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Original Article

The Impact of Market Efficiency on Spice Production among Smallholder Farmers in Zanzibar

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Market Information, Price Fluctuations, Returns, Spices, Production.

ABSTRACT

This study aimed to examine the impact of market efficiency factors on spice production within the smallholder farming community in Zanzibar. An explanatory research design was used, involving a stratified random sample of 269 smallholder farmers, whereas Structural Equation Modelling (SEM) using IBM SPSS Amos 28 was used to test the hypotheses. Structured closed-ended questionnaires were administered randomly to the selected strata of respondents. The results revealed that access to market information and returns has a significant positive impact on spices production, whereas price fluctuations have a significant negative impact on production. The study concluded by affirming that access to market information and returns positively impacted spice production, whereas price fluctuations had a detrimental effect on it. The study therefore recommended that Governments and Policymakers assist in seeking platforms and channels that provide timely insights regarding market conditions, to enhance decision-making among smallholder farmers.

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INTRODUCTION

The increasing interest in the global fast-growing food industry has mainly centred on spices as an international cuisine, cooking variety, natural culinary, an additive of taste, input in pharmaceutical products, and other health benefits are some of the factors propelling its market expansion (World Bank, 2022; ISB, 2023). Market efficiency factors influencing spices production has been a focus of many scholars today in trying to address the challenges facing the sector; Scholars such as (Dhaka *et al.,* 2023; Bhandekar *et al.,* 2023; Poudyal *et al*., 2023) suggest an association between production and market structure; moreover have concluded that declining spices production is associated with limited access to market information, declining returns forcing farmers opting to scale down production and switching to other crops with more profit margin.

Akerele *et al*. (2023), Kumar *et al*. (2023), and Dhaka *et al*. (2023) suggested that limited access to market information negatively influences spices production in the majority of farmers; however, other scholars reported a positive correlation between market prices and crop yield (Hickes *et al.,* 2023).

Moreover, studies have shown that, uncompetitive prices offered by buyers and supply chain intermediaries at the farm gate, price instability due to frequent changes in demand and supply, lack of organized market information, force farmers to keep spices in storage for a long time with the ambition of fetching higher prices in future were reported to be the major marketing constraints in spices subsector (Dessie *et al.,* 2019; Hibistu, 2020; Kumar *et al*., 2023).

Similar and related factors were raised by Dessie *et al.,* (2019); Raziya (2020); Shasani *et al*., (2020); Biswajit (2023); Santosa & Wahyuningtyas (2023), suggested lack of reliable and structured market information, low prices, poor returns, problem in price setting, lack of marketing networks were observed to be the major market related challenges facing spice farmers.

The extent to which market efficiency impacts spice production in Zanzibar is not well studied. Thus, the study objectives were to assess the effect of access to market information on spice production among smallholder farmers in Zanzibar. Secondly, to assess the effect of price fluctuations on spices production among smallholder farmers in Zanzibar and lastly to assess the effect of returns on spice production within the smallholder farming community in Zanzibar. Moreover, the study was considered important to policymakers, Government authorities and smallholder farmers in improving the spice subsector.

LITERATURE REVIEW

The study was accrued from the Efficient Market Theory (EMT) as it explains the optimum elements constituting an efficient market. Likewise, the research constructs were developed from this theory. The EMT states that market prices fully reflect available information in an efficient market: An efficient market is defined as a market that adjusts rapidly to new information (Fama, 1991). Market information is the central focus of the EMT, which is referred to as the flow of data or truths formulated in the sequence of signs of a certain language from the sender to the receiver (Anetta, 2016). Access to information enables farmers to plan for production, harvesting, and selling according to market demand and, in some cases, to choose the optimal marketing channel (Kwingwa *et al*., 2023).

