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Full Length Research Paper

Factors influencing output commercialisation among small scale farmers in Nigeria

Femi Ogundele

Nigerian Institute of Social and Economic Research (NISER).

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Abstract

This study presented evidence-based analysis of the degree of commercialisation among small scale maize producing households in Nigeria as well as factors that determine their levels of output commercialisation using the National Bureau of Statistics Generalise Household Survey wave 2 and 3 panel data. Analysis involved computation of the household crop commercialisation index (HCCI) and Tobit regression of the determinants of output commercialisation. The results are quite revealing and brought to the fore a number of significant findings on output commercialisation among small scale farmers in Nigeria. One of such critical findings is the challenge faced by women (in terms of ownership and control) as plot management and control as well as decision over earnings from crop sales was dominated by male spouse. Also, while increased output is necessary for improved commercialisation, finding suggests that this was only achieved through extensification while storage constituted critical challenge. Also, the study underscores the significance of output price in driving output commercialisation, storage for the future sale only increased marginally due to limited capacity of the households to store for long period. This study, therefore, recommends gender inclusive agricultural commercialisation policy and the development of market infrastructure (storage and transportation).

Keywords: Crop, output, commercialisation, small scale, farmers.

INTRODUCTION

The importance of smallholder farmers in transforming the agricultural sector in Nigeria is embedded not only in their numerical strength but also in their potentials to serve as the fulcrum for ensuring food security and achieving poverty reduction if properly harnessed. The National Agricultural Sample Survey by National Bureau of Statistics (2012) put the population of small scales farmers in Nigeria at 18.2 million while that of corporate farmers was 171. Meanwhile, one of the major characteristics feature of smallholder farms in Nigeria is the fact that they are widely dispersed with fragmented holdings thus, making it difficult for provision of market support services and proper integration into the market. Aside, production is largely rain fed with less than 1% of the arable land irrigated; therefore production varies with the amount and distribution of rainfall. This type of production system couple with lack of appropriate storage facilities, make it difficult for small scale farmers to cope with seasonal price volatility which often made them to sell their produce during harvesting season at very low price. In other words, smallholder farmers in Nigeria are price takers and thus, the need for an in-depth understanding of how they can be properly integrated into the output market.

Meanwhile, commercialization of agricultural output as a characteristic of agricultural change is more than

Corresponding author. E-mail: olorunfemiogundele@gmail.com

whether or not a cash crop is produce to a certain extent in a production system. It can take many different forms by either occurring on the output side of production with increased marketed surplus or on the input side with increased use of purchased inputs. Abu (2015) posited that smallholder commercialisation requires both well-functioning output market and efficient and cost effective factor market that reflect opportunity cost of farm inputs.

Commercialization is the outcome of a simultaneous decision-making behaviour of farm households in production and marketing. Smallholder commercialization in Nigeria encompasses: sale of a marketable surplus of traditional crops; diversification into the production of new crops; introduction of new income generating and post-harvest activities such as processing of farm produce.

All though a number of empirical studies on agricultural output commercialisation such as (Adenegan et al, 2013; Oteh and Nwachukwu, 2014; Falola et al., 2014; Olanrewaju et al., 2016 and Ugwu and Alimba, 2018) exit in Nigeria, they are, however, localised (limited to a particular location) and do not considered crop specific analysis as proposed in this study. Even though a few of them considered factors that drive market participation and degree of output commercialisation, none of them examine the inter-temporal shift in the degree of output commercialisation as well as changes in the drivers over time. Therefore, what remains empirically contentious is how the inter-temporal changes in factors that drive output commercialisation determine the degree of integration of farmers into the output market in Nigeria. This is very important as study by Murithi and Matz (2014) have shown that improved output commercialisation could impact positively on livelihood generation. Against this backdrop, the study examines factors that influence smallholder output commercialization among small scale maize farmers in Nigeria and how these factors changes over time.

