# Determinants of Clove Exports in Zanzibar: Implications for Policy

*Zanzibar'da Karanfil İhracatının Belirleyicileri:Politika Önerileri*

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## ABSTRACT

**Keywords:**

*Cloves,*

*Exports,*

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**Jel Codes:**

*C22, Q01, Q11*

*Clove is one of the high value spices that have supported the economy of Zanzibar for many decades since the 18 th Century. However, clove production and exports have been declining significantly and consistently since the 1980s. The declining of the clove exports most likely jeopardizes the Zanzibar efforts to improving human development with positive changes in living standards. This paper analyses factors for the declining trend in clove exports using time series data that were collected between 1980 and 2020 and analysed using the vector error correction model, complemented with qualitative data collected from 39 key informants. The time series results show that clove production, producer price, world price, Gross Domestic Product (GDP), and Exchange Rate had positive and statistically significant impact on clove exports in a long-run at 1% level of significance; while Foreign Direct Investment, human population and Cross Capital Formation showed significant negative impact. Only inflation showed insignificant negative impact. Based on qualitative results, there were two major determinants: (i) factors that affected clove production, and (ii) low and fluctuation of the clove price. The time series results coincided with qualitative information. We conclude that some factors affected clove exports indirectly through clove production. Other factors affected exports through fluctuation of clove price. Therefore, we recommend an integrated policy approach that aims at improving clove production and price stabilization in order to rectify the decreasing trend in clove exports.*

## ÖZET

**Anahtar Kelimeler:**

*Karanfil,*

*İhracat,*

*Vektör Hata Düzeltme Modeli,*

*Zanzibar*

**Jel Kodları:**

*C22, Q01, Q11*

*Karanfil, 18. Yüzyıldan bu yana onlarca yıldır Zanzibar ekonomisini destekleyen yüksek değerli baharatlardan biridir. Ancak, karanfil üretimi ve ihracatı 1980'lerden bu yana önemli ölçüde ve sürekli olarak azalmaktadır. Karanfil ihracatındaki düşüş, Zanzibar'ın yaşam standartlarında olumlu değişikliklerle insani gelişmeyi iyileştirme çabalarını tehlikeye atmaktadır. Bu çalışma, 1980 ve 2020 yılları arasında vektör hata düzeltme modeli kullanılarak analiz edilen zaman serisi verilerini kullanarak karanfil ihracatındaki düşüş eğiliminin faktörlerini analiz etmekte ve 39 önemli bilgi kaynağından toplanan nitel verilerle tamamlanmaktadır. Zaman serisi sonuçları, karanfil üretimi, üretici fiyatı, dünya fiyatı, Gayri Safi Yurtiçi Hasıla (GSYİH) ve Döviz Kurunun karanfil ihracatı üzerinde uzun vadede %1 önem düzeyinde pozitif ve istatistiksel olarak anlamlı bir etkiye sahip olduğunu göstermektedir. Doğrudan yabancı yatırım, insan nüfusu ve brut sermaye oluşumu ise önemli ölçüde olumsuz etki göstermiştir. Sadece enflasyon önemsiz negatif etki göstermiştir. Analiz sonuçlarına göre i) karanfil üretimini etkileyen faktörler ve (ii) karanfil fiyatının düşük ve dalgalanması iki ana belirleyicisidir. Buna karşın diğer faktörler, karanfil fiyatındaki dalgalanma yoluyla ihracatı etkilediği tespit edilmiştir. Bu nedenle, karanfil ihracatındaki düşüş eğilimini düzeltmek için karanfil üretimini iyileştirmeyi ve fiyat istikrarını hedefleyen bütünleşik bir politika yaklaşımını öneriyoruz.*

## 1. INTRODUCTION

This paper analyses the determinants of the declining trend in clove exports in Zanzibar. The clove is one of the most common spices on the Island of Zanzibar. It contributes to about 60 percent of the foreign exchange of Zanzibar (Hervé et al. 2014; Bakar 2015; URT 2016; Suda et al. 2020), suggesting that it has significant potential in driving economic growth and development on the Island. Studies like Juma (2010) demonstrate an association between Zanzibar's economy, livelihood, and performance of the clove industry. The same study shows that the economy of Zanzibar and the livelihood of the clove growers improve during periods of rising clove prices in the international markets and vice versa. For instance, the increase in clove prices in the international markets is accompanied by increased foreign exchange earnings, the share of agriculture in the gross domestic product (GDP), and employment in the clove industry. This translates into an improvement in economic growth and social welfare in Zanzibar.

The Island of Zanzibar comprises two sister islands of Unguja and Pemba. In the previous years, Zanzibar was considered a hub for international trade between USA, France, Britain, and India. The Island has fertile soil, arable land, and good climatic conditions for agricultural activities (Moh'd et al. 2017). With that, the economy of Zanzibar mainly depends on the agricultural sector, particularly on exports of cloves and seaweed. Cloves are an essential cash crop and have remained important since the colonial period. This crop is a principal source of revenue in Zanzibar. Nevertheless, the dependence of the economy on clove and seaweed exports implies that there are few commodities for export on the Island. In addition, the clove industry has been affected by recurring and common problems that decrease production and productivity, and some are concerned with the inefficiency of the clove marketing system. According to Hervé et al. (2014) and Moh'd et al. (2017), the problems encompass poor agricultural extension services, the decreasing farm size of cloves, inadequate use of clove processing firms, low producer prices, lack of funds, poverty, monopoly of the Zanzibar State Trading Corporation (ZSTC), increased clove production in other parts of the world, a limited market for Zanzibar clove products, and a lack of involvement of the private sector. Authors like Moh'd et al. (2017) categorize the problems into internal and external problems. While internal factors include price, production-related factors, inadequate funding, a lack of participation in the private sector and poverty, external problems are mainly concerned with the monopoly of the market.

The contribution of traditional agricultural crops to export earnings in the United Republic of Tanzania (URT), of which Zanzibar is a part, fell dramatically from 50 per cent in the 1990s to about 20 per cent in the 2000s (Akyoo and Lazaro 2007). Cloves are not an exception. For instance, between the 1960s and 1970s, the earnings from cloves were high, and therefore, the Island financed the Zanzibar Development Budget by over 80 per cent. However, currently, the clove industry in Zanzibar shows a significant and consistent decrease in production and world market price. For instance, the annual clove production in tonnes declined by 84.4 per cent in the period between the 1970s and 2000s. Similarly, export volumes fell by 60 per cent between 2003 and 2009 and by 89 per cent between 2003 and 2018. Although the world market demand for cloves increased, exports by volume fell from 90 per cent in the 1940s to about 6 per cent in the 2000s, 0.5 per cent in 2012, and 0.12 per cent in 2016 (Masoud 2017; REPOA 2018). This state of affairs has implications on the amount of cloves exported and export earnings, therefore affecting the economy and livelihood of clove growers.

This paper contributes to the international literature on the debate 'why clove exports are showing a decreasing trend in Zanzibar'. This is an area with inadequate information about Zanzibar. The results will help clove stakeholders, including policy makers, to improve the clove industry. Moreover, while considering quantitative analysis as a major empirical approach, the study contributes to innovation of complementing qualitative analysis with time series results. This helps to explain factors that cannot easily be quantified and entered in the regression model.

## 2. LITERATURE REVIEW

### 2.1. Theoretical Review

One of the frequently used theorectical arguments in development economics includes Ricardian hypothesis, which advocates the importance of technological change as the major source of comparative advantage, and Heckscher-Ohlin, which argues for the importance of relative factor endowments as a prime source of trade competitiveness. According to the Ricardian theory, the relative efficiency of producing goods and services determines the direction and magnitude of trade between two countries. In contrast, the Heckscher-Ohlin factor endowment theory predicts that countries with an abundance of one or more of the factors of production (land, labor, and capital) will specialize in commodities that require much of the abundant resources.

