

RESEARCH ARTICLE

DETERMINANTS OF MARGIN AND INCOME DISPARITY AMONG PEARL MILLET TRADERS

Godfrey C. Onuwa^a, Salawu A. Jibril^b, Sunday S. Mailumo^c^aDepartment of Agricultural Extension and Management, Federal College of Forestry, Jos, Nigeria.^bDepartment of Agricultural Economics and Extension, Abubakar Tafawa Balewa University, Bauchi, Nigeria.^cFederal College of Forestry Mechanization, Kaduna, Nigeria^{*}Corresponding Author Email: onuwa@gmail.com; 08035606473

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ABSTRACT

This study analyzed the determinants of market margin and income disparity among Pearl Millet traders at Tilden Fulani Main Market, Toro, Bauchi State, Nigeria. A multistage technique was used to collect data from 90 respondents. Descriptive statistics, Market margin and efficiency ratio, regression analysis and Gini Coefficient index were analytical techniques adopted. The mean age, years spent in school, household size, trading experience and quantity of bags sold were 39 years, 6 years, 8 people, 10 years and 4 bags per month respectively. The market margin and efficiency index were ₦5,200 and 0.30 respectively. The highest volume of produce net sales was Channel 3 (29%). The regression coefficient (R^2) was 0.707; implying that marketing margin variations were attributable to factors in the econometric model. The index of Gini coefficient was 0.51. The constraints of Pearl Millet marketing include inadequate capital (83.3%), transportation cost (78.9%), price information (61.1%), poor infrastructures (46.7%), storage facilities (33.3%), price volatility (27.8%) and exploitation by middlemen/ agents (17.8%). This study recommends improved access to credit and capital, subsidizing marketing costs, adoption of information communication and storage technologies; provision of market infrastructure and interventions, improved transportation; regulation of commodity prices and activities of middlemen; policy modifications.

KEYWORDS

Constraints, determinants, gini index, market efficiency, market margin

1. INTRODUCTION

Pearl millet (*Pennisetum glaucum*); an essential grain specie, accounts for about two-thirds of the gross grain production in Africa (FAO, 2008). It is an important staple food for millions of Nigerian households and an important resource for smallholder farmers and agricultural markets. It is the seventh most essential cereal crop in the world and a vital cereal in Africa and South Asia (ICRISAT, 2005). It is a basic food for approximately 90 million persons residing in the semi-arid tropical regions of Africa and the Indian subcontinent. Millet is a multipurpose crop used as food, industrial raw material and fodder. For agro-allied industries, Pearl millet is an important feedstock for producing fuel and ethanol, fermenting 30% more than maize with higher protein and fat content (Gulia *et al.*, 2007). In rural households it constitutes an important component of food consumption. In contrast to maize and potatoes, Pearl Millet thrives under adverse climatic conditions. India, Niger, Nigeria, Sudan, Mali, Burkina Faso and Senegal are important countries that contribute to the overall pearl millet market chain; with a planted area of 28 million hectares and a yield of 21.8 million tons (Murty *et al.*, 2007). Pearl millet output from Sub-Saharan Africa accounts for about 13 million tons per annum (FAO, 2003). Factors mitigating commercial Pearl Millet cultivation and marketing include deficient cultivation systems and agronomic practices; low capital, insufficient production technology and input supply, poor market linkages and infrastructure; commodity price volatility and inadequate storage facilities (Gulia *et al.*, 2007). Grain availability, sieving and extracting issues, and uncertainties regarding consumption demand are significant drawbacks of pearl millet compared to maize (Rohrbach, 2004).