Theoretical Review

Theoretical literatures on agricultural commercialization have proceeded along two main perspectives. These are the macro and micro perspectives. From the macro perspective, the development economists viewed agricultural commercialization as gradual replacement of integrated farming systems by specialized enterprises for crop, livestock, and poultry and aquaculture products. Changes in product mix and input uses are determined largely by the market forces during this transition. They also considered commercialization of agricultural production as an endogenous process which is usually accompanied by economic growth, urbanization and withdrawal of labour from the agricultural sector (Pingali and Rosegrant, 1995). From the micro perspective (farm household level), agricultural commercialization refers to the process of increasing the proportion of agricultural production that is sold by farmers (Pradhan et al., 2010). This view was held by the Structuralist and the Agricultural Economist. According to the Structuralist, agricultural commercialization, means more than the marketing of agricultural output, it means the product choice and input use decisions are based on the principles of profit maximization. Commercial reorientation of agricultural production can occur for the primary staple cereals as well as for the so-called high value cash crops. On the input side, commercialization implies that both traded and non-traded inputs are valued in terms of their market value (Abu, 2015). Commercialization of agricultural systems leads to greater market orientation of farm production; progressive substitution out of non-traded inputs in favour of purchased inputs; and the gradual decline of integrated farming systems and their replacement by specialized enterprises for crop, livestock, poultry and aquaculture products. According to Manyong et al., (2005), commercialization, can be viewed as the movement from a subsistence production to a market-based system of production. It involves raising the cash earnings of small-scale, agricultural related enterprises. In other words, commercialization can be brought about by increasing the unit of output, raising the value added or both, and producing for domestic and foreign markets.

Empirical Review

Determinants of Agricultural Output Commercialisation

Empirical studies on the determinants of agricultural commercialisation have proceeded along three major lines. The first category of these studies adopted the Hickman two stage selections approach and estimated probit model with emphasis on factors that drive farmers to select into a particular market. Most studies in this category do not consider crop specific factors. The second category adopted other analytical approaches such as OLS and multinomial logit. The main emphasis here are factors that determine rate of participation. Also here, the quantities or values of output offer for sale as proportion of total output are often used as index of commercialisation. The third category considered the case of censor data and the need for crop specific analysis. Such studies have adopted the tobit model to analyse the determinants of commercialisation focusing on the specificity of the market for each crops and this current study belongs to this third category.

Studies across the world have revealed some of the major

determinants of output commercialisation; however, these determinants differ within country due to heterogeneous conditions by smallholder farmers. As such, in several countries output commercialization have been associated with several factors prominent among which are landholding size, ownership of livestock assets, education, technology, rural infrastructure, transaction costs, ownership of agricultural implements, market information, wealth, family labour force, etc. (Asfaw et.al, 2010, Abu, 2015).

These factors can be broadly grouped in two categories namely household specific and external factors which have been broken further into eight by Afework and Geta (2016). Household specific factors include quality and quantity of household resources such as land, labour and capital. The external factors are factors that are beyond the smallholder's control. They include variables such as technological change, population growth, introduction of new commodities, infrastructure, market facilitating institutions, and public policies, agro-climatic variables, development of non-farm sector and broader economy, rising labour opportunity costs. Sigei, et al. (2014) also disaggregate these external factors to institutional, market and included political stability of the nation, natural disaster and calamities as other external factor.

In a study by Martey, et al (2014), a truncated Tobit regression model was used to ascertain determinants of commercialization in Effutu Municipality in Ghana with major focus on market information. The study analysed trends in maize and cassava production using both primary and secondary data. They found the extents of maize and cassava commercialization as 0.53 and 0.72 respectively and total agricultural commercialization of the two crops as 0.66. Gender, education, market information, farm size, access to land and non-farm income were found as significant determinants of commercialization of agriculture. In a related study by Kabiti et al (2106), Tobit model was adopted to examine factors driving smallholder commercialisation in Zimbabwe. The paper found that varying factors were responsible for the observed level of input and output commercialisation and recommended increased public and private sector contribution through training and financial support.

Empirical studies in Nigeria on smallholder agricultural commercialization are in agreement with some findings in other countries. Onoja, et al. (2012) in a study of determinants of market participation in Nigerian small-scale fishery sector used primary data and logistic regression model. The authors observed the significance of household size, distant to the nearest marketing channel, price of the commodity and sex of the fish farmer/marketer as determinants of fish farmers' participation in the market. The authors observed the importance of market access noting that those who live close to better roads and have more frequent and direct contacts with the market appeared more willing to produce more systematically for the market, while those with poor market access have little incentive to produce crops other than those required for domestic consumption. Okezie, et al (2012) studied factors driving commercialization processes in Abia State, Nigeria using panel data, observed some degrees of market orientation and identified off-farm income as important sources of agricultural commercialization. Inputs such as labour, fertilizer and planting materials are farm-level determinants of commercialization. They sell their labour and invest proceeds in subsistence production which implies subsistence agriculture tending to input side commercialization.