The increasing influence of policy on openness to the external world has led to numerous theoretical and empirical studies. Free trade is vindicated in different theories like the theory of absolute advantage (Smith 1776) and comparative advantage (Ricardo 1817). Others include neo-classical models like the Heckscher-Ohlin (Heckscher 1919; Bertil 1935) and New Trade Theory (Krugman 1979; Helpman and Krugman 1987). The free trade policies have been used to support policies of liberalization in developing countries (Sen 2010) as an alternative to the import-substitution policy after the 1970s. Export orientation has been credited for the remarkable economic transformation of many developing countries (Elbadawi 1998). According to Balassa (1990) and Edwards (1993), outward-oriented thinking is critical for economic transformation compared to inward-looking thinking. This implies the development of traditional agricultural exports and diversification into non-traditional exports, particularly in agrarian countries like those in sub-Saharan Africa including Tanzania.

According to Gbetnkom and Khan (2002), there are two schools of thought emanating from classical and modern theories of international trade that explain the determinants of agricultural export growth. First, agricultural exports are mainly determined by demand-side factors such as world market price and exchange rate. These are basically external factors to the exporting country. Thomas and Nash (1991) contend that developing countries' exports essentially comprise primary agricultural products. To that effect, export growth in developing countries depends on industrial growth in developed countries. This can also be interpreted as a low absorptive capacity of foreign markets in terms of accommodating imports from developing countries affects the growth of agricultural exports. The second school of thought focuses on supply-side factors, which are basically internal. According to this school of thought, the production of primary agricultural commodities determines exports, and increased production stimulates the growth of exports (David 2013). In this study, both classical and modern theories of international trade are used as the guiding theories. The premise that we put forward is that Zanzibar has favourable natural ecological and climatic conditions, and therefore, it should specialize in producing cloves for export. Moreover, the international trade of cloves attracts and fosters an environment for Zanzibar to continue producing and exporting cloves.

## 2.2. Empirical Literature

Export trade is one of the most important sources of foreign exchange in a country. Some scholars like Rivera-Batiz and Romer (1991) and Kingu (2014) succinctly support this premise. They argue that export trade stimulates economic growth and development through improvement of balance of payments deficit, enhancing diffusion of technologies, stimulating external demand for domestic products, increasing domestic production and efficient allocation of resources. Empirical literature confirms this premise in countries like Pakistan, Fiji, Vietnam, Tanzania, Turkey and Gabon (Suleiman et al., 2018). Others like Krugman and Venables (1995) contend that export trade tends to kill domestic infant industries particularly in developing countries where the industries cannot compete with those in developed countries. The current study considers export trade as a key for socio-economic development in the sense that the argument of the opponents of export trade can be addressed by an import-substitution strategy using foreign exchange earnings from exports (Rodrigues, 2010).

Studies on determinants of agricultural exports are not conclusive; the findings differ depending on the context. On one hand, Sharma (2001) and Babatunde (2009) determine factors for export performance and show that the exchange rate is a major factor affecting export performance in India and sub-Saharan Africa. In addition, Ahmed (2000) in Bangladesh, Bashir (2003) in Pakistan, and Santos-Paulino (2006) in the Dominican Republic show that export performance is determined by trade liberalization. On the other hand, using co-integration analysis, Menji (2010) shows that export performance in Ethiopia is determined by terms of trade, real effective exchange rate, and foreign direct investment (FDI). In addition, determinants of export in Africa include income per capita, the share of manufacturing in GDP, and FDI (Mold and Prizzon 2008). Other scholars like Kumar (1987) have reported GDP and level of production as determinants of export performance in India.

Gasheja et al. (2017) used the vector error correction (VEC) model to analyse the determinants of Rwanda exports. That study used data from 1976 to 2013. The factors that showed positive and significant impact on export growth rate were GDP, FDI, Industrial Value Added and Savings. Abdulai and Rieder (1995) and Abolagba et al. (2010) in Nigeria show, using ordinary least squares (OLS), that export of cocoa is determined by rainfall whereas the export of rubber is determined by domestic production, producer price, exchange rate, domestic consumption, and interest rate.

The Bank of Tanzania (2005) shows that determinants of agricultural exports include 'extension services, seasonal variation due to climatic changes, decreasing of clove farm size, underutilization of capacity of processing firms, and low farm gate price'. With regard to the importance of clove exports to Zanzibar's

economy, Kingu (2014) revealed that clove exports generate maximum earnings in the long run when the real exchange rate and world market price are taken into consideration.

Other studies have confirmed that differences in productivity and factor endowment explain a small part of trade performance variations over time and across countries (Bergstrand 1990; Bernstein and Weinstein 2002). Moreover, recent evidence suggests factor endowment has greater relative importance over productivity or technology in explaining international trade performance (Amoroso, Chiquiar, and Ramos-Francia 2011). The role of infrastructure in enhancing trade has also been widely discussed in policy circles and in the literature (Bougheas, Demetriades, and Mamuneas 1999; Francois and Manchin 2013; Bouët, Mishra, and Roy 2008; Moïsé et al. 2013). Empirical studies have generally confirmed positive and significant effects of infrastructure quality on trade values in exporting countries.

Both developed and developing countries provide financial and technical support to their agricultural producers for different reasons. Empirical studies assessing the link between domestic subsidies and trade have revealed mixed results depending on the type of commodity and support. Many have argued that the removal of European Union (EU) and U.S. agricultural subsidies could have a significant effect on the world prices of some commodities, such as cotton, tobacco, and soybeans (Bouët et al. 2005; Bureau, Jean, and Matthews 2006). However, the impact of domestic subsidies Global food, financial, and oil markets are increasingly interconnected (Tadasse et al. 2016). Shocks to any of these markets is likely to affect the nature and extent of agricultural trade. The 2007/2008 food price crisis, for example, caused many countries to impose export barriers and relax import restrictions on food products, which further aggravated the problem of price spikes and adversely affected agriculture lower than other cross-border measures (Hoekman, Ng, and Olarreaga 2004; Anderson and Martin 2005). Developing countries do also provide technical, financial, and institutional support to smallholder producers to boost productivity and improve market efficiency, thereby enhancing agricultural exports (Benin, Mogues, and Fan 2012).

A study by Staatz and Dembélé (2007) indicates that agriculture's capacity to contribute to growth and poverty alleviation in Africa has been greatly constrained in the past by underinvestment and miss-investment, in both physical and human capital, resulting in a huge cost to Africans in terms of foregone well-being. Helleiner's (2002) as cited in Bacchetta (2007) also found that FDI has not as yet made a particularly important contribution to African non-traditional export expansion. Oyejide (2007) investigated the critical of African investment codes which place heavy reliance on fiscal and other incentives which may be largely ineffective in attracting FDI and are at the same time quite costly in terms of lost revenue.

Degree of openness of the countries determines the export of primary commodities. Babatunde (2009) empirically investigates the effect of productive capacity (proxy by GDP of SSA countries) on its export by using both random and fixed effect regression of export supply model. The result reveals that GDP has highly significant positive impact on export volumes and export volumes appear to be lower when manufacturing share in GDP is higher. Traditionally, economists have argued that more open economies grow faster. This idea was largely based on the argument that openness improves resource allocation. According to Rodrik (1997) high levels of trade restrictions have been an important obstacle to exports, and their reduction can be expected to result in significantly.

