

EFFICIENCY PERFORMANCE TRENDS IN THE FOOD PROCESSING INDUSTRY IN TANZANIA.

ABSTRACT

Aim: This study aimed to examine the efficiency performance trends of food processing industries in Tanzania; in terms of technical efficiency using panel data of 40 food processing industries purposively selected industries throughout 2018 to 2020.

Material and Methods: A longitudinal or panel design, which involved pooling cross-sectional and time series data, was utilized in this investigation. A stochastic frontier production model was applied using a linearized Translog production function to determine the performance elasticity coefficients of inputs and technical efficiency. The quantitative strategy was chosen by the researcher since it is both time and money efficient and requires less time for data collecting and processing.

Results: The results from estimations reveal that the overall technical efficiencies for the selected food industry were 79.61%. However, the performance for food industries indicates ineffective performance with technical efficiency of 77.85%. This study concluded that an average of 22.15 percent technical potentiality were not achieved by the food in the period 2018 to 2020 respectively.

Contribution to Policy Implication: This study recommends the government to further investigate factors that slow down the growth of food industries. Such factors may include regulatory obstacles (external factors) and management systems (internal factors). Also, the study suggests taking into account how well public and parastatal agriculture agencies are performing.

Keywords: *Efficiency, Input, Output, Production Changes*

1. INTRODUCTION

Tanzania is one of the brightest stars of the African growth miracle [22]. The country had an average annual GDP growth of 5-7 percent since the turn of the century, an impressive track record that comes with several cautionary warnings [9]. First, the increase in GDP is less striking when adjusted to take into account rapid population growth [12]. Over the same period, per capita GDP growth has averaged just 2.5-3.5 percent per year, slightly higher than the sub-Saharan African average [20]. Second, despite its overall growth performance, Tanzania's economy has created fewer good jobs that can offer good earnings and work security. Third, despite Tanzania's tremendous economic expansion, poverty is still dominant [19].

A sector that has not played a significant role in Tanzania's success story is the industry [32;33]. Manufacturing, agro-industry, and tradable services which are among of components of the industrial sector have the potential to absorb large numbers of modestly skilled workers,

contribute to accelerated poverty reduction, and diversify the economy [20].

Recognizing this potential, Tanzania has made considerable policy changes in the manufacturing sector since 1996 to establish a welcoming climate for both domestic and foreign direct investment (FDI) [33]. Following this, several foreign companies including China, India, Turkey, and Japan are currently in the country exploring investment opportunities [33]

Even though the country has improved its investment policy and the huge potential that may accelerate the nation's industrialization process, the manufacturing sector is still underperforming [28]. The industrial sector's performance has been unsatisfactory, with little contribution to GDP and employment creation [14]. Its contribution to GDP has remained at 10% which is still very low. In particular, the contribution of the manufacturing sub-sector to the economy stayed stagnant [30]. Several structural barriers are preventing the sector's growth. The price of inputs is the main factor causing the slow growth of the industrial sector in Tanzania [36]. Due to the high input costs,

firms are forced to charge high prices for their goods, placing them in challenging competitive situations on both domestic and international markets [32] Other industry constraints include inconsistent electrical supply, a lack of management capacity, and a lack of operating capital [1]. The cumulative effect of these challenges has caused firms to underperform at their maximum production capacity [28].

Given this fact, this paper intended to assess the performance of Tanzania's manufacturing industry using a panel annual data set gathered from the management offices of the selected firms. The term performance in this study is defined as technical efficiency. The performance of firms determines the overall economic environment. For instance, there is a direct correlation between macroeconomic growth rates, unemployment, living standards, and company performance. To explain the overall performance of an economy must look at microeconomic performance. Understanding the sector's potential, it is crucial to assess the performance of Tanzanian manufacturing. In particular, it is essential to evaluate industries' performance to see whether they are meeting high expectations. Measuring a firm's efficiency is crucial since it helps to determine the causes of inefficiency and opens the door to additional research on how organizations may make the best use of their resources to increase efficiency. Given the levels of input, the efficiency measurements reveal the rate at which the productive inputs are transformed into outputs as well as the desired output levels. Therefore, efficiency measures compare actual output levels to maximum potential production levels to indicate the level of efficiency of firms.