Also, in another study by Adenegan et al. (2013), factors determining cassava farmers' market orientation in Nigeria were examined with the use of primary data and personal observations. The study adopted a combination of Probit and Tobit models as well as truncated regression model. The study observed the importance of market information, education and distance in the household's decision on the quantity of produce to take to the market. Age was also found to be a significant factor. Another study by Oteh and Nwachukwu (2014) examined the determinants of commercialization of cassava producing households and used household commercialization index and multiple regression models. Analysis of their primary data showed that less than 2 per cent of the households have very high commercial orientation. They also found out that output value, farm size, nearness to market, membership of cooperative and farming experience were significant determinants of commercialization in the study area.

Other studies in Nigeria such as Olanrewaju et al., (2016) observed an improved level of commercialisation among smallholder farming households in Southwest Nigeria with an average household commercialisation index of 0.83 while Ugwu and Alimba (2018) computed commercialisation index for smallholder farmers in Southeast Nigeria and found that the index was higher for cassava and rice. According to them, major determinants of commercialisation include gender, household size, processing cost and distance to the market. While studies in Nigeria revealed varying degree of output commercialisation by smallholder farmers as well as variation in the driving factors across the country, none of the above studies, however, considered the temporal dynamics in household output commercialisation and the associated factors which is the main focus of this study.

STUDY APPROACH AND METHODOLOGY

Data Collection

This study made use of secondary data which consisted of a set of panel data by National Bureau of Statistics in two nationwide surveys conducted under the Generalized

Household Survey (GHS) wave 2 and 3 in 2013 and 2015 respectively. The GHS data sets used in this study covered pre and post planting season. These two data sets provided an ambient for analysing the effects agricultural transformation that have taken place in the country with respect to commercialization of agricultural output among small scale maize producing households.

Analytical Approach

Measuring the Extent of Output Commercialization

For purposes of measuring the extent of crop commercialization, this study adopted the approach used by Govereh et al., (1999) in a study on smallholder commercialization in east and southern Africa and which was also used by Strasberg et al, (1999) to examining the effects of crop commercialization in Kenya. This approach has been used by Martey, Al-Hassan and Kuwornu (2012) and Olanrewaju et al, (2016). The advantage of this approach over other approaches such as profitability index, efficiency and productivity index is that apart from showing the dynamics of output commercialization among the households, it also measures the extent of integration of the farming households into the output markets. Where panel data is available as the case of this study, the index can be used to measure inter-temporal shift in household levels of commercialization.

The Household Crop Commercialization Index (HCCI) is defined mathematically as:

$$HCCI_i = \frac{\sum_{i=1}^{n} P_i q_{is}}{\sum_{i=1}^{n} P_i q_i} \quad \mathbf{X} \quad \mathbf{100}$$

..... (1)

Where $HCCI_i$ is household crop commercialization index

P_i is market price for crop i

q_i is quantity of crop i offer for sale by the household

q_i is quantity of crop i harvested by the household

The index above can be interpreted as the ratio of the gross value or quantities of crop sold to the gross value or total quantities of the crop produced in that particular year. This index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a totally subsistence oriented household; the closer the index is to 100, the higher the degree of commercialisation.The advantage of this approach is that commercialisation is treated as a continuum thereby avoiding crude distinction between "commercialised" and "non-commercialized" households. The $HCCI_i$effectively bring subsistence food production to the centre of discussions about commercialisation.

Analysing the Determinants of Agricultural Output Commercialization

Most studies have modeled agricultural commercialisation as a two-step analytical approaches involving the unobservable decision to commercialise and the observed degree or extent of commercialisation (Alene et al., 2008). This is the Heckman selection approaches which usually ask question "conditional on selection into the market and what influences the amount supplied by farmers and in most cases, probit models are estimated which may not properly capture some of the characteristics of a censored data. However, in order to properly address the many and varied research questions in this study, the Tobit regression approach was adopted following Martey, Al-Hassan and Kumornu, (2012). Although there are divers' issues related to agricultural commercialisation and its determinants as found empirical literatures, in order to address trends in commercialisation at household level, the central explanatory variables will be those related to the farmer household and farm characteristics and markets factors.

