensure higher entrepreneurial productivity, the study revealed otherwise. Agro-processors without formal education were more likely to meet their production level compared to those with formal education. This could be as a result of the fact that, agro-processors with formal education have it as a

secondary occupation whilst those without education have agro-processing as their primary occupation. The former could as a result dedicate less time and efforts to this activity which is likely to negatively affect their output and hence their ability to meet set production level. In addition, the study further revealed that entrepreneurs with no formal education had more years of experience in the venture. With experience, they can decipher which technology to adopt to boost productivity and hence are able to make best choices that increase their productivity. However, the key role that formal education plays in business development cannot be underscored and hence agro-processors with formal education need to dedicate maximum time and efforts to their enterprise in order to impact on their productivity positively.

Table 3. Results of the Logit regression model

Variable	β	S.E.	Wald	df	Sig.	Exp(B)
Experience	0.030	0.197	0.022	1	0.881	1.030
Educational level	-0.264	0.141	3.528	1	0.060	0.768*
Availability of R&D support	0.078	0.179	0.188	1	0.665	1.081
Access to Finance	0.130	0.156	0.695	1	0.405	1.139
Member of Association	-0.454	0.155	8.575	1	0.003	0.635***
Training Opportunity	0.052	0.148	0.121	1	0.727	1.053
Availability of Market	-0.984	0.206	22.908	1	0.000	0.374***
Access to Equipment/tools	0.831	0.134	38.295	1	0.000	2.296***
Constant	-1.151	0.191	36.365	1	0.000	0.316***

*** and * 1% and 10% significance levels respectively

Access to finance and support from R&D institutions was found to be positive drivers of entrepreneurial productivity, though not significant. This finding is similar with that of Cooney (2012) who reported that entrepreneurs who receive supports with regards to finances and other entities such as human capacity building and improved marketing outlets generally have higher potential for increasing productions and profitability. Limited access to credit is a severe constraint to agro-processing in Ghana. The entrepreneurs mentioned personal savings as a result of reinvestment from previous processing and borrowing from family/friends as their main sources of financial support amongst various other sources such as financial institutions, local money lenders, family support and personal savings. This denotes the entrepreneurs' limited access to financial support (15%) from financial service providers. As access to credit from formal financial institutions is a challenge, there are institutions such as the National Board for Small-Scale Industries (NBSSI) set up by the government of Ghana to cater for the needs of smaller agro-processing industries to promote and develop the small-scale industrial sector (Quartey and Darkwah, 2015). Their

mandates are to support small scale industries to secure credit by providing advice and direction for obtaining financing; help to locate sources of funding and working with the entrepreneur on his/her application; help to improve and streamline entrepreneur's accounting and business records and credit delivery and recovery. This seems contrary to Storey (2008) observation that, majority of financial service providers and governments in developing countries hardly provide sufficient financial support and incentives to entrepreneurs which affect the economic viability of their units. With the existence of NBSSI in Ghana, they are encouraged to extend more of their services to cover most of the agro-processors across the country.

Access to finance and support from R&D institutions, though did not significantly influence productivity of these entrepreneurs, the variables have shown a positive magnitude to productivity. This proves that with adequate support from these services, they can contribute significantly to improving the productive capacity of agro-processors. Research and Development institutions are known for ensuring maintenance of quality standards and quality control measures which is important for improved productivity as well. Getting access to finance and research and development support from appropriate institutions is considered key to entrepreneurial success.

Contrary to expectation, agro-processors who were members of an association were found to be less productive compared to those who did not belong to an association or group. Forming association with a common interest is good and even gets better if there are tangible forms of support members can give each other. Farmer associations have been seen as the feasible means through which various supporting institutions can reach out to farmers and hence often linked to improved practices on farms. It will therefore be expedient for agro-processors to leverage on the advantages that group membership present and find innovative ways of accessing and utilizing support for an increased productivity. To support this finding, Onumah et al. (2013) observed that farmers who had access to some form of support from the groups that they belonged to were more technically efficient and productive compared to those who had no support. Hence, the emphasis therefore is not a matter of belonging to a group of processors per se but the level of support one is able to obtain to impact productivity that is significant as suggested by Onumah et al. (2013). It is, therefore important that associations put down strategic plans and measures that gear towards fair and total development of its members.

One would argue that once there is market demand for a product, producers will produce to meet that market demand, hence allowing producers to take advantage of the market and produce to capacity. However, the study revealed that processors who had available market for their products significantly could not meet their production capacity. This could be due to the fact that processors who had ready market could still not meet the market demand due to low capacity of the enterprise and hence producing below the optimal. This implies that this category of producers could be more productive and profitable if they had larger capacity to process their products. It is therefore important for agro-processors to have enough human resource, technical and production capacity to produce to meet the market demand.

Another significant variable that positively determined entrepreneurs' ability to meet maximum production capacity was ownership and access to equipment/tools. Maximization of any production system

including agro-processing is highly reliant on the availability of equipment or tools amongst other factors (UNCTAD, 2011). This suggests that, if agro-processors should have ready access to equipment/tools by owning them thereby making them readily available when needed, they are more likely to meet their maximum production levels. Therefore, the important role that access to equipment plays in ensuring processors meets their productive capacity cannot be underestimated. Improving access to tools/equipment and general inputs for agro-processing activities is hence key to the success of these small and medium scale entrepreneurs.

4. Conclusion

Agro-processing enterprise in Ghana is dominated by females (92%) and youth in active age group (63%). Also, majority of the entrepreneurs have no formal education as it is evident in most enterprises found in the rural areas. The study identified input supply, training and extension, and market information the most accessed services by agro-processors and the less accessed support services were transport and quality assurance. The ability of agro-processing entrepreneurs to meet their maximum production capacity was dependent on access to a number of factors including education, business association membership, market availability, equipment/tools, experience, training opportunity, support from R&D institutions and finance. The drivers that positively influenced entrepreneurial productivity included access to finance, R&D support, training opportunities, equipment/tools and years of experience in the enterprise. Contrary to expectation however, group membership, education and market availability influenced productivity negatively.

Provision of entrepreneurial training and education on fostering creativity, innovation and good practices would be essential to enhance productivity. Promotion of the formation and formalization of effective business groups that positively impact each other to collectively improve their activities and market share should also be encouraged. This would in effect upturn the possibility of entrepreneurs to access financial and training opportunities to increase their output. Ownership/access of tools/equipment used for processing is very important to ensuring maximizing productivity as compared to hiring. This is due to the fact that, owning the equipment/tools ensures availability whenever needed compared to waiting for long periods before accessing them when hired. This delays production and decreases realizing full potential capacity of entrepreneurs. Also, NGOs supporting agri-businesses, other stakeholders and government at large should devise strategic means of readily providing agro-processors with the necessary equipment/tools in their communities to facilitate their operations. The tools could be provided for use at a fee to ensure maintenance and responsibility whiles improving performance of business enterprises. Furthermore, due to urbanization, food consumption patterns in Ghana suggest potential increase in demand for agro processed food implying the sector has the capacity to generate employment and improve livelihoods as well as reduce post-harvest losses. The right support and initiatives should be provided to access the identified factors to enhance productivity.

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