Despite Africa's manufacturing sectors' poor performance, it is thought that the continent has the potential to expand and become competitive in the world market [4]. Recognizing this potential, Tanzania has made considerable policy changes in the manufacturing sector since 1996 to establish a welcoming climate of both domestic and foreign direct investment (FDI) [33].

However, although the country has improved its investment policy and the huge potential that may accelerate the Nation's industrialization process, the manufacturing sector is still underperforming and largely, remain undiversified [35]. The industrial sector's

performance has been unsatisfactory with little contribution to GDP and employment creation [14]. Its contribution has remained at 10% which is still very low. In particular, the contribution of the manufacturing sub-sector to the economy stayed stagnant [30]. Several structural barriers are preventing the sector's growth. The price of inputs is the main factor causing the slow growth of the industrial sector in Tanzania [36]. Due to the high input costs, firms are forced to charge high prices for their goods, placing them in challenging competitive situations in both domestic and international markets [32]. Other industry constraints include inconsistent electrical supply, a lack of management capacity, and a lack of operating [1]. The cumulative effect of these challenges has caused firms to underperform at their maximum production capacity [28].

Despite the importance of manufacturing industries in supporting economic growth in Tanzania, little attention has been made to consider the efficiency performance trends, therefore this study intended to examine the efficiency performance trends in the food processing industry from 2018 to 2020. With a focus on determining the efficiency of capital factors, raw materials, and labor force in the food processing industry from 2018 to 2020.

2. LITERATURE REVIEW

2.1 Theoretical Framework Review

2.1.1 Production Theory

A microeconomic theory called "Production theory" aims to explain the rules by which a business firm chooses how much of each good it will sell (its "output" or "products") and how much of each type of labor, raw material, fixed capital item, etc. It will use (its "inputs" or factors of production")

The production function shows the relationship as shown in Equation 2.1

$$Q = f(L_d, L, K, M, T, t) \dots\dots\dots 2.1$$

Where L_d = land and building; L = labor; K = capital; M =materials; T = technology; and, t = time.

The final processed foods are represented by Q, the output of the firm. R denotes the number of raw materials utilized in the manufacture of the Q, while L denotes the labor input (people and skills). Fresh produce from the agriculture industry serves as the industry's primary source of raw materials. K is a symbol for the quantity of capital used in the production process, which could include stocks, real estate, equipment, and machinery [35].

A company strives to maximize profits by either producing more Q or doing so at a lower cost. The link between the number of things that can be produced technologically utilizing different combinations of labor, raw materials, and capital is given by the production function (K). The additional output produced by using one more unit of that input while holding other inputs constant is known as marginal productivity (also known as marginal physical product). given by the production function's first derivative concerning the input being studied.

$$\text{Marginal physical product of capital } p_k = \frac{\partial q}{\partial k} = f_k \dots \dots \dots 2.2$$

$$\text{Marginal Physical Product of labor} = Mp = \frac{\partial q}{\partial l} = f_l \dots \dots \dots 2.3$$

2.2 Empirical Literature Review

Globally, there is a growing body of empirical research on the technical efficiency of the manufacturing sector in both developed and developing countries (for appraisals see 24; 15; 27; 1;18). The empirical literature on the efficiency of the manufacturing sector focuses on developed countries and Asian economies, and a much smaller number relates to industrial performance in developing countries, especially in Africa.

[10] estimated a Translog production function for the Kenya manufacturing sector. Variables used were all output produced by the firm in a given year and input variables consisted of capital which was defined as the replacement cost of existing machinery and other equipment employed in the production process, multiplied by the degree of capacity utilization, wages which included the total wage bill including all allowances for the firm in one year. This study

reported average technical efficiencies of 77 percent, 80 percent, 76 percent, and 68 percent for the food, metal, textile, and wood subsectors respectively.