The general implicit model is simply specified as:

$Y_j^* = f(H, F, M_)$,) ..... (2)

Where, Y_j^* is defined as percentage of output soldand F, H and M are vectors of households, farm characteristics and market factors capable of explaining them. Details of the various components of each of the explanatory variables are listed in Table 1.

The Tobit regression approach wasemployed to quantify the magnitude and direction of the effects of the factors influencing commercialisation of the smallholder producers (Alene et al., 2008). The Tobit or censored normal regression model assumes that the observed dependent variables for observations j = 1,…, n satisfy:

$Y_j = Max (Y_j^*, 0)$ (3)

TheY_j^*s are latent variables generated by the classical linear regression model:

$Y^*_j = \beta' X_j + U_j$, $Y_j = \{ \{Y^*_j Y^*_j > 0$ and 0 if $Y^*_j \leq 0$ (4)

Where $X_j$denotes vector of regressorsincluding1 for the intercept and β isthe corresponding vector of parameters. The model errors U_j are assumed to be independently normally distributed: $U_j \sim N(0, \sigma 2)$

Table 1. Description and Measurement of Variables.

Variable name	Description	Measurement
Sex	Sex of household head	Dummy (Male=1)
Age	Age of household head	Years
Marital Status	Marital Status of household head	Dummy (married=1)
Location	Location of households	Dummy (Rural=1)
Crop pattern	Cropping pattern adopted by households	Dummy (mixed cropping=1)
Land Area	Total land area cultivated to maize by households	Hectares
Store sale	Quantity of output stored for future sale	Kg
Store seed	Quantity of output store for seed next year	Kg
Plot manage	Who control and manages the plot	Dummy (female spouse=1)
Price	Log of market price of maize output	N/kg

An observation of 0"s on the dependent variable could mean either a "true" 0 or censored data or Y_j would always equal Y^*_j and the true model would be linear regression and not Tobit. Following from the aforementioned discussion, the empirical model for quantifying the factors which influence the intensity of crop output commercialisation is specified as follows:

$$Y_j^* = \beta_0 + \beta_1 Sex + \beta_2 Age + \beta_3 Martstat + \beta_4 Loc + \beta_5 Croppat + \beta_6 Area + \beta_7 SSale + \beta_8 SSeed_j + \beta_9 PMN + \beta_{10} logP \quad (5)$$

Where Y_j^* is the proportion of output of maize that was sold. The explanatory variables are as defined in Table 1.

Marginal Effects

Tobit model parameters do not directly correspond to changes in the dependent variable brought about by changes in independent variables. According to Greene (2003), the marginal effect on the intensity of output commercialisation due to changes in the explanatory variable is given as follows:

$$\frac{\partial E\left[\frac{Y*j}{Xj}\right]}{\partial Xj} = \beta\phi\left[\frac{\beta' X_j}{\sigma}\right] \quad (6)$$

Thus, Equations 1 and 6 was estimated for small scale maize, producing households

RESULTS AND DISCUSSIONS OF THE ANALYSES

Changes in Household Socio-Economic and Farm Characteristics

The analysis of changes in household and farm characteristics over the two periods of the study was carried out for maize growing households and the results presented in Table 2. The results indicated the dominance of male headed households in the sample and a marginal increase of about 1.5 per cent during wave 3. Similarly, the number of household heads that were married also increased marginally by about 0.5 per cent. Crop management practices indicated a gradual movement from mixed cropping pattern to mono cropping between wave 2 and 3. Management and control of plots continued to be dominated by male spouse as proportion of female managed plots within the households declined by about 5 per cent during wave 3. Similarly, male spouse continued to dominate control over earnings from sales of crop as the proportion of female spouse that have control over earnings from sale of crop fell significantly from 22 per cent during wave 2 to 4 per cent during wave 3. Storage of crop continued to pose critical challenge as the proportion of households that store harvested crop fell more than 200 per cent between wave 2 and 3. Major reasons for storage of crop included the need to make provision for household food consumption, future market price speculation as well as provision for next season seeds. Meanwhile, the proportion of households that store harvest for future market increased marginally though household food security remained the most critical reason for storage. The location of households could be one of the critical factors for output commercialisation. Table 2 indicated that over 90 per cent of the households were located in rural areas.The location of households was used as a proxy for distance to the market which plays significant role in market access and participation. The result indicated that more than 90 per cent of the households were located in rural areas. As such with the dearth of rural transport and storage infrastructure the households are likely to face some structural constraints that will affect their level of market participation.In spite of this, Market participation for maize growing households in Nigeria improved significantly between wave 2 and 3 as the proportion of

Table 2. Households and Farm Characteristics by Wave.

