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Small Scale Domestic Agro-Processing: Implications for Women Empowerment in OTI Region of Ghana

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***Abstract**: This Agro-processing is one of the agricultural value chain activities that can contribute significantly to industrial development in Ghana and reduce large importation of agro-products with the attendant consequences of high inflation. Whilst factory agri-processing is still at the infant stage, domestic agri-processing which is dominated by women tends to empower them. With the help of a two-stage least square, this study assessed the impacts of small-scale domestic agro-processing on women empowerment in Oti Region of Ghana using cross-sectional data. The model also revealed the predictors of women's participation in agro-processing as well as women empowerment. The main predictors of women's participation in small-scale domestic agro-processing are education, training on agro-processing, group membership, parents, friends, or family members' participation in agro-processing. Also, women empowerment is influenced by education, participation in paid employment, marital age, group membership, distance to district capital, and leadership position. Women who are engaged in agro-processing are 18.2% more empowered than their counterparts. Therefore, interventions aiming at improving women empowerment should consider including small-scale domestic agro-processing. To do this effectively, women should be encouraged to get themselves educated, join women groups, and take up leadership positions. Women in rural areas should be prioritized in this regard.*

Keywords: Agro-Processing, Participation, Women Empowerment Index

1. INTRODUCTION

Agriculture continues to act as the oxygen of the Ghanaian economy as the majority of the people drive their livelihood from the sector. As much as 46% of the labour force is in the sector. The agricultural sector involves a chain that begins from input supply to production, marketing, process, and consumption. In Ghana, the agro-processing and marketing channels of the chain are dominated by women. Agro-processing is the conversion of raw agri-food products into semi-finished or finished products. Ago-processing is of different forms. Simple preservation of food involving sun drying or just salting is agro-processing. Similarly, there is also complex industrial agro-processing such as the processing of wheat into flour or the production of yogurt.

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Okorley and Kwaten (2000) opined that agro-processing is not today's activity as its products during the colonial area were mainly for local consumption. Some aspects of it evolved from small-scale activity to large-scale production of the finished product after independence. This was highly promoted by the industrialization drive embarked on by the Nkrumah government after independence. This led to the coming into force of the state-owned factories namely Komenda and Asutuare Sugar factories, the Pwalugu tomato factory, the Nsawam fruit cannery, the Bolgatanga meat factory, and many more. The political instability that engulfed the country from 1966 to 1980s and the subsequent liberalization agenda culminated in the collapse of these factories.

Though agro-processing is an important agribusiness activity, it is still at the infant stage in Ghana. As noted by Nkechi and Lambon-Quayefio (2017), the firms dominating the subsector are small and medium-scale which operate in the informal sector of the economy. A study by Afful-Koomson et al. (2014), revealed that 85 % of all agro-processing firms in Ghana are micro-enterprises, 7% are very small firms, 5% are small firms, and only 3% are medium-sized agro-processing firms.

The agro-processing according to Quartey and Darkwa (2015) is grouped into factory agro-processing and domestic agro-processing. Domestic agro-processing is dominated by females with the characteristics of illiteracy, informal training, use of family labour, variability in the quality of processed output (Nkechi and Lambon-Quayefio, 2017). Notwithstanding these, domestic agro-processing is highly important in the country as it provides livelihood support to women in rural areas. It also helps in the reduction of post-harvest losses which is a big agenda for the Ministry of Food and Agriculture. It adds value to the raw agricultural products thereby reducing the huge raw material exportation and importation of finished goods culminating in the appreciation of the domestic currency. It is important to note that most of the processed agrifoods are done by domestic agri-processors. Some of the crops that are processed are maize, cassava, shea nut, dawadawa, groundnut, pepper, palm fruits, etc. Therefore, one can talk of gari processing, flour making, fruit juice processing, fish smoking, shea processing, groundnut paste processing, palm oil processing, etc.

The concentration has not been much on the development of the agro-processing subsector which made Ampadu-Ameyaw and Omari (2015) assert that smallholder agro-processing industries' performance is discouraging in Ghana. The commitment is much seen by only the women. Some form business groups to support each other. In Oti Region, in particular, domestic agro-processing business groups are able to seek support from non-governmental organizations and district assemblies.