Additionally, pearl millet processing is complex by the need to remove the hulls from the grain before milling. Access to processing technology may therefore help open up new market options through extended shelf life and/or value addition (Reddy, 2013). Because it is gluten-free, opportunities exist for harvest marketing in pharmaceutical and health food stores (Gulia *et al.*, 2007). Pearl millet is an essential crop, but its enterprise use is relatively restricted. Moreover, research on Pearl Millet utilization has increased, adoption of improved technologies and commercialization prospects (DFID, 2010; Mwanga, 2002). Howbeit, its yield has stagnated at 200-800 kg/ha relative of worldwide potentials of 1,500-3,000 kg/ha; hence large deficits in local production (FAOSTAT, 2009). A study posited that improved market linkages and value addition can increase remunerative incomes and provide incentives for improving pearl millet productivity among smallholders (Pabuayon and Medina, 2007). Moreover, by evaluating pearl millet marketing, it is possible to determine the extent of value addition, market linkages, functions, participants and market constraints (Pabuayon *et al.*, 2009). Analysis of agricultural marketing assesses a wide range of interrelated challenges (ACT, 2007). They include critical barrier identification to improve market performance, reducing marketing restrictions, contributing to smallholder farmer commercialization and market participation levels, agricultural policy, and identifying ingenious methods of inclusive finance (Moldova, 2010). Uncertainties in Pearl Millet contract farming mitigate financing cereal marketing (Africa 2000 Network, 2007). Moreover, there's sparse data available on the impact of distribution channels, efficiency and Pearl Millet margin determinants. As a result, marketing features of pearl millet remain sparse in literature. This study supplements the knowledge deficit

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through market channel and performance (market margin and efficiency) analysis for Pearl Millet traders. The study identifies different marketing barriers of Pearl Millet and provides to alleviate marketing constraints; evaluate market channels and determine estimates of market margin and efficiency. Pearl Millet marketing is mainly ineffective. Distances between farms and produce markets are relatively afar (Rohrbach and Kiriwaggulu, 2007). The results of this study will help improve the operating mechanisms of the Pearl Millet market and provide a premise for reducing market ineffectiveness. Additionally, market profit margin information is an efficiency factor and an important component of analyzing market performance. The study draws new attention to the marketing and commercial practices of pearl millet, identifies different market channels, estimates market performance; identifies factors affecting market margins and Millet marketing constraints. Thus, the specific aims of this study are to:

- i. describe the respondents socioeconomic profile;
- ii. identify Pearl Millet marketing channels;
- iii. measure the respondents market performance;
- iv. ascertain the determinants of market margins;
- v. evaluate the income disparity among pearl millet traders; and
- vi. identify Pearl millet marketing constraints in the study area.

1.1 Literature Review

Commodification of agricultural products remains principal to many agriculture-based economies; as staple foods make up the majority of household expenditure on food (IFPRI, 2008). Agricultural traders are constrained by poor access to markets in terms of plunging and non-competitive prices of grains. It is typically affected by harvest time, market exploitation, undeveloped and ineffective channels of marketing; resulting to poor yields. Low output creates scarcity which further aggravates price volatility, inadequate supply, inferior grains, poor capital investments, deficit policy schemes and insufficient market information (Rohrbach and Kiriwaggulu, 2007). Agricultural markets are underdeveloped with fragmented marketing channels and deficient value chains, resulting in high assembly and processing costs; thus reducing subsector income and overall competitiveness (Rohrbach, 2004 and Gulia *et al.*, 2007). The difficulty of constrained access to markets is related to market inefficiency. A marketing channel is how agricultural products get from the farm to the consumer. It is a network of agents that carries the product from the producer to the final consumer (Sarode, 2009). The network of channels is differentiated for varying commodities, depending on the volume of movement, consumer demand and the level of geographical specialization of production. Other research on marketing identified many marketing channels. Previous study identified eight main marketing channels in their study of agricultural marketing in Ethiopia (Mussemu, 2006). Without markets, agricultural production stagnates. The market determines how often producers ramp up and/or produce (Oluwatayo *et al.*, 2003). Marketing systems in developing nations are depicted by functional ineffectiveness that limits market performance (Obasi, 2008). Market performance is a measure of how the market process is executed and achieves its objectives (Eronmwon *et al.*, 2014). Determining the marketing margin is important in market analysis. The marketing margin for a specific produce is the difference between the price paid by the consumer for the final commodity and the amount received by the producer (Arene, 2003; Toure and Wang, 2013). This is an essential factor in market performance and efficiency analysis (Achike and Anzaku, 2010). Marketing effectiveness is a key factor in determining market performance. The importance of agricultural marketing cannot be over emphasized. However, market margins in agricultural marketing have been reported to be low (Iheke, 2010).