[17] empirically investigated the technical efficiency of firms in the Kenyan manufacturing food, metal, and textile sub-sectors using data covering two periods: 1992/1993 - 1994/1995, and 2000/2001 - 2002/2003. The results showed that the technical efficiency point varied among the sampled firms in each period. The average technical efficiency of 52 percent, 58 percent, and 60 percent for the food, metal, and textile sub-sectors, respectively, imply that nearly 48 percent, 42 percent, and 40 percent technical potentialities were not achieved in the 1992/1993 -1994/1995 period. On the other hand, the average technical efficiency of 48 percent, 42 percent, and 68 percent for the food, metal, and textile sub-sectors, respectively, imply that nearly 52 percent, 58 percent, and 32 percent technical potentialities were not achieved in the 2000/2001 - 2002/2003 periods.

[6] determined the efficiency performance of Kenya manufacturing companies from 2009 to 2011. Three critical input variables (raw materials, staff expenses, and plant and machinery) and two output variables (net sale and earnings after tax) were used to evaluate the relative efficiency of 30 manufacturing companies in Kenya. The results indicated that small-sized company has the highest relative efficiency compared to medium-sized and large size company. In addition, the study finds that 1 large-sized company, 2 medium-sized companies, and 3 small-sized companies operate under the most productive scale size throughout the three years.

[3] examined the performance of manufacturing firms in Libya. Specifically, their study aims into evaluating firm-level technical efficiency. The study used an econometric approach based on a stochastic frontier production function to analyze 207 firms from a survey conducted from March to May 2013. The results from estimations revealed that the technical efficiencies of Libyan manufacturing firms range from 37.77 percent to 95.27 percent, with an average of 71.27 percent. While the percent of firms that are considered technically efficient is only 17.87 percent of the total firms.

[16] examined the efficiency analysis of the agro-processing industry and analyzed the trend in efficiency changes during the period under consideration. Panel data covering three years (2011, 2012, and 2013) for 41 firms in the agro-processing industry was collected from the Ministry of Industrialization, Kenya Daily Board, Kenya Sugar Board, KTDA, KNBS, and EPZ departments for the said periods. Econometric production frontiers were estimated for the agro-

processing industry in each period. The findings showed that the agro-processing industry had an overall efficiency score of 44 percent. The efficiency score was distributed as 53 percent, 60 percent, and 57 percent for the food, beverage, and non-food subsectors. The study findings revealed that an average of 56 percent technical potentiality was not achieved by the agro-processing industry in the period 2011, 2012, and 2013.