The challenges of the subsector do not necessarily translate its unimportance to the rural participating women. Domestic agro-processing might have livelihood outcomes such as welfare effects. It is expected that women who are engaged in agro-processing will have better welfare in terms of higher household expenditure, higher household income, improved health conditions, more food security, better shelter, reduced poverty, etc. Assessments of the effects of agro-processing on the above-mentioned welfare outcomes have been researched. The study hypothesizes that women's participation in agro-processing improves women's empowerment.

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Therefore, the focus of this current paper is to assess the extent of the contribution of agro-processing to women empowerment.
Empowerment of women has benefits such as economic or financial empowerment, which Alkire et al. (2013) and Said-Allsopp and Tallontire (2014) indicated can help women to have the ability to acquire plots of land and livestock. Knowledge of the magnitude of the contribution of women-dominated agro-processing to their empowerment is highly important as it serves as a springboard for the government to mainstream women into the ongoing one-district-one factory policy. Other factors that potentially determine women's empowerment will be revealed and this will provide good information to duty-bearers and other private stakeholders on where to tackle and accelerate gender equality.

2. THE AGRO-PROCESSING SUBSECTOR

Agro-processing is an agro-based manufacturing sector that gets sources of raw materials from the crop, fishery, livestock, and forestry subsectors. Due to the backward and forward linkages, it has the primary, secondary, and tertiary sectors of the economy. Agro-processing can transform the economy by creating business opportunities and providing sustainable employment by attracting investment from micro, medium, and small scale enterprises. Ghana as a country has not taken agro-processing seriously as most of the foods are still consumed raw or exported in the raw or semi-process form to other countries. Meanwhile, it is agro-processing has nutritional and food security importance to the country. Processed foods command higher prices on the global market and hence can improve export prospects of the country and provide sustainable income to smallholder farmers in rural communities (Owoo and Lambon-Quayefio, 2018).

According to Andam and Silver (2016), Ghana's changing demographics set the context for the observed changes in its food systems and resulting new demand for processed foods. More than half of the Ghanaian population resides in urban areas and for the sake of convenience, there is a growing demand and preference for already processed food (Hollinger and Staatz, 2015). Over the years, agro-processing has been rural-based. Though governments have over the years worked tireless to expand the agro-processing facilities in Ghana, this has not been successful. Therefore, the agro-processing sector has moved from the huge state-owned plants that were processing cocoa, sugar, tomatoes, meat, etc to the current private-led economy. Therefore, the agro-processing sector which is part of the manufacturing sector in Ghana has lost its contribution to extractive sectors and informal services (Ackah et al., 2014). Currently, the agro-processing sub-sector is principally dominated by women. This is observed in the fishery sector where men do the fishing activities and women are responsible for postharvest handling, processing, and selling of fish. Women are also involved in the grinding of cereals, pulses, and spices before the preparation of food.

3. METHODOLOGY

3.1 Study Area and Data Requirements

This study was conducted in the Oti Region of Ghana. Oti Region was carved out of Volta Region in 2018. It is among the five newly created regions in Ghana. Oti Region is located in the middle eastern corridors of Ghana and it shares boundaries with Togo to the East, Volta Region to the south, Northern Region to the North, and Volta Lake to the West. The northern

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part of the region has guinea savannah vegetation whereas the southern part is made up of forest savannah transition vegetation.

Out of eleven districts, Nkwanta North, Krachi East, and Buem Districts were selected using simple random sampling techniques. A recognizance survey was done to identify communities with agro-processing enterprises and those without. Three communities each were selected from communities with agro-processing enterprises and those without agro-processing enterprises using stratified sampling techniques. A total of 123 women engaged in agro-processing enterprises and 159 women who were not engaged in agro-processing activities were selected and interviewed using simple random sampling techniques. It is important to note that the stratification of the communities was done to minimize spillover effects. The survey instrument used was a semi-structured question. As shown in Figure 1, majority of the women were engaged in gari processing. Out of the 123 women engaged in agro-processing, 28% of them process gari for sale. This is followed by fish processors who constituted 24% of the agro-processors interviewed. Shea butter processing had the lowest percentage of women. Note that *Dawadawa* is the local name for African locust beans (*Parkia filicoidea).*