Variables	2011 / 2012 –wave 2		2014/2015 –wave 3	
	Frequency	Percentage	Frequency	Percentage
Sex of household head				
- Female	224	12.11	135	11.58
- Male	1625	87.89	1031	88.42
Marital Status				
- Not married	287	15.51	171	14.67
- Married	1563	84.49	995	85.33
Sold Harvested crop	533	28.81	600	51.66
Crop sales by sex				
- Female	94	41.96	76	56.30
- Male	439	27.00	524	50.82
Cropping pattern				
- Mono cropping	249	13.46	249	21.36
- Mixed cropping	1601	86.54	917	78.64
Plot manager				
- Male spouse	1604	88.28	950	94.81
- Female spouse	171	9.41	41	4.09
- Others	42	2.31	11	1.10
Control over earning from crop sales				
- Male spouse	401	76.53	952	95.01
- Female spouse	117	22.33	41	4.09
- Others	6	1.15	9	0.90
Store harvested crops	609	32.92	137	11.75
Main purpose of storage				
- Food	409	68.89	85	62.04
- Future sale	71	11.87	17	12.41
- Seed	118	19.73	35	25.56
Location of households				
- Urban	157	8.50	91	7.08
- Rural	1693	91.50	1075	92.20

Source: NBS-GHS 2011/2012 and 2014/2015 Wave 2 (n=1850); Wave 3(n=1166).

households that sold harvested crop increased from about 29 per cent in wave 2 to about 52 per cent in wave 3. This is probably driven by increased price of the commodity over the two periods (Table 2).

Households Characteristics and Crop Commercialisation Dynamics

The summary of the descriptive statistics presented in Table 3 showed a progressive increase in average age of household head between wave 2 and 3. Also, Average quantity of output harvested by households increased by about 20.75 per cent during wave 3. This may be as a result of the significant increase in average area cultivated by the households which rose from 0.95 in wave 2 to 1.75 during wave 3. Average price of a kg of maize also increased from N7.35 in wave 2 to N8.75 during wave 3. As such the proportion of output sold which is an index of household crop commercialisation (HCCI) increased significantly by 32 per cent between wave 2 and 3. Olanrewaju et al (2016) estimated HCCI of 0.83 among smallholder farming households in the Southwest, Nigeria which further confirmed the positive changes in HCCI in Nigeria.Given the improved changes in HCCI, therefore, what are the factors that accounted for the observed commercialisation dynamics between the two waves? The result of the analysis is presented in Table 3.

Crop Output Commercialization Dynamics and Its Determinants

The result of the Tobit regression of the determinants of output commercialisation among maize growing households for the two waves is presented in Table 4. Sincethe linear regression of the parameters of Tobit Model do not directly correspond to changes in the dependent variable brought about by changes in independent variables, the marginal effect of the intensity of output commercialisation due to changes in the explanatory variable was estimated following Green (2003). Seven variables were found to significantly influence output commercialisation during both waves. These include sex of household head, marital status of

Table 3. Descriptive Statistics of Variables.

Variables	2011/2012- wave 2		2014/2015- wave 3	
	N	Mean value	N	Mean value
Mean age of household head (yrs)	1850	53.10	1166	57.60
Average quantity of output harvested (kg)	1850	2921	1166	3527
Average quantity sold	533	1314	600	2716
Proportion of output sold (HCCI)	533	0.45	600	0.77
Average area of land cultivated (ha)	1.850	0.95	1166	1.75
Average price of output (N/kg)	1850	7.35	1166	8.75

Source: NBS-GHS 2011/2012 and 2014/2015.

Table 4. Marginal Effects of Tobit Regression of Determinants of Output Commercialisation.