Based on the foregoing theoretical and empirical literature, it is apparent that relevant factors that determine exports are many but differ by country and context. They include supply, demand, and institutional and climatic conditions. Importantly, while Zanzibar's economy substantially depends on clove exports, there is inadequate evidence on the factors that determine clove exports on the Island. In addition, most of the studies that have been done on exports have used OLS modelling, which is a weak estimation method; therefore, the results are not reliable. The reason is that most of the time series data trend over time, so regression between trended series using OLS techniques may produce erroneous but significant results with a high coefficient of determination (Granger and Newbold 1974). The cointegration methods employed by Menji (2010) have the ability to avoid this problem (Engle and Granger 1987). Cointegration methods offer a need for using the error correction model (ECM) for the same reason. Other studies that have used cointegration methods are Mustafa et al. (2016) and Soontaranurak and Dawson (2015).

## 3. METHODOLOGY

### 3.1. Data and Research Design

We used a trend analysis quantitative approach complemented by a qualitative approach in order to produce robust results for policy implications. The quantitative analysis utilises the vector error correction (VEC) model as specified in equation 1 to estimate clove export response from 1980 to 2020 in Zanzibar.

$$Zexp_t = a_0 + \sum_{k=1}^{k=n} a_k X_t^k + \varepsilon_t \tag{1}$$

Where: $Zexp_t$ is clove export from 1980 to 2020; $X_t^k$ denotes a set of explanatory variables, both demand and supply-side; $\varepsilon_t$ is an error term and $a_k$`s are model parameters.

The study used cointegration and VEC model to estimate the short-run and long-run effects of different determining factors on clove exports. The paper used demand- and supply-side factors to model clove exports. Using clove exports as our dependent variable, we used typical independent variables from international trade theories and empirical studies, particularly from Sharma (2001), Babatunde (2009), Bashir (2003), Abdulai and Rieder (1995), and Abolagba et al. (2010). The demand-side factors used include the world price of cloves, the producer price, and the real exchange rate. The supply-side factors used are clove production, FDI, GDP growth rate, population, inflation, climatic factors such as temperature and rainfall, and gross capital formation. Quantitative data were mainly secondary and were collected from different sources including the Office of the Chief Government Statistician of Zanzibar (OCGS), ZSTC, World Bank, United Nations–World Population Prospects, and World Development Indicators. A detailed description of the definition, units of measurement and data source for each variable used in the ECM model is shown in Appendix Table A1.

A qualitative approach was employed to collect information from key clove stakeholders in Mkoani, ChakeChake and Wete districts in Pemba; and Zanzibar North and Zanzibar West districts in Unguja. This was meant to complement the time series data in explaining the main factors for the decline of clove export. A total of 39 key clove stakeholders were selected using a snowballing sampling technique. This sampling technique enabled to capture of clove stakeholders with knowledge and experience in the clove industry. The stakeholders included 30 clove farmers, 20 from Pemba and 10 from Unguja; 2 officials from ZSTC; 3 officials from the Ministry of Agriculture, Natural Resource, Livestock and Fisheries; 3 officials from the Ministry of Trade and Industry; and 1 official from Zanzibar Investment Promotion Authority. Detailed information on the list of key informants is shown in Appendix A2.

### 3.2. Estimation of the Clove Export Response Model

The study employed Vector Error Correction Model (VECM) to estimate clove export function parameters. This is similar to many other researchers like Ahmed (2000), Bashir (2003), Penélope-López (2005) Agasha (2009), Allaro (2010) and Allaro (2012). This technique is superior to Ordinary Least Square (OLS) modelling because it establishes short-run and long-run relationships amongst variables. Granger (1986) cited in Gujarati (2004) asserts that testing for unit root and cointegration of the regression residual is an imperative condition since it is a pre-test to avoid the possibility of producing spurious regression output. In this study, these procedures were taken into consideration, by first conducting stationarity and cointegration tests.

### *Stationarity Test*

The Dickey-Fuller (DF) test developed by Dickey and Fuller (1981) was employed for testing stationarity. The DF-test requires estimating the following equation using OLS:

$$\Delta y_t = \sigma + \beta_t + (\varphi - 1)y_{t-1} + \mu_t \tag{2}$$

Equation (2) indicates that the series $y_t$ has both stochastic and deterministic trends and can be used as a DF-equation for testing the unit root null hypothesis such as:

> *Ho: ($\varphi - 1$) = 0*            *(unit root or non-stationary)*
>
> *H1: ($\varphi - 1$) $\neq$ 0*            *(no unit root or stationary)*

The test statistic used to test the unit root hypothesis is the *t*-statistic. If the calculated *t*-value (*t*-value of the coefficient $\varphi - 1$) is greater than the critical *t*-value, then $y_t$ is non-stationary.

*Cointegration Test*

In this analysis, we tested for cointegration among the variables using the Johansen Method of Maximum Likelihood approach developed by Johansen (1988). The rationale here was to test for the presence of long-run and stable relationships among the time series data. Johansen's methodology takes its starting point in the vector autoregression (VAR) of order $p$ given by:

$$y_t = \mu + A_1 y_{t-1} + \ldots \ldots + A_p y_{t-p} + \varepsilon_t \tag{3}$$

Where, $y_t$ is an n×1 vector of variables that are integrated of order one, commonly denoted as I(1), and $\varepsilon_t$ is an n×1 vector of innovations. This VAR can be re-written as:

$$\Delta y_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \tag{4}$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i - I; \quad \text{and} \quad \Gamma_i = -\sum_{i=1}^{p} A_j \tag{5}$$

If the coefficient matrix $\boldsymbol{\Pi}$ has reduced rank r < n, then there exist n×1 matrices $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ each with rank r such that $\boldsymbol{\Pi} = \boldsymbol{\alpha\beta'}$ and $\boldsymbol{\beta'y}$, are stationary. r is the number of cointegrating relationships, the elements of $\boldsymbol{\alpha}$ are known as the adjustment parameters in the VECM and each column of $\boldsymbol{\beta}$ is a cointegrating vector. It can be shown that for a given r, the maximum likelihood estimator of $\boldsymbol{\beta}$ defines the combination of $y_{t-i}$ that yields the r largest canonical correlations of $\Delta y_t$, with $y_{t-i}$ after correcting for lagged differences and deterministic variables when present. Johansen proposes two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the $\boldsymbol{\Pi}$ matrix: the trace test and maximum eigenvalue test are shown in equations (6) and (7) below;

$$J_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \tag{6}$$

$$J_{max} = -T\ln(1 - \lambda_{r+1}) \tag{7}$$

Here T is the sample size and $\lambda_r$ is the ith largest canonical correlation. On one hand, the trace test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of n cointegrating vectors. On the other hand, the maximum eigenvalue test tests the null hypothesis of r cointegrating vectors against the alternative hypothesis of r+1 cointegrating vectors.

*Error Correction Model Estimation*

An Error Correction Model (ECM) is a time series model commonly used for data where the variables are likely to have a long-run stochastic relationship referred to as cointegration. According to Engle et al. (2011), ECMs are superior in estimating short-run and long-run effects of a time series to OLS modelling. The error term considers the reality that a deviation of the last period influences its long-run equilibrium. In simpler terms, an error correction involves de-trending or differencing the series in order to attain stationarity before estimating the relationship between the variables. In this paper, ECM is preferred because of its estimation strength to address the historical declining trend of clove production and exports in Zanzibar, and specifically, it helps to observe the long-run effects of the determining factors to clove exports.