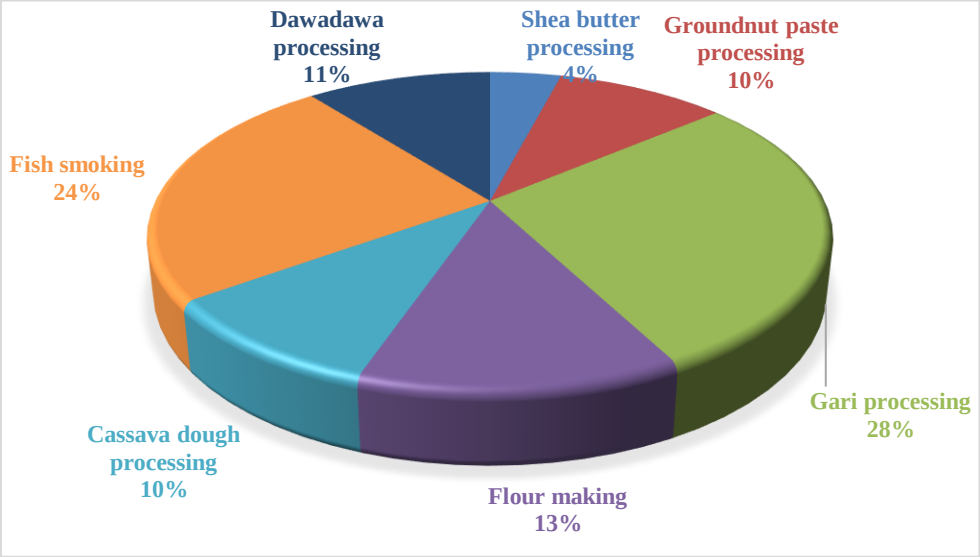

Fig. 1: Agro-processing enterprises

3.2 Conceptual Framework

Figure 2 shows the conceptual framework on how engagement in agro-processing affects women empowerment. The engagement of women in agro-processing activities or not can be influenced by a combination of individual, household, and community characteristics and institutional or policy variables. Whether the women are engaged in agro-processing or not has implications for their access to productive resources, production decision making, the quest for a community leadership position, time allocation, and control over income. It is expected women engaged in agro-processing will be empowered and this will have significant impacts on access to productive resources and production decision making which implies that the women can make input into productive decision making, own properties, and even access and make credit decisions. Empowerment of women influences the control over the use of income, which means that women can increase their stake in the agro-processing sector and increase

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investment. Empowerment can also influence the involvement of women in community leadership positions, which can enable them to create significant women's associations and help build strong relationships and networks in their communities. The empowerment of women is able to reduce the heavy workload imposed on women in various communities of the region. All these indicators contribute to improving the welfare of the individual women themselves, their households, and their communities at large.