Conceptual Framework

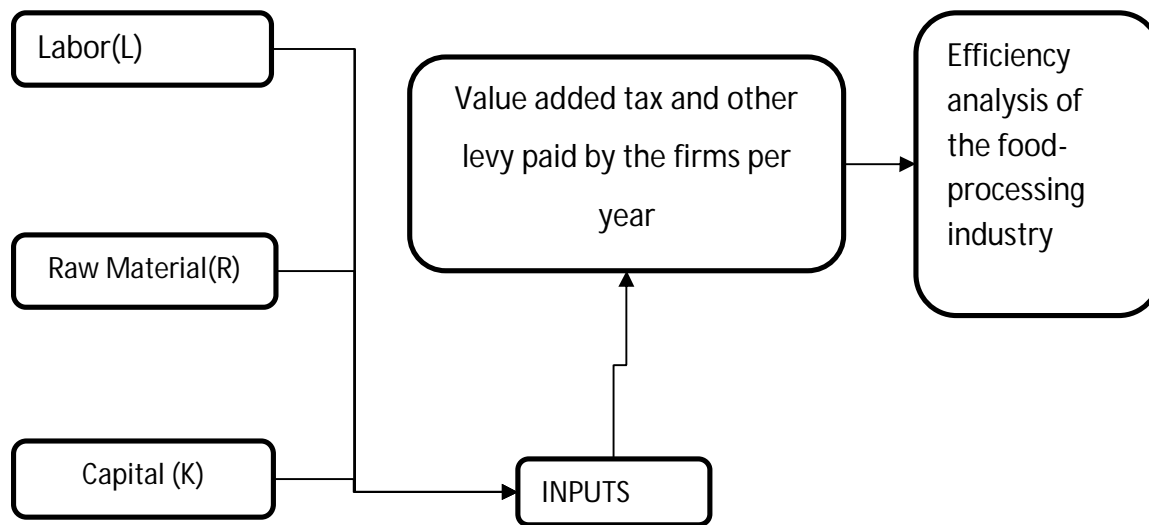


Figure 1: Conceptual Framework

3. RESEARCH METHODOLOGY

The main research approach used was quantitative, featuring a longitudinal or panel research design, which involved pooling cross-sectional and time series data. A total of 40 industries were chosen purposively from the 60 foods processing industry; where secondary data were collected based on their market participation and food processing strategy. The industry selection criteria were as; the industry must be existing in the industry for more than six years, it must be located in Dar es Salaam, and must be a food processing industry. The analyses were carried out following the study's goals. First, the SFA technique was used to calculate the performance levels of the various companies. Second, using the SFA approach's

data, the trend of enterprise performance levels was established during the study time. Finally, the performance levels within the subsector were looked at. The third step was to test the premise of these studies.

3. RESULTS ANALYSIS

3.1 Descriptive Analysis of Results

With consideration of the industry diversity under the study, it is important to first examine the characteristics of the sample through the statistical features of the dataset such as mean, median, and standard deviation. Table 1 provides the descriptive statistics of all the variables employed in this study, these statistics reinforce the heterogeneity of the food industries in Tanzania.

Table 1: Descriptive Statistics from Sample Data

Year	Unit	Gross Value	Capital	Raw materials	Labor
2018	Mean				
	Std.Dev	2,155,806,000	1,407,197,000	1,742,334,000	509,715,200
		2,189,375,000	1,590,776,000	1,743,326,000	665,237,700
	Min	397,923,900	124,827,400	302,512,700	34,038,630
	Max	9,321,582,000	6,615,824,000	7,437,830,000	3,355,812,000
2019	Mean				
	Std.Dev	2,639,654,000	1,581,447,000	2,007,219,000	638,114,400
		2,488,182,000	1,794,383,000	1,823,136,000	921,163,600
	Min	407,012,800	141,872,000	332,918,300	46,028,540
	Max	10,866,920,000	7,538,977,000	7,759,401,000	4,591,567,000
2020	Mean				
	Std.Dev	3,281,296,000	1,795,458,000	2,391,651,000	753,931,600
		2,739,146,000	2,145,205,000	2,158,199,000	1,101,179,000
	Min	630,341,200	143,028,800	340,624,100	54,983,210
	Max	11,658,920,000	8,649,036,000	8,991,891,000	5,000,427,000

From the descriptive statistics in table 1, it can be seen that some of the variables have higher standard deviations than the mean. This is not surprising considering the heterogeneity of the industries under study, which ranges from inputs variables with the smallest capital investment of 124,827,400Tsh to the largest capital of 6,615,824,000 Tsh in 2018. The higher standard deviation caused by the variability in capital investment was also seen in the study year of 2019 and 2020. Similar to capital, the other explanatory variables such as raw materials and labor show large variability due to the different levels or sizes of the industries under study. A large variation is also found for gross value as the dependent variable, with the standard deviation larger than the mean.

3.2 Classical Assumption Test Results

The classical assumption test is conducted in conjunction with the process of regression that measures taken in the classical assumption test using the same working step by regression. Four assumption tests must be done on the regression model; multicollinearity, heteroscedasticity, and normality.

Multicollinearity Test; Based on the output of results in Table 2, shows that there is no

multicollinearity among the input variables (capital, raw materials, and labor) in regression for the value of VIF > 10. Following this multicollinearity result, it is evident that all the explanatory variables are found to be not correlated hence MLE gave unbiased and consistent results.

Heteroscedasticity test: From Table 2 shows that the p-value is greater than a 5% level of significance. Thus, there the null hypothesis is not rejected which implies that there is no heteroscedasticity problem with the data.

Normality test; From Table 2 shows that the p-value is greater than a 5% level of significance. Thus there the null hypothesis is not rejected which implies that the data are normally distributed.

Production Frontier Estimates; From table 2 the Cobb-Douglas function is rejected therefore the trans-log model is chosen based on the LR value of 5.15 which is greater than the critical value of 0.35 based on a Chi-square distribution table, tested at 5% level of significance.