The long-run clove exports supply function is specified as follows:

$$lnCE_t = \beta_0 + \beta_1 lnWP_t + \beta_2 lnCLP_t + \beta_3 lnPP_t + \beta_4 lnER_t + \beta_5 lnFDI_t + \beta_6 lnGDP_t \\ + \beta_7 lnPOP_t + \beta_8 lnINF_t + \beta_9 lnGCF_t + \beta_{10} lnRF_t + \beta_{11} lnTP_t + u_t \tag{8}$$

Where CE is clove exports, WP is cloves world price, CLP is clove production, PP is producer price, ER is the exchange rate, FDI is Foreign direct investment, GDP is the Gross domestic product growth rate, POP is the population growth rate, GCF is gross capital formation, RF is rainfall, and TP is temperature. $\boldsymbol{u}$ is a random disturbance term with its normal classical properties, $\boldsymbol{\beta}$ is a vector of coefficients measuring long-run relationships, and **Ln** is a natural logarithm.

If these time series variables of lnCE, lnWP, lnCLP, lnPP, lnER, lnFDI, lnGDP, lnPOP, lnINF, lnGCF, lnRF, and lnTP are found to be unit roots, then the study required to take the first difference of the variables (as in equation (8) in order to obtain a stationary series:

$$\Delta lnCE_t = \beta_0 + \beta_1 \Delta lnWP_t + \beta_2 \Delta lnCLP_t + \beta_3 \Delta lnPP_t + \beta_4 \Delta lnER_t + \beta_5 \Delta lnFDI_t$$
$$+ \beta_6 \Delta lnGDP_t$$
$$+ \beta_7 \Delta lnPOP_t + \beta_8 \Delta lnINF_t + \beta_9 \Delta lnGCF_t + \beta_{10} \Delta lnRF_t + \beta_{11} \Delta lnTP_t + u_t \tag{9}$$

Equation (9) above does not have any inference to long-run aspects of decision making because the process of differencing equation (8) results in a loss of valuable long-run information in the data (Maddala, 1992 in Ahmed, 2000). In dealing with the loss of valuable information, the theory of cointegration came into place to mitigate the problem. The theory of cointegration addresses this issue by introducing an error, we specified the correction (EC) term in the model. We introduce an Error-correction term ($EC_t$) lagged one period ($EC_{t-1}$) so as to integrate short-run dynamics in the long-run clove export supply function. Thus a general Error Correction Model (ECM) in equation (10) is as follows:

$$\Delta lnCE_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta lnWP_{t-1} + \sum_{i=1}^{n} \beta_{2i} \Delta lnCLP_{t-1} + \sum_{i=1}^{n} \beta_{3i} \Delta lnPP_{t-1}$$
$$+ \sum_{i=1}^{n} \beta_{4i} \Delta lnER_{t-1} + \sum_{i=1}^{n} \beta_{5i} \Delta lnFDI_{t-1} + \sum_{i=1}^{n} \beta_{6i} \Delta lnGDP_{t-1}$$
$$+ \sum_{i=1}^{n} \beta_{7i} \Delta lnPOP_{t-1} + \sum_{i=1}^{n} \beta_{8i} \Delta lnINF_{t-1} + \sum_{i=1}^{n} \beta_{9i} \Delta lnGCF_{t-1}$$
$$+ \sum_{i=1}^{n} \beta_{10i} \Delta lnRF_{t-1} + \sum_{i=1}^{n} \beta_{11i} \Delta lnTP_{t-1} + \lambda_i EC_{t-1} + u_t \tag{10}$$

Where, $EC_{t-1}$ is the error-correction term which is the lagged value of the residuals obtained from the cointegrating regression of the dependent variable on the regressors; $\lambda_i$ = the speed of adjustment parameter. It is expected to be negative; $\beta_i$ = Coefficients measuring short-run relationship/effects among the variables; and $u$ = Disturbance term.

### 3.3. Analysis of the key clove stakeholders' perceptions of clove export determinants

Qualitative results were used to explain trends in clove exports. The content analysis was used to analyse stakeholders' perceptions of the important factors that explain the trends in clove export in Zanzibar. The content analysis technique is a careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings (Berg 2009). This technique is useful in analysing the large amounts of verbal data collected through interviews with key informants in this paper.

## 4. RESULTS

### 4.1. Descriptive Statistics of Time Series Data

Before presenting the analysis of time series data, we present the properties of each variable by generating summary statistics to help observe how the variables behave. Descriptive statistics are based on the reforms made in the clove industry in Zanzibar. The first was from 1981 to 2010 during the implementation of the Clove Market Law, when ZSTC was the sole legal buyer and exporter of cloves on the Island (Table 1). Second, we present similar properties from 2011 to 2020 during the implementation of a 10-year (2011–21) clove development strategy, when a role to strengthen the clove industry was played by providing incentives to the farmers to encourage better management, supplying clove farmers with free clove seedlings and raising the clove price (Table 2).

**Table 1.** Implementation of the Clove Market Law (1981–2010)

| Variable | Obs | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Export | 30 | 4,411.192 | 3,384.201 | 12 | 12,000 |
| Production | 30 | 4,905.935 | 4,369.707 | 41 | 16,052 |
| Producer price | 30 | 810,007.7 | 1,131,71 | 13,43 | 3,374,39 |
| World price | 30 | 1,144,88 | 1,281,89 | 13,52 | 3,770,97 |
| Gross domestic product (GDP) | 30 | 4.346774 | 2.160189 | 0.5 | 8.17 |
| Exchange rate (ER) | 30 | 567.4248 | 483.3378 | 8.2 | 1,453.54 |
| Foreign direct investiment (FDI) | 30 | 1.956677 | 2.023286 | 0.0 | 5.77 |
| Inflation | 30 | 19.54265 | 11.42925 | 4.73 | 36.14 |
| Population | 30 | 4.604194 | 0.672794 | 3.15 | 5.49 |
| Rainfall | 30 | 996.5097 | 104.8457 | 792.04 | 1,198.55 |
| Temperature | 30 | 22.70333 | 0.2847059 | 22.15 | 23.23 |
| Gross capital formation (GCF) | 30 | 21.95787 | 5.035915 | 14.899 | 32.84936 |

Note: number of observations: 30.
Source: authors' own computation using data from WDI, OCGS, and WB

**Table 2.** Implementation of the 10-year (2011–20) Clove Development Strategy

| Variable | Obs | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|
| Export | 10 | 2,932.21 | 1,768.57 | 860 | 7,077 |
| Production | 10 | 3,804.7 | 2,467.63 | 211 | 8,572 |
| Producer price | 10 | 12,800,00 | 4,218,48 | 1,433,28 | 15,900,00 |
| World price | 10 | 16,700,00 | 4,106,04 | 10,900,00 | 23,900,00 |
| Gross domestic product (GDP) | 10 | 5.85 | 1.90160 | 1.3 | 7.7 |
| Exchange rate (ER) | 10 | 1,963.5 | 328.822 | 1,557 | 2,298 |
| Foreign direct investiment (FDI) | 10 | 2.7564 | 1.49759 | 0.76 | 4.69 |
| Inflation | 10 | 6.27 | 3.50366 | 2.7 | 14.7 |
| Population | 10 | 4.441 | 0.19098 | 4.14 | 4.62 |
| Rainfall | 10 | 1,053.07 | 131.807 | 827.48 | 1,293.22 |
| Temperature | 10 | 22.773 | 0.396037 | 22.08 | 23.22 |
| Gross capital formation (GCF) | 10 | 28.099 | 2.466925 | 25.04924 | 33.24036 |

Note: number of observations: 10
Source: authors' own computation using data from WDI, OCGS, and WB

The findings in Tables 1 and 2 show that, on average, Zanzibar exported 4,411.192 tonnes of cloves during the implementation of the Clove Market Law in the period between 1981 and 2010, but it exported, on average, 2,932.21 tonnes of cloves during the implementation of the 10-year clove development strategy from 2011 to 2020. This shows a huge disparity in the number of clove exports between the two reform periods. Clearly, the Clove Market Law was characterized by higher exports, while exports declined during the 10-year clove development strategy. Similarly, clove production showed a decreasing trend while producer price showed an increasing trend during the implementation of the Clove Market Law and following the introduction of the 10-year clove development strategy. The clove prices show a significant improvement after the implementation of the 10-year clove development strategy, although part of the improved prices, both producer prices and world market prices, may capture inflation and exchange rates of the Tanzanian Shilling. The rest of the variables are not directly related to the two major clove reforms.