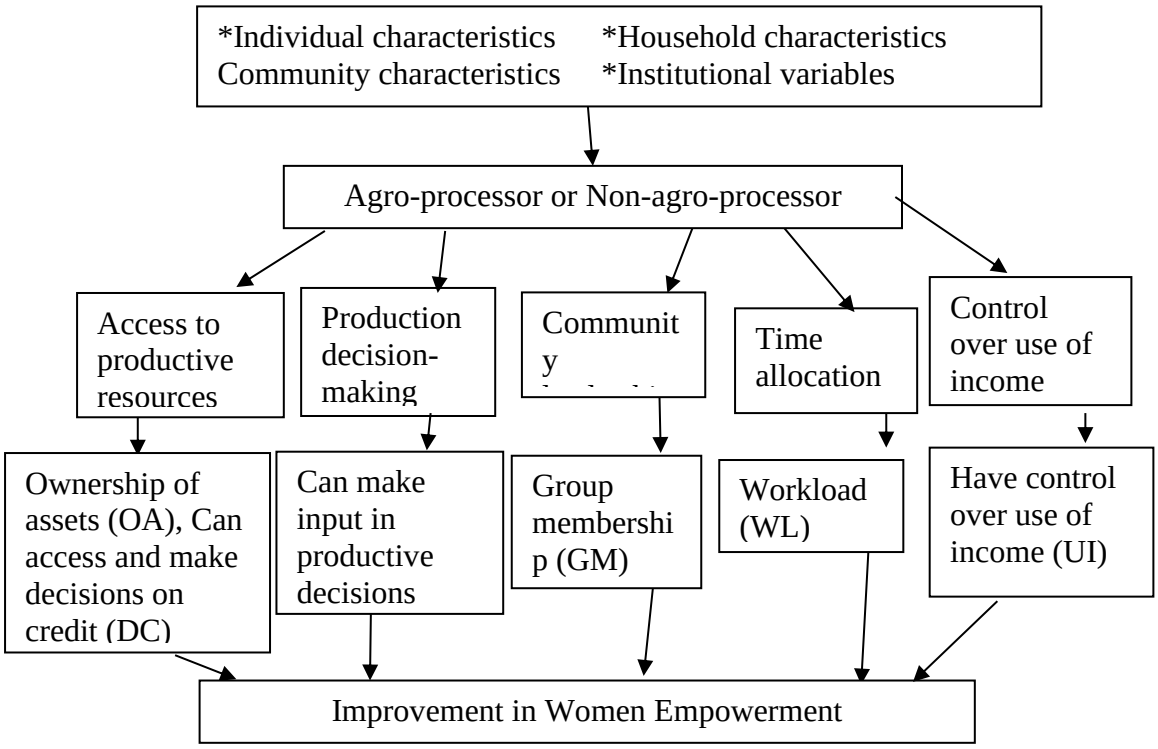

Fig. 2: Conceptual framework of effects of agro-processing on women empowerment

3.3 Analytical Techniques and Framework

3.3.1 Women empowerment indicators

Women empowerment is very critical to achieving gender equality goals as enshrined in the sustainable development goals. The issue is how to assess women empowerment. Many indicators are used in the assessment of women empowerment. Whatever indicators are used must be in context. It is always best to adopt the multi-dimensional concept of measuring women empowerment. In measuring women empowerment, several studies were consulted and the indicators identified were contextualized to fit well in the study area. Some of these studies are Malapit et al. (2017), Sharma and Bansal (2017), Alkire et al. (2013) and Etuah et al. (2020). What is common in all these studies are grouped into personal, relational, and environment by Lombardini et al. (2017). These three domains are measured using VeneKlasen and Miller (2002) definition of women empowerment as a process of moving women and girls from a situation where they have limited power to one where their power is enhanced. Adopting Malapit et al. (2017) and Alkire et al. (2013), five women empowerment domains with six indicators were used to estimate the women empowerment index. Table 1 shows the five

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domains and the six indicators as used by Malapit et al. (2017) and Alkire et al. (2013). The five domains provide scores on women's level of decision-making and control, using ten indicators across five domains: production, resources, income, leadership, and time (Alkire et al. 2013). In this study, the five steps in constructing a women empowerment index were followed. According to Lombardini et al. (2017), these steps are "defining the characteristics that describe an 'empowered women' in the context of the study; designing the questionnaire for data collection; constructing indicators and applying cutoff points for each person in each indicator; defining a relative weight for each indicator, and finally calculating the empowerment index". The study identified five main domains with specific indicators that indicate the level of women empowerment in the region.

A woman was asked to score an indicator 2 if she performs it alone, 1 for joint performance, and 0 if she is not allowed to perform it at all. This pertains to productive decisions, access, and decisions making on credit, ownership of assets, and control over the use of income. For group membership, a woman who is a member of a community or an association is scored 1 otherwise 0. Whether or not a woman is a leader in the group or any association is also assessed using a score of 1 for affirmative and 0 for otherwise. Lastly, women were asked to indicate the number of hours spent on household activities and whether or not the activity is jointly done with the husband or any member of the household. It is important to note that all the aspects of the indicators are not equally important and hence need to be assigned different weights. An opinion survey of experienced women about empowerment who are highly involved in women empowerment advocacy was conducted in the study area to get the assigned weights to each of the indicators. The result from the opinion survey was used to assign weights indicated against each of the indicators shown in Table 1.

Table 1: Women empowerment indicators

Domain	Indicators	Weight
Production decision-making	Can make input into productive decisions (PD)	$^{2}/_{15}$
Access to productive resources	Ownership of assets (OA)	$^{3}/_{15}$
	Can access and make decisions on credit (DC)	$^{1}/_{15}$
Control over use of income	Has control over use of income (UI)	$^{3}/_{15}$
Community leadership	Group membership (GM)	$^{3}/_{15}$
Time allocation	Workload (WL)	$^{3}/_{15}$

Adopted from Malapit et al. (2017)

3.3.2 Analytical framework

To determine the impact of agro-processing on women empowerment, this study used Two-Stage Least Squares (2SLS). As a structural equation model, 2SLS is an extension of the Ordinary Least Square (OLS) regression. It is used when the dependent variable's error terms are correlated with the independent variables. OLS is based on the assumption that the value of the error terms is independent of explanatory variables. A 2SLS econometric model is used to solve the problem of correlation between the error terms and the explanatory variables. To

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model a 2SLS model, one needs to add an explanatory variable that is correlated to the problematic predictor but not with the error term. For OLS, women empowerment model could have been estimated as:

$$WEI_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_p AP_i + \varepsilon_{1i} \quad (1)$$

The problem is that *AP* (Agro-processing engagement) is correlated with the error term (ε_i), that is *c*orr (AP, ε_1) $\neq 0$. Note that the X_s are explanatory variables and β_s are the coefficients measuring the magnitude of effects on the women empowerment index (*WEI*).