Table 2; Assumption Test Results

Multicollinearity Test	Input Variable	VIEW	Tolerance (1/VIF)	
	Log(Capital)	3.09	0.323264	
	Log(Raw materials)	2.65	0.377107	
	Log(Labor)	2.49	0.402413	
Heteroscedasticity test:	Hypothesis	Test Statistics	P-Value	
	Ho: Constant variance	chi2(1) = 2.78	Prob > chi2 = 0.0954	
Normality test;	Hypothesis	JB test statistic	P-Value	
	Ho: normality	4.305	0.1162	
Production Frontier Estimates;	Null Hypotheses	Test Statistics	Critical value	Decision
	$H_0 = \beta_1 = \beta_2 = \beta_3 = 0$ (Cobb-Douglas function)	LR = 5.15	0.35	Reject

3.3 Pairwise Correlation

The objective of this step is to determine if there are variables that are highly correlated as this makes the regression parameters less precise [5], this problem is known as multicollinearity. In practice, correlation among explanatory variables is a common occurrence, particularly for macroeconomic variables. However, in the presence of high correlation or severe multicollinearity among regressors, a few

problems may arise. First, high multicollinearity results in large variance and standard errors, which make the regression coefficients imprecise [5], and second, high multicollinearity makes it difficult for regression to assess the individual impact of an explanatory variable on the dependent variable [26]. Therefore, before proceeding to the regression analysis, it is necessary to examine the correlation among the independent variables. Pairwise correlation is employed, and the result is presented in Table 3

Table 3. Correlation Matrix, 2018 to 2020

Variable	Gross Value	Capital	Raw materials	Labor
Gross Value	1			
Capital	0.7137	1		
Raw materials	0.8533	0.7532	1	
Labor	0.6521	0.5550	0.7592	1

The positive correlation between the inputs and output variables as shown in table 3 indicate that, as the industry increase inputs (capital, raw materials, and workers' salary in production), the output (gross value) increases as well. The value of pairwise correlation is higher than 0.8 (in absolute value) as an indication of high multicollinearity. Following this rule of thumb, all the explanatory variables are found to be not highly correlated hence MLE gave unbiased and consistent results.

3.4 The Maximum-Likelihood Estimates of Parameters of the Translog Stochastic Frontier Production Function

The ordinary least square estimates of the parameters are used as initial values (to estimate) for the maximum-likelihood estimates of the parameters. The adjusted R-squared for the ordinary least square estimates is 0.87, which indicates that 87 percent total variation of the output is explained by the input variables. Tables 4 show the estimation results of the Translog production function based on the stochastic frontier model.

Table 4; OLS and MLE estimates of Translog Stochastic Production Frontier Model

Variables	Parameters	Estimated OLS Coefficients	P-Value	Estimated MLE Coefficients	P -Value

Constant	β_0	1.513064	0.000	1.9347	0.000
log capital	β_1	0.0573	0.163	0.0661	0.071
lograwmaterials	β_2	0.7014	0.000	0.6809	0.000
log labor	β_3	0.0995	0.005	0.08984	0.007
Variance parameters					
Sigma - squared	σ_s^2			0.1457	
Log-likelihood function				--7.414	

The result in table 4 shows that the value of the log-likelihood function for OLS and MLE allows for a test of whether technical inefficiency exists or not. In case technical inefficiency does not exist then technically there will be no difference in the parameters of OLS and MLE. From the analysis, we have observed that the coefficients of raw material) and labor is statistically significant. These results indicate that these input variables significantly affect the gross value of the food industries in Tanzania. Reasonably enough, capital has a positive output elasticity and is found to be insignificant in the gross value of revenue. This implies that capital does not affect the gross value of the food industries in Tanzania significantly.

From the MLE analysis, we have observed independently that all the variables except capital are significant in affecting the gross value of the food industries in Tanzania. It implies that capital does not affect the gross value of the selected industries. We observe that the variable labor and raw materials show a significant effect for both OLS and MLE estimation of the Translog production function.