### 4.2 .Estimation of Clove Export Supply Response Model

*Unit root test results*

In order to carry out cointegration tests, the study tested the order of integration of the time series data. When the series was integrated in the same order, we proceeded with cointegration tests. The results in Table 3 show that the series was non-stationary at levels but became stationary at first differences. This is because, at levels, the Augmented Dickey and Fuller (ADF) statistic values are less than ADF critical table values, while in the first difference the ADF statistic values become greater than ADF critical table values. This shows that the series were integrated of the first order. Therefore, the unit root test results suggested that the existence of cointegration relationships between the series had to be tested (Table 4).

**Table 3.** ADF Unit Root Test Results

| Variables | Level | First difference | Critical value (5%) |
|---|---|---|---|
| Export | -1.914 | -5.145 | -2.97 |
| Production | -1.957 | -5.607 | -2.97 |
| Producer price | 1.943 | -2.99 | -2.97 |
| World price | -1.376 | -2.98 | -2.97 |
| Gross domestic product (GDP) | -2.554 | -3.009 | -2.97 |
| Exchange rate (ER) | 1.924 | -2.99 | -2.97 |
| Foreign direct investiment (FDI) | -1.951 | -3.62 | -2.97 |
| Inflation | -1.375 | -2.987 | -2.97 |
| Population | -2.824 | -3.019 | -2.97 |
| Rainfall | -2.579 | -14.214 | -2.97 |
| Temperature | -1.421 | -3.213 | -2.97 |
| Gross capital formation (GCF) | -1.344 | -5.379 | -2.97 |

Note: model with constant for variable series. Number of observations: 41
Source: authors' own computation using data from WDI, OCGS, and WB

*Cointegration test results*

We continued by testing if there was cointegration between the series—that is, testing if the variables had long-run and stable dynamics. We employed the Johansen Co-integration Test by performing cointegration tests with a constant with no trend. Table 4 shows the results from the Johansen likelihood ratio tests for cointegration. The two common likelihood ratio tests—the trace and maximum Eigen value ($\lambda$-max)—were used to determine the number of cointegrating relations in the time series. The hypothesis of no cointegration between the series was rejected at the five per cent level of significance based on both the trace and maximum Eigen statistics. The results indicate that there existed a long-run equilibrium relationship between the series.

**Table 4.** Johansen Cointegration Test

| Hypothesis | Statistic | | Critical values (5%) | |
|---|---|---|---|---|
| | Trace | Max | Trace | Max |
| r = 0 | 327.90 | 81.89 | 233.13 | 62.81 |
| r = 1 | 246.01 | 76.55 | 192.89 | 57.12 |
| r = 2 | 169.45 | 63.71 | 156 | 51.42 |
| r = 3 | 105.74* | 36.43* | 124.24 | 45.28 |

Note: * denotes significance at the 5% significance level. The number of observations: 41.
Source: authors' own computation using data from WDI, OCGS, and WB.

*Vector error correction model results*

The results from the VEC model presented in Table 5 show that the R-squared was 0.8706, indicating that 87.1 per cent of the variations in clove exports were explained by the variables entered in the model. The F-statistic probability of 0.0408 implies that the model, as a whole, was statistically significant at the five per cent level of significance. The coefficient of the error correction term in the first cointegration equation measured the speed of adjustment. The -1.77 indicates that about 177 per cent departure from long-run equilibrium was corrected in each period. Put differently, the previous period's deviation from long-run equilibrium was corrected in the subsequent

period at an adjustment speed of 177 per cent. The p-value of 0.000 shows that the speed of adjustment was statistically significant at the 0.1 per cent level.

**Table 5.** Vector Error Correction Model Results

| Model summary | | | |
|---|---|---|---|
| R-squared =0.8706 | F-statistic =4.4832 | | Durbin-Watson =1.6738 |
| Adj.R-squared= 0.6764 | Prob (F-statistic)=0.0408 | | |

**Short-run effects**

| Variables | Coefficient | Std. err. | t-statistic | Prob. |
|---|---|---|---|---|
| D(EXPORT(-1)) | 0.1617 | 0.2890 | 0.56 | 0.576 |
| D(PRODUCTION) | 0.0956 | 0.2276 | 0.42 | 0.674 |
| D(LOCAL_PRICE) | 0.00008 | 0.0002 | 0.48 | 0.628 |
| D(WORLD_PRICE) | 0.00002 | 0.0001 | 0.18 | 0.86 |
| D(GDP) | -172.50 | 317.722 | -0.54 | 0.587 |
| D(ER) | 15.938 | 8.7735 | 1.82 | 0.069 |
| D(FDI) | 146.096 | 503.229 | 0.29 | 0.772 |
| D(INFLATION) | -11.141 | 141.211 | -0.08 | 0.937 |
| D(POPULATION) | -178.584 | 1,456.95 | -0.12 | 0.902 |
| D(GCF) | 18.1786 | 166.554 | 0.11 | 0.913 |
| D(RAINFALL) | 4.5178 | 4.5643 | 0.99 | 0.322 |
| D(TEMPERATURE) | 132.616 | 1,788.05 | 0.07 | 0.941 |
| ECT(-1) | -1.7745 | 0.50917 | -3.49 | 0.000 |

**Long-run effects**

| Variables | Coefficient | Std. err. | t-statistic | Prob. |
|---|---|---|---|---|
| EXPORT | 1 . | . | . | |
| PRODUCTION | 1.317139 | 0.0534763 | 24.63 | 0.000 |
| LOCAL_PRICE | 0.0004496 | 0.0000895 | 5.02 | 0.000 |
| WORLD_PRICE | 0.0002902 | 0.0000545 | 5.32 | 0.000 |
| GDP | 188.5299 | 63.19344 | 2.98 | 0.003 |
| ER | 2.091077 | 0.5666581 | 3.69 | 0.000 |
| FDI | -790.5653 | 113.7831 | -6.95 | 0.000 |
| INFLATION | -36.5714 | 25.63772 | -1.43 | 0.154 |
| POPULATION | -720.6474 | 174.8021 | -4.12 | 0.000 |
| GCF | -146.5855 | 25.857 | -5.67 | 0.000 |
| RAINFALL | -3.878556 | 1.272401 | -3.05 | 0.002 |
| TEMPERATURE | 607.087 | 381.5521 | 1.59 | 0.112 |
| _cons | 2,372.64 . | . | . | |

Note: number of observations: 41.
Source: authors' own computation using data from WDI, OCGS, and WB.