With this, when equation 1 is estimated using OLS estimator, the estimates (βs) will be biased. Therefore, estimated impacts of agro-processing on women empowerment which is represented by β_p will be biased and inconsistent thereby not giving us the true impacts. The main causes of this situation is when there are unobserved factors influencing both agro-processing (*AP*) and the outcome variable (*WEI*). To solve these biases, a 2SLS estimator is used in this study. True to its name, a 2SLS involves two procedures in estimating the model. The first stage involves the regressing of a binary endogenous variable (herein the participation of women in agro-processing) on exogenous variables including the instruments used to identify the equation. From this first stage, the values of endogenous variables for each observation are predicted and used as one of the explanatory variables in the second stage. Therefore, the stage involves the regressing of outcome variable (women empowerment index) on the explanatory variables including the predicted values of endogenous variable (participation in agro-processing) in the first stage (Wooldridge, 2010).

Stage 1:
Specifying the model for agro-processing *APi*:

$$AP_i = \propto_0 + \propto_1 X_{1i} + \propto_2 X_{2i} + \cdots + \beta_1 Z_{1i} + \beta_2 Z_{2i} + \cdots + \varepsilon_{2i} \quad (2)$$

Where Z_1 and Z_2 affect *Ap*. They do not affect *WEI* directory except through *Ap*. Also, they are exogenous [*c*orr (Z_1, $\varepsilon_2 = 0$)] and [*c*orr ($Z2$, $\varepsilon_2 = 0$)]. Therefore, Z_1 and Z_2 are called the instrumental variables. A variable is qualified as an instrument if it is uncorrelated with the unobserved variables (error terms) of the outcome equation but rather correlated with the endogenous variable (engagement in agro-processing).

Stage 2:
As explained, after estimating equation 2, *Ap* values are predicted and used as one of the explanatory variables in stage two to get.

$$WEI_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots + \beta_p \widehat{AP_i} + \varepsilon_{1i} \quad (3)$$

4 RESULTS AND DISCUSSIONS

4.1 Summary Statistics of Variables

Table 2 presents summary statistics of respondents based on participation in agro-processing. It was established that the average household size of women who participate in agro-processing was 7 and 8 for non-agro-processors. The t-test confirms a statistically significant difference in average household size across the two categories of processors. This implies that women participation in agro-processing decreases with an increase in household size. This is understandable because women with larger household size are likely to be overburdened with household duties (caring for children, sick, elderly, etc.) and may not have time to participate

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in agro-processing. Again, the average number of years spent in school by agro-processors and non-agro-processors was found to be 6.7 years and 1.9 years respectively. The independent t-test revealed a significant difference in years spent in school by agro-processors and non-agro-processors. This finding implies that women participation in agro-processing is a positive function of the number of years spent in school. Thus, more educated women are more likely to participate in agro-processing than their counterparts. This makes sense because women who are educated are expected to have good income and easily understand training on agro-processing. Thus, have the financial capacity, knowledge, and skills to undertake agro-processing which increases their affinity to participate.

Table 2: Summary statistics of variables

Variables	Agro-processors (123)	Non-agro-processors (159)	t-test
Distance to the District capital (Km)	0.53	0.59	1.0497
Age (years)	42.02	42.69	0.5459
Household size (count)	7.33	8.40	2.2895**
Education (years)	6.70	1.86	9.3649***
Participation in a paid job (yes)	0.34	0.22	-2.2680**
Training on agro-processing (yes)	0.63	0.30	-5.4336 ***
Group membership (yes)	7.48	4.23	5.6494***
Age of marriage after 18 years	2.32	1.36	-5.0288***
Dependency ratio	0.34	0.28	-1.5611
Leader (yes)	0.75	0.45	-4.9824***
Parents engaged in agro-processing (yes)	0.60	0.14	-8.0111***
Friends or family members engage in agro-processing (yes)	0.56	0.17	-6.8745***