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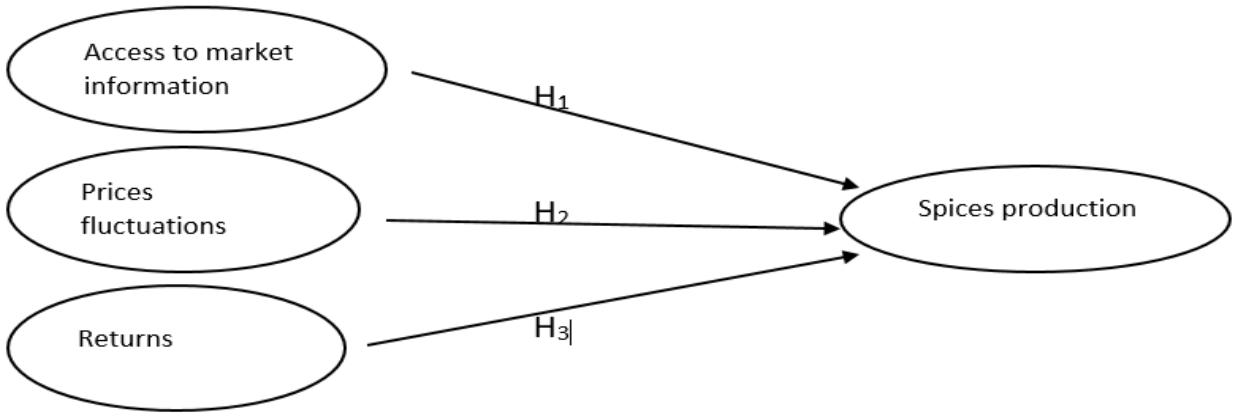
Price fluctuations is another factor which can impact the production and trading of spice; Ramazanov *et al*. (2018) add that for agricultural products, price fluctuations pose a challenge to small-scale farmers, causing capital loss and shifts to other activities, making it important for producers to monitor and analyse price changes to make informed decisions.

Nair (2013); Kamrul *et al*. (2017); Hasan & Uddin (2017); Roushon *et al.* (2023) indicated that the changes in values of spice prices has a significant negative influence on production, such that it was recommended to keep spice price fluctuation under control to uplift production and supply.

However, frequent price fluctuations undermine the capacity of the economy to generate gains in output as they erode the value of investment and decline production (Bank of Tanzania, 2023). Other related studies confirm a positive correlation between returns and production (Cariappa & Chandel, 2020; Asidawati *et al.,* 2022; Babu & Ramchandra, 2023; Dhaka *et al.,* 2023). Returns are considered a motivation factor to enhance production among smallholder farmers (Sahu *et al*., 2019). The study proposed a conceptual framework showing the relationship and dependency among variables, as shown in Figure 1

Figure 1: **Conceptual Framework Underlying the Study**



Source: *Theoretical and Literature Review (2022)*

The following hypotheses were tested from the theoretically developed model to determine the association between variables.

> *H_1: Access to market information has a significant positive effect on spices production among smallholder farmers in Zanzibar.*
>
> *H_2: Price fluctuations have a significant negative effect on spices production among smallholder farmers in Zanzibar.*
>
> *H_3: Returns have a significant positive effect on spices production among smallholder farmers in Zanzibar.*

METHODOLOGY

Study Area

According to the Zanzibar Research Agenda (2020), spices occupy a prime position in the history and agricultural system of Zanzibar. Spices have been a major foreign exchange earner for the last one and a half centuries. This study was carried out in 11 Districts of Zanzibar (Unguja and Pemba), namely: Kati – Unguja, Magharibi - A, Magharibi - B, Kaskazini – A, Kaskazini – B, Kusini Pemba, Mjini Pemba, Wete, Micheweni, Chake Chake, and Mkoani.

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Research Philosophy

This research employed a positivist research philosophy, which aligns with the perspective of natural scientists. Positivism involves engaging with an observable social reality to generate generalisations similar to laws. It relies on universalism through observable and measurable facts, causal explanations, and predictions. This approach is typically deductive, characterised by structured methodologies, large sample sizes, quantitative measurements, and specific data analysis techniques (Saunders, 2016).

Research Design

Following the positivist approach, an explanatory study design was used to explain the causal and effect relationship between the variables. Explanatory research design is useful to investigate the relationship between variables of a phenomenon in order to establish a causal relationship between variables (Al-Ababneh *et al.,* 2020). Saunders *et al*. (2012) articulate that an explanatory research design seeks to explain the relationship between variables related to the problem.

Research Strategy

In order to enhance outcomes and collect valuable data, a survey strategy was chosen as a suitable research approach for this study. This method was selected for its effectiveness in concluding the population. The survey approach was utilised due to its association with tools requiring numerical data inputs related to the research subject. Additionally, it was deemed appropriate for establishing causal relationships between variables as emphasised by Saunders *et al.* (2012).