The results for short-run and long-run impacts are shown in Table 5. The lagged value of clove exports is a proxy for the existing capacity of Zanzibar's clove exports. In the short run, all variables were not significant at any level of significance. In the long run, the quantity of clove production, clove local price, world price, GDP, and exchange rate showed a positive significant impact on clove exports at the one per cent level of significance. Furthermore, the results show that FDI, population growth rate, gross capital formation, and rainfall had significant negative long-run impacts on the level of clove exports in Zanzibar at the one per cent level of significance.

## 4.3. Qualitative Findings

This section presents the stakeholders' views of the factors determining the decreasing trend of clove exports in Zanzibar. The factors raised during the interviews are clove price fluctuation, extension services and farming practices, government policies, climate and disease factors, and urbanization.

*Price fluctuation*

Interviews showed that price fluctuation was one of the biggest challenges impacting clove production and exports in Zanzibar. The rise and fall of clove market prices in the international markets relate to increasingly strong competition from other clove-producing countries like Indonesia, Madagascar, and Comoros (Juma 2010). This is common in most developing countries that depend on raw agricultural commodities. Price fluctuation was a serious concern to the clove growers. It also appeared that price challenges led farmers to sell cloves through smuggling channels.

*Extension services and farming practice*

According to the interviews, extension services granted by the government were inadequate. In order to expand clove production in Zanzibar, extension service is one of the crucial factors that should be prioritized with the aim of enabling farmers to get basic farming skills. According to a study by Birkhaeuser et al. (1991), 'agricultural extension services are one of the most common forms of public-sector support of knowledge diffusion, and this can bridge the gap between discoveries in the laboratory and changes in individual farmers' fields'.

Interviews with clove stakeholders showed poor management of clove trees. This decreased clove production due to weed competition for nitrogen and other nutrients. Owners of clove trees had inherited them from their forefathers, and some did not have the passion to continue managing the trees despite their great impact on their income earnings. The government has started a programme for re-planting new clove trees, but some clove farmers are not interested in it, perhaps because of focusing on non-farm activities.

*Government policies*

Following the Zanzibar Revolution in 1964, the land was nationalized. According to Martin (1991), the larger Arab plantations were also nationalized, and the three-acre policy was established. By 1974, almost 22,262 tenants—residents and landless peasants—had received three-acre plots of land from the government; a considerable proportion of this would have been clove land. This caused land fragmentation of the large original clove plantations. In addition, the administrative structure of the clove market in Zanzibar shows that all powers and authority on cloves are under the government through ZSTC, something which deprives intervention of the private sector.

*Climate and disease factors*

Better clove production highly depends on favourable climatic conditions with moderate rainfall and temperature (Chami 2020). Interviews showed that the impact of climate change manifested through floods and drought, and increased surface temperatures have adverse consequences on clove production. Clove growers also observed increased temperature and unpredictability of rainfall since the 1990s, which led to clove trees dying and the remaining ones becoming less productive compared to the period before the 1990s.

In connection with climatic factors, interviews showed that disease outbreaks, particularly sudden-death diseases, caused clove tree mortality. The disease was increasing in both Unguja and Pemba and persisted for many years. The only premonitory symptom is slight chlorosis, followed by thinning of the foliage and a decline of the absorbing system. Death follows after a period that may vary from only a few days to many months. Death occurs from lack of water caused by disorganization of the absorbing roots, therefore reducing the tree population, followed by a decline in production. Therefore, the Government of Zanzibar established a Clove Rehabilitation Programme in 1975, which involved clove nurseries re-established between 1975 and 1985 (Revolutionary Government of Zanzibar 2003). This programme increased clove production.

*Urbanization*

Interviews showed that there was a process of urbanization caused by migrants from Tanzania Mainland and the rest of East Africa. Meanwhile, there has been the mobility of the population from the two islands of Zanzibar as well as rural-urban migration within Unguja Island. This has reduced the size of land for clove production since the 1960s due to the expansion of urban areas.

## 5. DISCUSSION

Based on the descriptive statistics presented in Tables 1 and 2, the two major reforms that took place in the clove industry in Zanzibar showed different trends in clove exports, the quantity of production, producers, and world market prices. Unlike during the implementation of the Clove Market Law which took 30 years from 1981 to 2010, the efforts of the Revolutionary Government of Zanzibar through ZSTC partly increased producer prices

during the implementation of the Clove Development Strategy in a 10-year period from 2011 to 2020. The world market price was also high during that particular reform. However, clove production and exports showed a decreasing trend when compared with the period during the implementation of the Clove Market Law. These findings imply that increasing clove exports is attributed to increased clove production in the sense that an increase in clove production increased clove exports and vice versa. Unlike expectations, an increase in price during the Clove Development Strategy (2011 to 2020) did not influence clove production, possibly because the period was too short.

A decrease in clove production during the Clove Development Strategy and failure to increase producer prices in the same period imply the failure of the Revolutionary Government of Zanzibar to improve the clove industry because the government controls the industry. In addition, there is almost no private sector investment and participation in the clove industry in Zanzibar (Moh'd et al. 2017). Therefore, the price of cloves is not left to the vagaries of the market forces.

Further analysis of the results using the VEC model showed that all independent variables had no significant impact on clove exports in the short run. In the long run, the number of cloves produced, producer price, world market price, GDP, and exchange rate showed positive and significant impacts on clove exports at a one per cent level of significance, while FDI, population growth rate, rainfall, and gross capital formation showed a negative significant impact. The variables had positive signs, implying that there was a direct positive relationship between each of them and the dependent variable—in this case, clove exports. This implies that when the variables increased, clove exports increased as well, and vice versa. For example, a unit increase in the number of cloves produced increased clove exports. The impact of clove production on the clove export supply function that was significant implies that a decision to export cloves into external markets was dependent on the producer country's capacity. Despite the government's efforts through the Clove Development Strategy to improve clove production, data on clove productivity are limited. Interventions like improving extension services to clove farmers are critical for improving productivity. The results of the impact of clove production on clove exports are in line with Jongwanich (2007) who argues that clove exports in nine countries in East and Southeast Asia are determined by factors including supply-side production capacity.

In addition, the time series results showed that improved producer and world market prices, in the long run, stimulated domestic production, which in turn influenced clove exports. This implies that producer and world market prices were together a key in enhancing exports. Importantly, this study has shown that producer and world market prices increased during the Clove Development Strategy (2011–2020) compared to the period during the Clove Market Law (1981–2010). This is a good indicator of improving the clove industry. The long-run findings about GDP imply that increased production created surplus output supplied to the international markets. In addition, exchange rate depreciation in the international market stimulated export. These results are in line with findings by Odunga (2020), Mwinuka (2010), Mwinuka and Felix (2015), Ndulu and Lipumba (1990) for Tanzania, and Fugazza (2004). Regarding the world price, the results are in line with findings by Edward and Golub (2002) who used South African data. Regarding the exchange rate, the results are in line with Sharma (2001).

The existence of a long-run negative impact of FDI and gross capital formation on clove exports implies low levels of investment in the clove industry. Despite the fact that FDI is considered potential for development through technology transfer and employment creation, the agricultural sector attracts low FDI inflows compared to the accommodation and food service sectors in Zanzibar. For instance, between 2016 and 2017, there was completely no FDI inflow into the agricultural sector, including the clove industry, whereas accommodation and food services attracted, on average, inflows of USD$74.9 million (Zanzibar Revolutionary Government 2017). This implies that there are neither foreign nor domestic companies involved in the clove industry in production and processing. Clove production is dominated by smallholder farmers, whereas the market is controlled by the Revolutionary Government of Zanzibar through ZSTC. Processing and value addition are hardly done, although the law gives a provision for them (International Trade Centre 2014). This is possible because of the low level of technology invested in the clove industry.