Furthermore, participation in a paid job, receiving training on agro-processing, age of marriage after 18 years and holding group positions were found to be positively and significantly related to women participation in agro-processing. Again, 75 percent of women who were leaders participated in agro-processing as against 45 percent who did not participate. The proportion of women leaders' participation across the two categories was statistically significant at 1 percent, according to the t-test. This means women in leadership are more likely to participate as compared to their counterparts who are not. This is plausible because those in leadership positions are more likely to participate in programmes and training that will whip their interest to enter into the agro-processing value chain. Additionally, parents' engagement in agro-processing was found to be 60 percent and 14 percent respectively for agro-processors and non-agro-processors. The t-test indicated that the proportional difference across the two categories was statistically significant at 1 percent. This is expected because women who have parents in the value chain are expected to have the experience and the skills needed to enter the value chain thus, would have a higher affinity to participate in agro-processing. Finally, friends or family members' participation in the agro-processing value chain was 56 percent and 17 percent for agro-processors and non-agro-processors. The t-test confirmed a statistically significant difference in proportional participation across these two categories. This implies

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women who have their family members or friends in the agro-processing value chain positively influence their decision to participate in agro-processing.

4.2 Mean Comparison Test of Women Empowerment Indicators between Agro-Processors and Non-Agro-processors

Table 3 shows the mean comparison test of women empowerment indicators between agro-processors and non-agro-processors. The test results show that there are statistical significant differences in women empowerment indicators between women engaged in agro-processing and those who do not. Women engaged in agro-processing can make inputs into productive decision making than their counterparts. The pattern is the same for ownership of assets, access to credit, control over income, group membership, and workload. The results revealed an average women empowerment index of 0.75 and 0.55 for agro-processors and non-agro-processors respectively. This implies that women who engaged in agro-processing are more likely to have an improvement in their empowerment than non-processors.

Table 3 Differences between women empowerment indicators of agro-processors and non-agro-processors

Women empowerment indicators	Expected Weight	WEI for pooled data	Agro-processors (123)	Non-agro-processors (159)	t-test
Can make input into productive decisions (PD)	0.13	0.10	0.12	0.09	4.55***
Ownership of assets (OA)	0.20	0.08	0.10	0.06	10.23***
Can access and make decisions on credit (DC)	0.07	0.05	0.07	0.04	7.34***
Has control over use of income (UI)	0.20	0.15	0.18	0.13	8.61***
Group membership (GM)	0.20	0.13	0.14	0.11	4.73***
Workload (WL)	0.20	0.13	0.15	0.11	8.06***
Women empowerment index	1.00	0.64	0.76	0.55	11.06***

4.3 Impact of Agro-processing on Women Empowerment

To determine the implications of agro-processing on women empowerment, this study used 2SLS. For any 2SLS estimation, one needs to conduct an appropriate diagnostic test. This section presents the results of the diagnostic tests and the actual regression model.

4.4 Diagnostic Tests of 2SLS

For any impact estimation econometric model, the issue of endogeneity of the treatment variable and the appropriateness of the selected instrument may arise. Also, the 2SLS estimation has an added issue with the identification of the treatment equation. Therefore, Table 4 presents the results of the post-estimation diagnostic tests that were carried out to ascertain whether or not the 2SLS econometric model used is appropriate. For the endogeneity test of

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the engagement in agro-processing, the Durbin test score of 6.35 is 5% statistically significant as shown by the P-value. Similarly, the Wu-Hausman test had a score of 6.18 with 5% statistical significance. The significance of these two tests implies that the null hypothesis of exogeneity of the treatment variable (agro-processing) is rejected in favour of the alternate. Therefore, agro-processing is endogenous and hence the estimates would have been biased if OLS was used. So, 2SLS was able to deal with the presence of the endogeneity of the treatment variable, agro-processing.

The quality of the two-instrument selected was validated by the use of F-statistic. The F-statistic value of 15.02 is statistically significant at 1% implying the joint significance of the instruments. As noted by Staiger and Stock (1997), if the *F-test* for joint significance of the instruments is less than 10, then the instrument selected may be weak. The consequence of the biasness of the estimates is eliminated in 2SLS results since the selected instruments passed the weakness of the instruments tests. The over and under-identification of the selected instruments was validated using Sargan and Basman tests. Table 4 shows that Sargan and Basman Chi^2 values of 0.27 and 0.26 respectively are not statistically significant. The non-significant nature of Sargan and Basman tests implies that the null hypothesis that the instruments are not correlated with the error term is not rejected. This means that the explanatory variables which are not used as instruments are correctly excluded from the model estimation and therefore, over or under-identification of the instruments is absent.