2. METHODOLOGY

2.1 Study Area

The study was conducted in Tilden Fulani Main Market, Toro Local Government Area (LGA), Bauchi State, Nigeria. The LGA has a total area of 6932 km²; with a gross population of 350,000, which is projected to reach 499,586 in 2018 with an annual growth rate of 3% (NBS, 2012). Toro Municipality is a hilly area with an altitude of 100m; with coordinates at longitude 9°N and 12°E and latitude 8°N and 11°E. Located in the Sudan Savannah Zone of Nigeria, it has mean annual rainfall of 830mm to 1,100mm from April to October, with mean temperatures of 35°C in the lowlands and 31°C in the highlands (NBS, 2012).

2.2 Method of Data Collection

Structured questionnaires drafted based on the study objectives were used to collect primary data.

2.3 Sampling Procedure

Purposively, Tilden Fulani Main Market was selected in Toro, Bauchi state, due to the large population of grain marketers in the area. Random sampling technique at constant proportionality of 0.1 (10%) (A fixed ratio or fraction of one variable quantity to another) was used to select respondents for this study; 90 respondents from a sample frame of 902 pearl millet traders were selected for the survey, in synergy with local enumerators. This was validated at 95% level of confidence and 10% error margin using sample size calculator (raosoft).

2.4 Analytical Techniques

Collected data was analyzed using descriptive statistics, analysis of market performance (marketing margin and efficiency); ordinary least squares (OLS) regression and the coefficient of Gini index.

Market Performance: Marketing system efficiency minimizes the costs of the marketing process. It ensures higher yields for growers while providing end users with a quality product at a reasonable price. Marketing margin and marketing efficiency analysis were employed to measure market performance.

2.4.1 Market Margin

Pearl millet market performance was evaluated by calculating the marketing margin. Market margin (profit) is the price difference at various market levels in a marketing system. Market margin estimates the portion of the final sale price earned by a particular class of dealers within the marketing chain. Howbeit, the term can also be used to describe the difference between producer and consumer prices for the same quantity and quality of a product, or as the price difference between two points in the marketing chain. Market margin (profit) is essential in measuring trade transactions, as it indicates how much profit a trader will make on the sale of goods. The size of the market margin represents the amount of value (profit) addition to the marketing system. Market margin is made up of various factors: Cost of marketing services, gross revenue and net revenue (profit). Marketing cost analysis measures the amount spent on each marketing activity. It also compares the marketing costs incurred by different parties in the distribution channel. Marketing margin analysis was calculated by comparing the difference between selling price and cost price of pearl millet at various transaction levels. For the calculation, we used the following formula shown in equation (1).

$$MM = P_2 - P_1 \quad (1)$$

Where: MM = margin at transaction level 1 and 2 in ₦ (Nigerian Naira) /kg; P₁ = farm gate price at transaction level 1 (cost price and cost of marketing), in ₦/kg; and P₂ = market price at transaction level 2 (selling price) in ₦/kg.

2.4.2 Marketing Efficiency

Marketing efficiency is the ratio of marketing profit to marketing cost (Sreenivasa *et al.*, 2007). Marketing efficiency is about maximizing the ratio of output to input. Marketing effectiveness is the most commonly used measure of market performance. Improving marketing efficiency is a general goal of smallholders, wholesalers, retailers and agro-commodity marketers. The study uses the following marketing efficiency formula shown in equation (2):

$$M. E. = \text{Marketing margin (profit)} \div \text{Marketing costs} \quad (2)$$

Decision Rule:

If M.E. = 1, it denotes efficient marketing.

If M.E. < 1, it denotes inefficient marketing.

If M.E. > 1, it denotes highly efficient marketing.

2.4.3 Ordinary Least Square (OLS) Regression

Ordinary least squares (OLS) regression was used to ascertain the variables that influence the market margins of the respondents. The OLS regression model was the best fit and was chosen as the principal equation based on the aggregate of significant factors, coefficient sizes, numeric and economic measurements'. OLS regression was used to determine the

impact of specific variables on marketing margins (Wissmann *et al.*, 2007; Greene, 2002). The model in its implicit form is presented in equation (3):

$$Y_i = \beta_0 + \beta_i X_i + e_i \tag{3}$$

Where: Y_i = Market margin (₦/kg); β_0 = intercept; x_i = vector of predictor variables (explanatory variables); β_i = vector of estimated parameters; and e_i = residual term

The model in its explicit form can be expressed in equation (4) as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e_i \tag{4}$$

Where: Y = Marketing margin [₦ (Naira) /100kg bag]; β_0 = intercept; β_1 - β_6 = Coefficient of parameters to be investigated; x_1 = Gender (male =1; female =0); x_2 = Marketing experience (years); x_3 = cost price (₦); x_4 = Quantity sold (number of bags); x_5 = Marketing cost (₦); e_i = residual term.