About the human population growth rate, its impact has an implication on population size and the declining size of land devoted to clove production as the population increases. The statistics on the changing size of arable land are limited. But this is categorically a typical case in Zanzibar, particularly in Unguja, where most of the clove farms have been turned into residences because of increasing population size and expansion of urban areas, as reported by ZSTC (2018). According to the URT, Zanzibar's population size increased from 640 in 1978 to 675 in 1988 to 1,303,569 in 2012, growing at a rate of 3.0 per cent per annum, but from 2012 it grew at a rate of 2.8 per cent per annum. The urban population grew at 4.4 per cent in 2012, higher than the growth rate of the rural

population, which was 1.7 per cent (URT 2014), resulting in increasing urbanization. In urban areas, 44 per cent are working in the service sector compared to 41 per cent working in the agriculture sector, including clove farming in rural areas. The rest are working in the manufacturing sector. This state of affairs associated with urbanization has decreased clove production and, by implication, exports.

Based on the long-term average rainfall, the negative coefficient implies that rainfall had a negative association with clove production. For instance, between 1981 and 2010, the long-term mean was 996.5 mm per annum with a standard deviation of plus or minus 104.8 mm. From 2011 to 2020, the long-term mean increased to 1,053.07 mm per annum with a standard deviation of plus or minus 131.8 mm. Although these statistics show an increasing long-term mean in a period of 40 years, rainfall was not adequate when compared with the moisture requirement for clove production. For instance, in the eight years between 2005 and 2012, the amount of rainfall was below the normal or below the long-term mean (Appendix Table A4). This was a period of drought, so clove production was negatively affected. Moreover, the standard deviation was high implying that there was high rainfall variability, which is most problematic in affecting clove production. The graph of rainfall anomaly against time shown in Appendix Table A4 also justifies the presence of rainfall variability in Zanzibar from 1980 to 2020. Interviews with clove stakeholders showed that irrigation was not practised in clove farming in Zanzibar. This implies that drought and rainfall variability most likely decreased clove production or made it more challenging. According to the Zanzibar Revolutionary Government (2003), cloves require heavy and reliable rainfall between 1,500 and 2,000 mm per annum. The temperature did not show an impact, possibly because it remained almost constant, at a long-term mean of $22.7^0$C throughout the period under consideration.

Qualitative results complement the time series results in this study. Interviews with clove stakeholders show that clove exports were determined by a number of interwoven factors that collectively influenced clove exports indirectly through clove production. Some of these factors were also reported by the Bank of Tanzania (2005). The clove stakeholders argued that despite government control, the producer price of cloves was low and not stable and was controlled by the rise and fall of the world market price. Since the clove industry in Zanzibar is controlled by the government through ZSTC, Moh'd et al. (2017) are of the view that the ZSTC provides lower producer prices than the black market. Therefore, there has been an emergence of smuggling cloves into Kenya. These together frustrated stakeholders' efforts and therefore paralyzed clove production and exports as well. Some farmers sold cloves to middlemen in an effort to get better prices compared to the ones offered by ZSTC. However, the availability of middlemen was not predictable, possibly because of too much control of the state in the market system through ZSTC. These results imply that giving farmers a better and stable price could be an incentive for clove production that in turn increases clove exports. During the implementation of the Clove Development Strategy, the Government of Zanzibar, through ZSTC, improved producer prices of cloves from TZS3,500 to TZS14,000 per kg. It also pledged higher prices to farmers even if the world market price fluctuated downwards (ZSTC 2018). Nevertheless, the world price continued to dictate the producer price, implying that falls in the world price caused falls in the producer price. Moh'd et al. (2017) argue that price disparity is one of the factors for the decline in the clove industry in Zanzibar.

Clove tree diseases decreased the clove tree population. The main disease manifests through the yellowing and thinning of foliage, followed by the death of a clove tree. This was exacerbated by inadequate extension services offered by the government through ZSTC. Despite the clove rehabilitation programme of 1975, the problem persisted, causing a decrease in the clove tree population—low production that in turn decreased clove exports. This is also reported by Hilal (2013) and Bakar (2015). Martin (1991) shows that in a period of 50 years from the 1940s to the 1990s the clove tree population decreased by 20 per cent. The same author indicates that the problem is caused by clove tree diseases and the ageing of the trees. This implies that clove diseases and a decrease in the clove tree population have affected the industry for many decades. Other factors that had similar impacts include poor clove tree management and poor harvesting practices, suggesting poor extension services and therefore failure of the ZSTC. Disease control measures, including the use of pesticides, were hardly used because of poor knowledge among clove growers. The poor performance of the clove industry has definitely caused poor livelihoods among smallholder farmers. According to Chami (2020), some clove growers cut clove trees for firewood and charcoal to sell to earn a living. Although statistics are limited, the unimpressive performance of the clove industry suggests that the number of clove farmers has decreased.

Urbanization has increased since the 1960s. This is attributed to pulling factors, largely tourism and service industries, in Zanzibar which led to an increase of immigrants from Tanzania Mainland and other parts of East Africa. Increased urbanization coupled with poor land governance exacerbated the problem of unofficial settlements and improper land use apart from clove farming. Complex land tenure legislation has further aggravated the problem. For example, the key informants in Unguja asserted that '*we are the natives of Unguja;*

*our experience is that there are many areas that were full of clove trees in the 1980s, and some were covered by natural forests, but now those areas have been changed for other uses due to urbanization, with huge construction of various infrastructures and human settlements'*. Although infrastructure development is critical for development, it has decreased clove trees which in turn decreased clove production and exports. The Revolutionary Government of Zanzibar recognizes the importance of the clove industry to the people, and the economy and thus continues to support the industry at the level of laws, policies, and interventions. In addition, the government is promoting diversification into other crops like rice, cassava, banana, sweet potatoes, vegetables, selected tropical fruits, and other spices including pepper.

Other factors were the government policies, particularly the three-acre policy and the role of ZSTC. The revolution of Zanzibar in 1964 came with the nationalization of clove plantations from the Arabs. As such, indigenous farmers were given three acres to produce cloves. The government intended to restore the land to the natives and empower them economically. In addition, the three acres were restricted for agricultural use, and the government forbade the selling of the land. This caused problems in that the new owners of clove farms did not manage the farms well because of inadequate farming knowledge (ZSTC 2018). Indigenous farmers also ended up building houses or selling the land to immigrants for residential purposes, implying a weakness of the three-acre policy. This justifies the arguments put forth by Hikmany (2015) on the premise that the objectives of land acquisition contradict the constitution of Zanzibar of 1984. This also decreased land for clove production, which definitely reduced the clove tree population.

About government control of the cloves market through ZSTC, it is the sole and legal buyer and exporter of cloves in Zanzibar. Cloves are purchased from the farmers by ZSTC and then exported to the world market (Moh'd et al. 2017). This is a monopsony marketing system. Interviews with clove stakeholders indicated that the government controlled the price of cloves offered to the farmers, and the price was supposed to be constant even if the world market price fluctuated downward. Such government intervention sounds better in a situation of stabilized world market price. However, the situation was challenging when the world market fluctuated downward; it was difficult to compensate the farmers. Another option to deal with the price fluctuation is to process raw cloves into other products for export. Although information about processing cloves is limited, the processing is hardly done, and it is not well developed in Zanzibar. We urge the government to promote clove processing in addition to supporting production, ensuring good quality of cloves and marketing.