Table 4: Diagnostic tests of 2SLS estimating women empowerment impact of agro-processing

Test	P-value	P value
Endogeneity		
Durbin score Chi2 (1)	6.3542**	0.0117
Wu-Huasman (F1, 828)	6.1780**	0.0135
Weak instruments		
F-statistic (2, 828)	15.02***	0.0000
Over-identification		
Sargan score Chi2 (1)	0.2737	0.6009
Basman Chi2 (1)	0.2603	0.6099

4.5 Predictors of Agro-processing and Implications on Women Empowerment

Table 5 shows the regression results of the 2SLS. The selection or the treatment model represented by the agro-processing engagement of women has an adjusted R-square of 0.394 implying that 39.4% variations in the women engagement in an agro-processing activity is explained by the covariates included in the model. Out of the thirteen variables, five are statistically significant in the agro-processing model. These include education, training on agro-processing, community group membership, inheritance of agro-processing from parents, and engagement of friends or family members in agro-processing. Whilst education, inheritance of agro-processing from parents, and engagement of friends or family members in

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agro-processing are each 1% statistically significant, training on agro-processing is 10% statistically significant. The level of significance of community group membership is 5%.

The positive sign of the coefficient of education implies that as the years of education increase the probability of women engaging in agro-processing increases. This meets the a priori expectations. It is expected that women who have some level of education will be able to easily understand any training on processing of agro products and hence will have a higher affinity for engaging in the venture. Training in agro-processing has a positive coefficient, implying that women who have undergone such training have higher probability of entering the agro-processing value chain. Being a member of a group in one's community increases the likelihood of engaging in agro-processing. Friends or family members' engagement in agro-process value chain influences the decision of women to engage in the venture.

As shown by the diagnosis of the outcome model (women empowerment model), it is clear that 58.6% of the variations in women empowerment index are due to the predictors included in the model. Wald Chi Square has statistically significant signaling that the data fit well for the 2SLS model being used. The covariates in the model that statistically influence women empowerment as indicated by the significance of their P-values are distance to district capital, education, participation in a paid job, age of marriage after 18years, group membership, and being a leader. Whilst distance to district capital, age of marriage after 18years, and women leader position are 1% statistically significant, education and group membership are 10% statistically significant. Meanwhile, participation in paid employment is 5% statistically significant. Apart from distance to district capital, which shows a negative direction of the effects on women empowerment, all other predictors that are significant in the model tend to increase the women empowerment index. For instance, an additional year increase in the educational level of a respondent increases the level of women empowerment index by 0.5%. This positive direction of the effects of education on women empowerment meets the a priori expectation as Garbero and Perge (2017) concluded that education can predict women empowerment. Similar findings have been observed by Etuah et al. (2020) as their study concluded that formal education increases the median women empowerment score by 16.3%. They explained that education is a medium for women in gaining knowledge, skills, and self-confidence to make decisions to demand and protect their rights to change and improve their situations. Similarly, Banerjee et al. (2020) revealed that education provides opportunities for women to enable them to become socially and financially independent.

As the distance to district capital increases, the extent of women empowerment decreases. This observation from the result is plausible and meets the a priori expectation. This is in line with Kishor and Subaiya (2008) and Musonera and Heshmati (2016) that women in urban areas are more likely to reject wife-beating than women in rural areas. This suggests that women in urban areas or living closer to urban areas are much more empowered as compared to their counterparts in rural areas. Additionally, scholars like Ashraf et al (2009), Chant (2013), Goldman and Little (2015) have urbanization help women to receive better education which capacitates them know their rights and engage in women's grassroots organizations and social movements for social and economic empowerment.

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In a similar situation, women who have participated in paid employment are 4.0% more empowered than their counterparts. This finding confirmed the work of Garbero and Perge (2017) that participation in paid employment has a positive effect on the likelihood of being adequate in both Bangladesh and the Western Highlands of Guatemala. The adequacy here is a measure of empowerment thus adequate achievements in four of the five domains. As a woman engages in paid employment, her improvement in income increases her capacity to significantly contribute to household spending (especially expenditure on food or child nutrition) and decision making thereby leading to empowerment (Malapit, et al., 2013). Being a member of a woman group and being a leader of a woman group increases the empowerment index by 0.3% and 5.1% respectively. A baseline survey by Abdu and Gray (2020) seeking to understand gender and empowerment in cocoa farming communities in the Brong Ahafo Region of Ghana concluded that membership in influential groups improves one's empowerment irrespective of male or female. Group membership in this study includes farmer-based organizations, village savings and associations' groups, agro-processing groups, and religious groups.