Variables	20111/2012 – wave 2			2014/2015 – wave 3		
	Coeff.	Std. err	t-values	Coeff.	Std. err	t-values
Sex of household head - female =1	0.0405	0.056	0.72	0.48**	0.179	2.70
Age of household head	0.0007	0.0007	0.95	-0.003	0.002	-1.37
Marital status - Married =1	0.014	0.053	0.27	-0.449**	0.173	--2.59
Location of Household - Rural =1	0.028	0.039	0.71	-0.318	0,173	-1.83
Cropping pattern - Mixed cropping =1	-0.047	0.052	-0.89	-0.043	0.147	-0.66
Land area cultivated	-0.022**	0.007	-2.94	0.021**	0.006	3.22
Storage for sale	0.084**	0.028	2.91	0.099**	0.028	3.50
Storage for seed	-0.135**	0.0259	-5.22	-0.073	0.072	-1.01
Plot manager - Female spouse = 1	0.071**	0.032	2.21	0.083**	0.032	2.60
Log of price	0.069**	0.009	7.35	0.069**	0.008	7.79
Constant	0.019	0.124	0.16	-0.033	0.114	-0.29
No of observations			314	137		
Log likelihood			98.868	-12.77		
Pseudo R^2			-1.0443	0.50		

Sources: NBS-GHS 2011/2012 and 2014/2015 ** significant at 1%.

household, area cultivated, storage for future sale, storage for seed, plot management by female spouse and output price. The direction of the effects of some of the variables however varied between the two waves. Headship of households has implication for output commercialisation. Results indicated that household headed by female significantly improved commercialisation particularly during wave 3 when output price increased. Also, married household tends to significantly influence output commercialisation than single headed households though excessive expansion in household size may increase the proportion of output reserved for household consumption thereby reducing output commercialisation. The coefficient of area of land cultivated was negative for wave 2 but positive for wave 3. This underscores the progressive increase in average area of land cultivated from 0.95 during wave 2 to 1.75 in wave 3. Storage for future sale in anticipation for price increase positively enhanced output commercialization during the two waves. This shows that opportunity for farmers to store their output over a period of time will assist them to overcome the problem of selling at lower prices that usually accompany the harvesting period due to market glut. Storage for seed for the next growing season can, however, be inimical to output commercialization as the coefficient carries negative sign for the two waves and was highly significant particularly during wave 2. The proportion of households that stored output increased from 19.73 in wave 2 to 25.56 during wave 3 and this could be traced to increase in output price which drives households to increase the quantity of output offer for sale during the year thereby cutting down on quantity of output stored for seed purpose. When plot is manage and control by female spouse even in male headed household, output commercialisation significantly increases. The result was

consistent for the two waves. Finally, output price was found to be a positive and significant determinant of output commercialisation during the two waves. The stability of these variables over the two period calls for a renewedfocus and policy attention targeting on them as a way of driving output commercialisation among smallholder farmers in Nigeria.

Even though the location of the household (proxy for distance to market) was not significant probably due to the fact that 0ver 90 per cent of the household are located in rural areas, the variable exert negative influence on output commercialisation indicating structural constraints on market access by households in rural areas. Similarly, practice of mixed cropping reduces commercialisation though it was not significant. Mixed cropping enhances diversification and can increase total harvested output from a given land area but where it is not properly managed, it can also reduce crop specific output which can in turn lead to reduction in the quantity offer for sale by households. Table 2 indicated that the proportion of household practicing mixed cropping reduced by about 8 per cent during wave 3.

CONCLUSION

This study has brought to the fore a number of significant findings that characterised output commercialisation among smallholder farmers in Nigeria. The study further underscored one of the critical challenges faced by women participation in agriculture (issue of ownership and control). Findings from this study suggested that plot management and control as well as decision over earnings from sales of output continued to be dominated by the male spouse.Though there was significant improvement in market participation over the two periods, storage of output constituted critical problem. These were further exacerbated by the location of the house (90% in rural areas) which imposed serious structural constraints occasioned by the dearth of critical market infrastructure such as transport and storage in the rural areas.Findings also indicated that though increased output enhanced commercialisation, output increased was only achieved through extensification (increase in area cultivated) and finally, the study underscored the significant of output price in driving output commercialisation nevertheless.

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