## 6. CONCLUSION AND POLICY RECOMMENDATIONS

### 6.1. Conclusion

Clove exports in Zanzibar are determined by a combination of factors. The major ones are clove production, producer price, world price, GDP, and exchange rate. Others are rainfall variability, FDI in the production and processing of cloves, increased human population, and gross capital formation. These factors determine clove exports directly or indirectly, and their impacts are considerably high. Other determinants are diseases, poor clove tree management, and poor harvesting practices, which collectively imply poor extension services. Others are urbanization, the three-acre policy, and the monopoly nature of the clove market system. These factors determine clove exports indirectly through clove production. Clove production and exports were so directly linked that an increase in production increased exports and vice versa. Therefore, the determinants of clove exports can be collapsed into production factors, those which influence clove production on the supply side, those related to market and price at the local and world market levels, the demand side, institutional factors including policies and laws, and climatic factors. The world market price controls the producer price such that a fall in the world market triggers falls in the producer price. There is also the government's institutional and policy failure to revitalize the clove industry.

### 6.2. Policy Recommendations

Based on the conclusions, we recommend the following policy interventions:

(i) We recommend an *integrated policy approach*, which considers together different factors that affect clove exports. The integrated policy can coordinate different goals to address factors affecting clove exports. Some of the interventions to consider in this policy include increasing, stabilizing, and sustaining producer prices. At the government level, the interventions should include creating an enabling environment for FDI inflows into the clove industry to improve clove production. It appears that a larger number of the clove tree population results in greater production; therefore, at the grassroots level, the government should implement a replanting programme to restore the population of clove trees. The replanting programme is not new; it was

implemented in the 1960s and showed a positive impact in terms of restoring the clove tree population and production. To deal with drought and rainfall variability, the government should consider introducing an irrigation farming system.

(ii) Because clove production and exports are directly linked, the *integrated policy approach* should aim to increase clove productivity. The intervention should include intensification of clove farming systems, introducing a high level of intercropping, new post-harvest techniques, clove farming methods, management of clove trees, control of diseases, and improvement of extension services to the clove farmers. Farmers should be trained to improve the farming skills and knowledge required for clove production and processing.

(iii) The government has been implementing the Clove Development Strategy, and its success has indicated positive results. This paper recommends that some of the issues to consider in the *integrated policy approach* are those implemented by ZSTC through the Clove Development Strategy. These include the establishment of modern clove-buying centres, provision of interest-free loans to the clove farmers, provision of free seedlings, provision of training to the farmers, and rehabilitation of road infrastructure in clove-producing areas. When these are implemented collectively and effectively, they can revamp clove production. Therefore, the key clove stakeholders like ZSTC; the Ministry of Agriculture, Natural Resources, Livestock, and Fisheries; and the Ministry of Trade, Industry, and Marketing should consider the factors raised in this study in order to improve clove production, which appears to be affected by a combination of different factors that in turn determine clove exports.

(iv) The existing clove marketing structure in Zanzibar is currently a monopsony controlled by the government through the ZSTC. In this system, the government is supposed to control producer prices, thereby protecting farmers from being affected by the downward price fluctuations. This is important because producer price is affected by the world market price such that a fall in the world market price causes a fall in the producer price. Therefore, this study recommends two policy issues. First, the government should compensate smallholder farmers when the world market price fluctuates downward. This will help stabilize producer prices and so not negatively affect their income and livelihood. Second, the government should consider promoting investments in processing cloves. This needs the adoption of technologies to produce products from cloves. This is critical for value addition and can enable the Revolutionary Government of Zanzibar to diversify export products instead of depending on exporting raw cloves, therefore increasing government revenue. Thus, given the increased competition of cloves in the world market that causes downward fluctuation of the producer price, the future sustainability of the clove industry in Zanzibar depends on the ability of the revolutionary government to offer good prices and protect smallholder farmers from being affected negatively by the falls of the world market price.

(v) The Revolutionary Government of Zanzibar should promote and implement new policies that aim at reducing farmers' income dependence on cloves. This should be done by promoting diversification of other crops including other spices with a competitive advantage. Since the livelihood of the majority depends directly or indirectly on the agricultural sector, diversifying income sources besides agriculture is inevitable for improving the livelihoods of the people and economy of Zanzibar.

(vi) In order to understand the dynamics of clove exports, researchers need to consider the vigorous analysis of time series data using a VEC model, complemented with qualitative information. A mixed-methods approach helps to get more useful insights in addition to a better explanation of the factors that determine clove exports.

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**APPENDIXES**

**Appendix A**. Definition, Level of Measurement, and Data Source of Variables Used in the ECM Model

| Variable | Definition | Unit of measurement | Data Source |
|---|---|---|---|
| Export quantity of cloves | The quantity of cloves exported to the world market from Zanzibar | Tonnes | OCGS and ZSTC |
| World price of cloves | Price of cloves at the world market | TZS | OCGS and ZSTC |
| Exchange rate | Rate at which TZS is converted into USD | TZS | OCGS and ZSTC |
| Foreign direct investment | Foreign direct investment, net inflows (per cent of GDP) | Per cent | WDI |
| Clove production | Amount of cloves harvested | Tonnes | WDI |
| Producer price | Price of cloves paid to the producers | TZS | WDI |
| GDP growth rate | Annual growth rate of GDP per cent at prices of market based on constant local currency | Per cent | UN-WPP |
| Population | Population growth rate (annual per cent) | Per cent | WDI |
| Inflation | Inflation, consumer prices (annual per cent) | Per cent | OCGS and ZSTC |
| Gross capital formation | Gross capital formation (per cent of GDP) | Per cent | WDI |
| Rainfall | Long-term mean in millimetres per year | mm per year | https://climateknowledgeportal.worldbank.org/country/tanzania-united-republic |
| Temperature | Long-term mean | °C | https://climateknowledgeportal.worldbank.org/country/tanzania-united-republic |

Note: OCGS=Office of the Chief Government Statistician of Zanzibar, ZSTC=Zanzibar State Trading Corporation, UNWPP=United Nations - World Population Prospects, and WDI=World Development Indicators.

**Appendix B**. Clove Stakeholders' Key Informants

| Stakeholders | Stakeholder's role in clove industry | Number of interviewees | Designation of interviewees |
|---|---|---|---|
| Farmers | Farm preparation, clove planting, caring, harvesting, drying, cleaning, handling, and transporting to the selling point. | 30 | Small and medium farmers |
| Zanzibar State Trading Corporation | Providing input services, including implements, equipment, fertilizers and chemicals, post-harvest management, and handling materials. Promoting production, marketing, processing, storage, and trade of cloves and other agricultural products. Providing assistance in the formation and support of farmers and actors, farmers' group, and cooperative organizations. | 2 | Managing director Marketing officer |
| Ministry of Agriculture, Natural Resources, Livestock, and Fisheries | Extension services to clove growers and other clove stakeholders. Agricultural research on cloves. | 3 | Director of agriculture and extension services Extension officer Extension officer |
| Ministry of Trade, Industry, and Marketing | Ensure the State Corporation fulfills their tasks efficiently and effectively. Ensure farmers have better conditions and access to services such as extension, loans, subsidized inputs, and better prices. Responsibility for the growth of the clove industry and encouraging farmers to invest in this sector. | 3 | Director of trade and marketing External trade officer Marketing officer |
| Zanzibar Investment Promotion Authority | Improving productivity and aid trade diversification of exports that meet international standards. Attracting FDI in agriculture. | 1 | Director of investment facilitation and project development |

**Source:** authors' own compilation and Chami (2022)

**Appendix C**. Rainfall variability in Zanzibar between 1980 and 2020



Rainfall Anomaly Index