Also, a 1year increase in the age of marriage after 18years increases her empowerment by 8.6%. This according to Kishor and Subaiya, (2008) can be explained that a younger age at marriage curtails a woman's chance of accessing education thereby causing disempowerment (Kishor and Subaiya, 2008). Women who married at a younger age are more likely to accept wife-beating.

The study seeks to use a more deterministic statistical approach, 2SLS model to establish whether or not there is quantitative empirical evidence that agro-processing engagement improves women empowerment. The coefficient of agro-processing engagement is 1% statistically significant. The coefficient is highly significant and has a positive direction of effects on women empowerment index. Therefore, the null hypothesis that agro-processing has no impact on women empowerment is rejected in favour of an alternate. The alternate hypothesis conjectures that women engagement in agro-processing improves their empowerment more than their counterparts who do not engage in agro-processing value chain activity. As shown clearly in Table 5, women who are engaged in agro-processing value chain activity are 18.2% more empowered than those who do not. As noted by Kahinde et al. (2021), women empowerment indicates that the achievement of females in group membership, income control, and reduced workload decreases the extent of food insecurity.

Table 5: Impacts of agro-processing on women empowerment

Variables	**Agro-processing (*Ap*)**			**Women Empowerment Index (*WEI*)**		
	Coef.	**Std. Err.**	**P>t**	**Coef.**	**Std. Err.**	P>t
Agro-processing				0.1819***	0.0509	0.0000
Distance to the District capital	0.0231	0.0562	0.6810	-0.0823***	0.0178	0.0000
Age	-0.0001	0.0026	0.9690	0.0003	0.0008	0.7410

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Household size	0.0048	0.0069	0.4860	-0.0016	0.0022	0.4710
Education (years)	0.0276***	0.0063	0.0000	0.0050*	0.0027	0.0620
Participation in paid employment	-0.0108	0.0562	0.8480	0.0404**	0.0177	0.0220
Agro-processing	0.0973*	0.0531	0.0680	0.0015	0.0173	0.9290
Age of marriage after 18 years	0.0374	0.0583	0.5220	0.0857***	0.0187	0.0000
Group membership	0.0113**	0.0054	0.0390	0.0033*	0.0018	0.0650
Farming	0.0090	0.0171	0.5980	0.0086	0.0055	0.1150
dep_ratio	0.0335	0.0843	0.6910	-0.0141	0.0268	0.5990
Leader	0.0587	0.0516	0.2560	0.0514***	0.0170	0.0030
Parents engaged in agro-processing	0.2483***	0.0574	0.0000			
Agro-processing	0.1925***	0.0567	0.0010			
_cons	-0.0475	0.1353	0.7260	0.4921	0.0424	0.0000
n	282			282		
R-squared	0.4216			0.5857		
Adj R-squared	0.3935					
Root MSE	0.3869			0.12178		
F(13, 268)	15.02 (p=0.0000)					
Wald chi2(12)				434.56 (p=0.0000)		

5. CONCLUSIONS

The main aim of this study was to assess the extent of contribution of agro-food processing to women empowerment. The study applied women empowerment index to access the level of women empowerment and the 2SLS to assess the impact of agro-processing to women empowerment. The 2SLS results revealed that participation in agro-processing was a positive function of improvement in women empowerment. The study established that education (years), training on agro-processing, group membership, parents' participation in agro-processing and friends or family members' participation in agro-processing increase the probability of a woman to participate in agro-processing. The study further revealed that women empowerment increases with increasing with education (years), participation in paid employment, age of marriage after 18 years, group membership and holding leadership position. Meanwhile, the closer the community to the district capital, the more empowered the women.

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Therefore, it can be concluded that women who participate in agro-processing are more empowered than those who do not. This suggests that participation in agro-processing has the potential to improve women leadership, improve their income and asset ownership, and reduce their work load. As a result, government policies and interventions aimed at improving women empowerment must target increasing women participation in agro-processing with particular attention to non-participant. Special attention should also be given to women education both formally and informally since education positively influences both participation in agro-processing and empowerment. Additionally, women should be encouraged to join women groups so that they can get the opportunity of learning from other group members the rudiments of agro-procession and women empowerment.

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