Sampling Frame

The sampling frame for this study was based on the United Republic of Tanzania – National Sample Census of Agriculture (NSCA) National Report, which was funded by the World Bank, OCGS, USAID, EU, and USDA and published by the National Bureau of Statistics (NBS) in August 2021. The report covers the agriculture census, providing the baseline data on agricultural statistics in Tanzania. According to NSCA, there were 890 smallholder farmers in the 5 regions of Unguja and Pemba. The report helped the researchers to identify the distribution of farmers in all regions, as summarised in Table 1

Table 1: **Summary of Distribution of Smallholder Spice Farmers by Regions**

Smallholder spice farmers; Category (strata)	**Region**					
	Kaskazini Unguja	**Kusini Unguja**	**Mjini Magharibi**	**Kaskazini Pemba**	**Kusini Pemba**	**Total (N)**
Non-perennial farmers (short-lasting spices)	90	74	124	33	57	**378**
Perennial farmers (long-lasting spices)	56	24	28	18	74	**200**
Mixed farmers	47	22	112	33	29	**243**
Supporters of agriculture and post-harvest activities	15	12	15	10	17	**69**
Total	**208**	**132**	**279**	**94**	**177**	**890**

Source: *URT National Sample Census of Agriculture – 2021*

Sampling Technique

The study used stratified sampling since the population was grouped in strata depending on the type of farming; Simple random sampling was then used to acquire respondents from the specific strata. In this study, at the first stage, the population was divided into four categories according to NSCA grouping. The selection of individual smallholder farmers in a specific Shehia was done randomly in the field, assisted by the heads of Shehia based on

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the pre-established categories, this being the second stage of sampling. According to Kothari (2008), randomisation ensures the sample selection is bias-free. However, developing large samples and dividing the population into groups is useful to minimise sampling error.

Sample Size

The Krejcie & Morgan Formula for sample size calculation for a finite population was used in obtaining the sample size "n". The sample size was calculated at a 95% confidence level and 5% margin of error.

$$n = \frac{\chi^2 Np(1-p)}{e^2(N-1) + \chi^2 p(1-p)}$$ **(Krejcie & Morgan, 1970)**

n = Sample size

e = 5 % precision (acceptable error of sample size) = 0.05

X^2= Chi square, df = 1, at 95% confidence level = 3.841

N = Population size = 890

P = Population proportions assumed to be 0.5

$$\text{Sample size "n"} = \frac{3.841 \times 890 \times 0.5\,(1-0.5)}{0.05^2\,(890-1) + 3.841 \times 0.5\,(1-0.5)} = 269$$

The sample size of 269 smallholder farmers was selected from different but related strata. The respondents were picked randomly from the identified strata as tabulated in Table 2. Memon *et al.* (2020) suggest that SEM requires a minimum sample size of 200 and a maximum of 400 sample size beyond that, the model could be over-sensitive. The researcher ensured this condition was met by selecting an adequate sample size, which led to accurate output.

Based on these grounds, a sample size of 269 respondents was thought to be optimal to develop a perfect measurement and structural model. The developed SEM models were analysed using IBM SPSS Amos software version 28.

Table 2: **Distribution of Sample Size "n"**

Smallholder spice growers; Category (strata)	**Region**					
	Kaskazini Unguja	**Kusini Unguja**	**Mjini Magharibi**	**Kaskazini Pemba**	**Kusini Pemba**	**Total (n)**
Non-perennial farmers	27	22	39	11	19	**118**
Perennial farmers	17	6	7	6	23	**59**
Mixed farmers	14	6	35	11	9	**75**
Supporters of agriculture and post-harvest activities	3	3	4	3	4	**17**
Total (n)	**61**	**37**	**85**	**31**	**55**	**269**

Source: *Researcher's manipulation*

Data Collection Methods

Primary data was collected through a self-administered structured questionnaire interpreted in the Swahili language. The survey questionnaire had two sections: the first section included general questions about the respondents, while the second section of the questionnaire consisted of a series of statements presented in a seven-point Likert scale

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format. The researcher opted for a seven-point Likert scale rather than a five-point Likert scale based on the findings of Joshi et al. (2015) and Subedi (2016), which suggest that the Seven-point Likert scale is more sensitive to statistical tests, yielding stronger results since it provides participants with more choices to indicate the strength of their responses.