2.4.4 Gini Coefficient

The Gini coefficient method is a statistical variance measure intended to represent the variance in income among respondents in the i^{th} class. This is the most conventional estimate of income inequality. The coefficient of Gini index varies from 0 to 1; with 0 implying equality in income distribution and 1 implying inequality (Wooldridge, 2000). The closer the Gini coefficient is to zero, the greater the degree of equality in income distribution among the respondents. Similarly, the closer the value is to unity (1), the greater the degree of inequality. In other words, Gini coefficient therefore measures the degree income disparity among respondents. The Gini Coefficient (G.C) is presented in equation (5) as:

$$G = 1 - \sum X_i Y_i \tag{5}$$

Where: X_i = percentage of traders in the i^{th} class; Y_i = percentage of trader's gross income in the i^{th} class; \sum = Summation; and $X_i Y_i$ = proportionate values of X and Y in the i^{th} class.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Profile

Table 1 shows the socioeconomic profile of Pearl Millet traders. The finding shows that average respondents age was 39.3 years old. This means that majority of the respondents belong to the working population and therefore may take higher enterprise risks related to commodity trading. They are expected to be able to use available resources effectively and efficiently. This finding conforms to Nwaiwu *et al.* (2012) who reached similar conclusions in a study on marketing efficiency. The average years spent in school was 6.4 years; suggesting that majority of the respondents have primary education. This is useful hence the educational level of respondents increases not only their productivity but also their capacity to comprehend modern practices. This factor influences the marketing of pearl millet in the study area. Based on the researches, they suggested that the educational background of respondents increases their versatility and equips them with other skills that will enhance their capacity to comprehend and utilize available innovations that drive increased marketing activity. Thus, education mitigates barriers in trade transactions. The mean household population was 8 people; implying that the respondents have reasonable household sizes. A studies found that more people in the household worked; and as a result, higher household incomes, *ceteris paribus*, and thus improved household welfare (Iheke, 2010). Additionally, average mean household size of 6 persons was reported by (Nwaiwu *et al.*, 2012). Pearl Millet's average marketing experience was 10 years; implying that traders have a sufficient number of years of experience in the enterprise and that a high degree of practical knowledge is required to master the marketing challenges relevant to the enterprise. This period would have exposed them to various challenges associated with Pearl Millet trading and therefore would have more adaptive strategies to marketing challenges; hence better profitability. As a result, experienced marketers have better comprehension of marketing systems, situations/circumstances and price dynamics. A study posited that the respondents trading experience improved marketing efficiency compared to their educational background (Nwaiwu *et al.*, 2012). The respondents' average monthly sales were 4 bags. This suggests the respondents sold minimal quantities of their commodities; an indication that the business was relatively viable in the study area. This suggests that most of the Pearl Millet traders were predominantly retailers. This corroborates with who posited related outcomes on agricultural produce trading (Ugwumba, 2009).

Table 1: Summary Statistics of Respondents Socioeconomic Characteristics	
Variable	Mean
Age(years)	39.3
Educational level (years)	6.4
Household size (population)	8.1
Trading experience(years)	10.6
Bags sold (number)	4.2

Source: Field survey (2021)

3.2 Marketing Channels for Pearl Millet

Figure 1 shows the movement of Pearl Millet through the market chain. It reveals the relationship between market participants in terms of the proportions of goods that pass through various channels. A comparison of Pearl Millet channels was made on the basis of the percentage (%) of Pearl Millet volume flowing via various mediums; also, the market participants procured the commodity from multiple sources. Seven channels through which Pearl Millet flows across the market chain in the study area were identified. The market channels with the highest percentage volume of sales were channel 3 (29%), channel 4 (17%), channel 6 (15%) and channel 5 (13%). Thus, channel 3 had the highest percentage sales volume and trade preference; attributable to the fact that the produce are bought in bulk and sold in larger quantities in this channel, thus minimizing operating expenses. Comparatively Channel 1 was the least preferred and processed only 3% of farmers' produce. Trading through wholesalers and middlemen was a safer way for farmers to obtain bulk purchases than trading with retailers or end-users that processed or bought smaller amounts. The result also revealed that the respondents traded with multiple clients. The findings also revealed a preference for transacting directly with the producers (farmers) and wholesalers, due to relatively low market prices charged by these participants; to resell at good remunerative prices. This result conforms to who reported related outcomes on marketing channels (Ojo *et al.*, 2014). Additionally, posited a related result on agricultural produce marketing (Onuwa *et al.*, 2017).