The MLE provides estimates of the variance parameters sigma – squared (σ^2) and gamma (γ). The first variance parameter (σ^2) determines whether there is technical inefficiency or not. If

σ^2 is equal to zero, all firms are fully efficient. If σ^2 is larger than zero, then all firms are not fully efficient. Table 4.5 shows that the value of σ^2 is 0.3729, indicating that all firms in the sample are not fully efficient. The second variance parameter, γ , determines whether all deviations from the frontier are due to random error or technical inefficiency. If γ is equal to zero then all deviations from the frontier are caused by random error. If γ is equal to one, then all deviations from the frontier are caused by technical inefficiency. Gamma (γ) is estimated at 0.4150 that imply over 41.5 percent of the total variation from the frontier is due to technical inefficiency. The result also reveals that the technical efficiency (TE) of the sector is equal to 60 percent.

On average, this sector produces 60 percent of the total gross value output. This further suggests that the sector needs to increase its gross value output by 40 percent to attain the optimal efficiency level.

4.3.2.2 The efficiency performance of food industries in Tanzania for the period 2018 to 2020

The efficiency of industries' gross value is depicted in Table 5.

Table 5 The efficiency estimates for food industries in Tanzania

Subsector	Year	Efficiency estimate
Food	2018	0.8051
	2019	0.7557
	2020	0.7746

Mean

0.7785

From the analysis, it is observed that for gross value, the overall mean technical efficiency of Tanzania food industries during the period 2018 to 2020 is found to be 0.7785 and the technical efficiencies range from a minimum of 0.7557 to a maximum of 0.8051 for the selected food industries in Tanzania. This implies that the gross value of 77.8% has been achieved by the selected industries in Tanzania. In the present study, none of the food industries had achieved

a 100% level of efficiency for gross value. The findings also suggest that 20% of technical inefficiency exists. There is wide variation in the technical efficiencies among the selected industries.

In addition, Table 6 lists the ranking of subsectors generated by ordering the subsectors according to the average efficiency levels of the period 2018 - 2020

Table 6 Subsectors Rankings by Average Efficiency Scores, and Minimum and Maximum Efficiency Score by Subsectors and by Year

By Subsector					By Year		
Subsector	Minimum	Maximum	Average	Rank	Year	Minimum	Maximum
Food	0.7557	0.8051	0.7785	2	2018	0.776	0.8051
					2019	0.7557	0.7634
					2020	0.7746	0.9013

On the whole, table 6 shows the beverage subsectors are more efficient than the food subsectors. Efficiency scores for the beverage subsector were ranked first in efficiency performance. The food subsector was found to be second behind the beverage subsector in generating industries' gross value.

The underperformance of food industries has caused inefficiency to succeed in the sector, the main problem cited by firms as contributing to them is a lack of raw materials and capital, therefore, any policy reforms should address the underlying factors contributing to the underutilization of each firm's production capacity. In addition, efficiency variation may also be explained by such other factors as the use of obsolete technologies, poor product design, lack of management skills, lack of exposure to international markets, and the production of non-competitive products. Firms need to adjust to the changing environment, for example, by investing in training workers so that they can acquire the necessary management skills. Also, the firm should use more funds to invest in new production technologies. In addition, the role of the government in providing advisory support regarding training, market information, and technology choice are also recommended. Also, the study recommended for the government to further investigate factors that slow down the growth of food industries. Such factors may include regulatory obstacles (external factors) and management systems (internal factors).

4. CONCLUSION AND RECOMMENDATIONS

The general performance level based on the average technical efficiency level for the food industries was 79.61%. This result indicates the underperformance of Tanzania's food industries because the average of 20.39% of the technical potentialities of food processing industries was not achieved for the period 2018-2020. The results supported by literature such as [25;19] assessed trends in job creation and found that government should focus considerably more on encouraging the development of agro-processing businesses because they are crucial for generating income and creating jobs in emerging agricultural economies. Other writers, such as [22] examined the performance of labor productivity in places with electricity, while the growth of firms was analyzed by [11;7; 13].

Furthermore, the effectiveness of autonomous agriculture firms is one area that needs more study. Two, taking into account how well public

and parastatal agriculture agencies are performing.

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