Data Processing and Analysis

The data were initially analysed descriptively to determine normality, standard deviation, variance, mean, frequencies, missing data, outliers, and linearity, as suggested by Kaur *et al.* (2018) and Sohil (2019). It is important to examine data for issues related to missing data, outliers, linearity or nonlinearity, normality or nonnormality, which affect statistical methods and especially SEM applications (Maja *et al*., 2020). Table 3 shows the parametric tests' assumptions results.

Table 3: Parametric Tests Assumptions

Assumption	Test	Acceptable values	Acquired values
Normality	Skewness (s)	$-2 \leq s \leq +2$	-1.633 – 0.258
	Kurtosis (k)	$-10 \leq k \leq +10$	-1.390 – 0.587
Missing data	MCAR	No missing values	8 responses had missing values & deleted
Multicollinearity	VIF	VIF < 5	AMI: 1.100 PF: 1.627 RE: 1.681
	Tolerance	Tolerance > 0.2	AMI: 0.909 PF: 0.615 RE: 0.595
Linearity	Regression/ANOVA	Sig < 0.05	AMI*SP: 0.023 PF*SP: 0.011 RE*SP: 0.036
Homoscedasticity	Levene statistics	Sig > 0.05	0.661
Outliers	Box plot	No significant outliers	1 response had an outlier and retained

MCAR: Missing Completely at Random
ANOVA: Analysis of Variance
AMI: Access to Market Information
PF: Spices Production
VIF: Variance Inflation Factor
RE: Returns
SP: Spice Production
Sig: Significant

Source: *Researcher's manipulation*

FINDINGS

Demographic Information

This study measured age in years, which was categorised into four groups as summarised in Table 4. The majority (48.3%) of the respondents fell in the age range between 25 to 44, which reflected people with moderate to adequate business experience, economically active, and able to make individual production decisions.

Table 4: Demographic Statistics for Age, Gender, and Marital Status

	Frequency	Percent	Cumulative percent
Age (Years)			
Less than 18	1	4	4
18 – 24	39	14.5	14.9
25 – 44	130	48.3	63.2
45 - 65	99	36.8	100

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Gender			
Male	176	65.4	65.4
Female	93	34.6	100
Marital status			
Not married	72	26.8	26.8
Married	174	64.7	91.4
Divorced	6	2.2	93.7
Widow	13	4.8	98.5
Separated	4	1.5	100

Source: *Field Data, 2024*

Reliability and Validity Assessment

The researcher assessed the reliability of a set of items used to measure particular attributes of a factor by checking the internal consistency using the Composite Reliability (CR) values. Hair *et al.* (2010) and Tabachnick & Fidell (2013) suggested that a CR value exceeding 0.5 is deemed significant, while a CR value of 0.6 or higher is considered more desirable in research. Convergent validity was assessed using Average Factor Loadings (AFL), Average Variance Extracted (AVE) values, where a value of 0.5 or higher was considered acceptable (Fornell & Larcker, 1981). Discriminant validity was assessed by comparing the square root of the AVE value for a construct with the correlation estimates between the constructs. Hair *et al.* (2010) suggest that where the AVE for a construct is greater than the square of all correlation estimates between the constructs, the discriminant validity is significant. Table 5 gives a summary of the results.

Table 5: Reliability and Validity Assessment

Variable	Variable Item	Standardised regression weights (AFL>0.5)	Composite Reliability (CR) (CR>0.6)	Average Variance Extracted (AVE) (AVE>0.5)	Correlation^2	Discriminant Validity AVE>Correlation^2
AMI	AMI1	.851	0.90186	0.6554	0.4295	Sig.
	AMI2	.759				
	AMI3	.911				
	AMI4	.701				
PF	PF1	.865	0.86014	0.6724	0.4521	Sig.
	PF2	.811				
	PF3	.782				
RE	RE1	.854	0.89797	0.7463	0.5569	Sig.
	RE2	.811				
	RE3	.923				
SP	SP1	.770	0.906578	0.7651	0.5853	Sig.
	SP2	.908				
	SP3	.937				
AFL: Average Factor Loading			**Sig: Significant**		**AMI: Access to Market Information**	
PF: Prices Fluctuations			**RE: Returns**		**SP: Spices Production**	

Source: *Field Data, 2024*

The results for model fit indices were; Chi-square/Degree of freedom (CMIN/DF) = 1.410, Goodness of Fit Index (GFI) = 0.953, Adjusted Goodness of Fit (AGFI) = 0.928, Comparative Fit

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Index (CFI) = 0.988, Tucker-Lewis Index (TLI) = 0.985 and Root Mean Square Error of Approximation (RMSEA) = 0.039 which reflected good fitness of the model as referred to threshold criteria for the model fit proposed by Awang (2011). The model should be considered to have a good fit when it has the following minimum fit indices values: CMIN/DF ≤ 3, GFI >0.90, AGF>0.90, CFI>0.90, TLI>0.90, and RMSEA<0.08 (Awang, 2011).