Channel 1: Farmers → End users = 3%

Channel 2: Farmers → Retailers → End users = 5%

Channel 3: Farmers → Wholesalers → End users = 29%

Channel 4: Farmers → Wholesalers → Retailer → End users = 17%

Channel 5: Farmers → Middle-men → Wholesalers → Retailers → End users = 13%

Channel 6: Farmers → Middle-men → Wholesalers → End users = 15%

Channel 7: Farmers → Middle-men → End users = 8%

Figure 1: Pearl Millet Market Channel Flowchart

3.3 Market Performance

Table 2 shows the market performance (profit and efficiency) results. The market margin estimate was ₦5,200 per 100kg bag; indicating that marketing Pearl Millet is a relatively viable enterprise in the area under study. Furthermore, the estimated market efficiency ratio was 0.30, which means that pearl millet trading in the area was inefficient. This result is reported comparable market margins and efficiency ratio for harvested produce (Iheke, 2010).

Table 2: Pearl Millet Marketing Margin and Efficiency	
Variables	Cost [₦/bag (100kg)]
(A) Sales income	22,400
Gross sales income	22,400
(B) Marketing expenditure:	
i. Cost per unit	16,200
ii. Transport expense	300
iii. Market/union levies	150
v. Storage expense	200
vi. Packaging & handling expense	350
(C) Gross marketing expenditure	17,200
(E) Trade profit (A-C)	5,200
(F) Index of Marketing efficiency (M.E.I) (E/C)	0.30

Source: Field survey (2021)

3.4 Determinants of Market Margin

Table 3 shows the analysis of regression. Ordinary Least Square (OLS) regression was used to determine the effect and variables influencing pearl millet market margin among respondents in the area under study. The F-ratio (4.381) had significance level of 5% ($P < 0.05$), which means that the regression model variables (x_i) precisely estimates the dependent variable (Y_i). Thus, the regression model fits the data set well, indicating a linear relationship between the variables. The estimated regression coefficient (R^2) was 0.707; thus, 71% variation in pearl millet marketers' margin was explained by the independent variables in the regression model, while the remaining 29% that was not explained could be attributable to omission or non-specification of variables and the residual term. Therefore, the interpretation of the regression result shows: Marketing experience: The marketing experience coefficient (0.441) was positive at 5% level of significance. Thus, the amount of years the respondents spent in the marketing function has a direct impact on their marketing experience; and as such, improving agricultural produce marketing effectiveness over a period of time. This finding is supported by (Onuwa *et al.*, 2022; Onuwa *et al.*, 2017) who posited related findings on profitability of agricultural produce marketing.

Farm-gate price: The farm-gate (cost) price coefficient (-0.72) was

negative but had 5% significance level. This means that when the price of goods inflates, the demand declines. As a result, a decrease in the amount of goods sold affects the margins that can be obtained. This conforms to who reported comparable outcomes on profitability of agro-commodity marketing.

Quantity sold: The sales quantity coefficient (0.463) was positive at 5% level of significance. This means that Pearl Millet merchants earned more profits as their sales volume accrues. This factor is affected by the forces of supply and demand, which also determine market equilibrium. This finding is on agricultural product marketing by (Ugwumba, 2009; Onuwa *et al.*, 2017).

Marketing Costs: The marketing costs coefficient (-0.51) was negative but had 5% level of significance. This means that increasing marketing costs affects the number of bags sold. Marketing costs for agricultural products are influenced by the costs of various market functions. This factor has a reverse correlation with market margins; so the higher the rates, the smaller the margins Pearl Millet traders can earn. In order to increase supply and profitability, a policy aimed at reducing marketing costs is necessary. A studies reported a related outcome among participants in agricultural produce marketing (Ayoola and Zeven, 2010).

Table 3: Factors that Influence Pearl Millet Market Margins

Variable	Coefficient	Standard Error	T-Ratio
Constant	3.155**	1.213	2.568
Gender (X_1)	0.764 ^{n.s}	0.248	1.4
Market Experience (X_2)	0.441**	0.156	2.827
Cost price (X_3)	-0.72**	0.26	-2.769
Quantity sold (X_4)	0.463**	0.177	2.616
Marketing cost (X_5)	-0.51**	0.191	2.67
R^2	0.707		
F-Ratio	4.381		

Source: Field survey (2021); **= Significant at 5% ($P < 0.05$) Level; ^{n.s} = Not Significant

Table 4: Estimation of Income Disparity Among Pearl Millet Traders

Income class (₦)	Frequency	% (X)	Gross income (₦)	% Gross income (Y)	ΣXY
≤49,999	59	65.6	1,008,000	64.3	0.42
50,000-99,999	25	27.8	336,000	21.4	0.06
≥100,000	6	6.7	224,000	14.3	0.01
Total	90	100	1,568,000		0.49
Gini coefficient: 0.51					

Source: Field survey (2021)

Table 5: Distribution According to Pearl Millet Marketing Constraints

Constraint	Frequency	%
Inadequate capital	75	83.3
High cost of marketing	71	78.9
Inadequate price information	55	61.1
Poor market infrastructures	42	46.7
Inadequate storage facilities	30	33.3
Price volatility	25	27.8
Exploitation by middlemen/ agents	16	17.8

Source: Field survey (2021); *Multiple responses were allowed

3.5 Income Disparity (Inequality)

Table 4 revealed that the computed index of Gini coefficient for Pearl Millet traders in the study area was 0.51. This index indicates an average level of income disparity (inequality) in the sales income of the respondents; attributable to marketing inefficiencies and volume of trade transactions of market participants. This conforms a comparable outcome on agricultural produce marketing by (Onuwa *et al.*, 2017).

3.6 Constraints of Pearl Millet Marketing

Table 5 shows the major constraints of marketing Pearl Millet in the area under study. These constraints include inadequate capital (83.3%), cost of marketing (78.9%), inadequate price information (61.1%), poor market infrastructures (46.7%), inadequate storage facilities (33.3%), price volatility (27.8%) and exploitation by middlemen/ agents (17.8%). This corroborates with (Onuwa *et al.*, 2022; Nwaiwu *et al.*, 2012) who reported related outcomes in studies on agricultural produce marketing.

4. CONCLUSIONS

This study analyzed the factors influencing the marketing margin and income disparity among Pearl Millet traders at Tilden Fulani Main Market, Toro, Bauchi State, Nigeria. The study revealed that socioeconomic factors affected Pearl Millet marketing in the study area. A comparison of Pearl Millet channels was made on the basis of the percentage (%) of Pearl Millet volume flowing via various mediums; also, seven channels were identified in this study. Additionally, Pearl Millet marketing is a relatively profitable business venture as indicated by the estimates of the marketing margin; however, marketing efficiency was low. Also, regression model variables including marketing experience, cost price; quantity sold and marketing cost significantly influenced the likelihood of variation in the market margin. Furthermore, the index of Gini coefficient indicated an average level of income disparity (inequality) in the sales income of the respondents. Furthermore, they identified constraints were very critical and affected Pearl Millet marketing. Policies should therefore aim to remedy these limitations in the area under study. According to the results

of this study, the following suggestions are proposed: Implementation of measures to improve market participants' access to agricultural finance and enterprise funding; implementing policies to subsidize the cost of marketing functions and the use of modern transportation facilities to ensure effective exchange of goods. Introduction of modern information and communication tools (ICT); to effectively disseminate market information among market participants. Stakeholders and relevant institutions should supply essential market infrastructure and interventions. Introducing modern storage facilities to extend the shelf life of agricultural products; developing and implementing policies to mitigate agricultural price instability and agent exploitation; Adoption of policies to improve market performance and reduce revenue discrepancies among merchants. Such policies may include the formation of small-scale marketing schemes, the use of contractual arrangements and the establishment of online marketing systems that provides information on supply sources and the level of domestic production per annum.

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