Model Path Coefficients and Hypothesis Testing

SEM was performed to determine the level of significance of the variables (AMI, PF, and RE) concerning SP. Table 6 summarises the SEM results and hypothesis testing.

Table 6: SEM Results and Hypothesis Testing

	Path	Hypothesis		C.R.	P	Standardized Estimate (γ)	Results
AMI	---->	SP	H_1	1.997	.028	.270	Supported
PF	---->	SP	H_2	-3.117	.002	-.228	Supported
RE	---->	SP	H_3	2.984	.029	.317	Supported

C.R: Critical Ratio

Source: *Field Data, 2024*

- Standardised estimate should be at least 0.2 to be considered statistically significant: ($0.2 < \gamma$)
- C.R. value of greater than 1.96 is considered significant: (C.R.> 1.96)
- *p*-value of less than 0.05 is considered significant: ($0.05 > p$)

The results of the path of AMI linking to SP revealed a positive path of the coefficient, $\gamma = 0.270$ (standardised estimate), which implied that access to market information is positively related to Spices Production. Moreover, the path of PF connecting to SP was indicated, a negative path of the coefficient, $\gamma = -0.228$ (standardised estimate), which implied that price fluctuations is negatively related to spices production. Similarly, the path of RE linking to SP showed a positive path of the coefficient of $\gamma = 0.317$ (standardised estimate), implying that returns are positively related to spices production.

DISCUSSIONS

Access to Market Information and Spices Production

Access to market information has been associated with several advantages among smallholder farmers and other market participants; It enables smallholder farmers to make strategic decisions based on accurate data rather than speculation, helps in identifying potential risks and uncertainties, but also provides insights into consumer needs and preferences (Grunert, 2005; OECD, 2013).

On the other hand, limited access to market information among smallholder farmers can have several negative outcomes, impacting production, income, and overall livelihoods. Farmers may face obstacles, including limited ability to secure fair prices for their products (Aker, 2010; Nugroho, 2021).

Price Fluctuations and Spices Production

Price Fluctuations may have implications for producers, consumers, and market stability. Consumers may change their purchasing behaviour in response to price fluctuations, seeking alternative products or adjusting their consumption patterns based on price changes (Schmitz & Karp, 2002). Understanding price fluctuations is crucial for consumers, producers, and policymakers as they can impact purchasing decisions, production behaviours, and overall market stability (Blanchard, 2017).

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Returns and Spices Production

The study confirmed the fact that the higher the returns, the more the production, since the farmers are motivated to produce more. Understanding how returns influence production can help producers make strategic choices that optimise their operational efficiency and profitability (Salvatore, 2015).

CONCLUSIONS

Theoretical Contributions

The researcher tested the EMT in the context of spice production. Based on Confirmatory Factor Analysis, the study attested and confirmed the EMT in explaining the impact of market efficiency factors on spices production. The results confirmed the significance and direction of the relationship among the variables under study. The results found that there is a positive and significant relationship between access to market information towards spices production. In relation to the second objective, the study concluded that price fluctuations had a negative and significant effect towards spices production. With respect to the third specific objective, the study concluded that returns had a positive and significant effect on spices production. The uplifting returns led to increased spices production. Hence, access to market information, price fluctuations and returns become important determinants of spices production.

Practical Contributions

Based on the findings, access to reliable market information is essential to enhance spice production. Governments should assist smallholder farmers in seeking platforms and channels that provide timely insights regarding market conditions, consumer preferences, and competitor activities to enhance their decision-making. The stakeholders, parastatal organisations, and companies could provide support by creating infrastructure to support the instant dissemination of information in marketplaces.

Understanding and anticipating price changes can help farmers mitigate risks associated with price uncertainties, thereby stabilising their earnings. Similarly, profitability and hence returns could be improved through the facilitation of subsidised inputs, improving market prices by respective regulatory authorities, and encouraging efficient production practices.

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