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The influence of geographical concentration of firms on performance of small agro food processing enterprises in Tanzania

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ABSTRACT

Geographical concentration/clustering of firms are important in growth of small agro processing firms, having prominent impact in the subsector. Using descriptive statistics, gross sales per worker measured in normal and seasonal monthly output production. This paper assesses the performance of small agro food processing firms by comparing the performance of 31 geographically concentrated firms and 31 dispersed firms using three empirical considerations namely: output per worker, enterprise employment intake (EEI) and average sales per worker were used to analyze the difference in performance of agro food processing enterprises located in clustered/geographically concentrated relative to others located elsewhere enterprise employment intake (EEI). Survival costs were used to determine sunk costs which are the difference between survival costs and total costs of successful design. Remarkably the results showed that there are differences in mean output per works in both normal and seasonal production. In seasonal production the difference in mean output per worker between firms in clustered and non-clustered firms were significant (p value = 0.0510) compared to normal production with (p value = 0.000). This shows that there is slight significant difference between clustered and non-clustered firms respectively. The results further show that enterprise employment intake vary in the sub sector vary between districts. The survival costs between clustered and non-clustered. Firms show that the cost of staying in the market by sampled agro processing firms is very high because the total value of products in the market is very low. The paper concludes that cluster initiatives with specialization improve the performance of small firms.

1. Introduction

In an economy where agriculture is a major occupation of the people, industrialization should lay more stress on agro processing industrialization which facilitates integration between agriculture and industry. In this context, industrialization calls for setting up of agro-processing industries which make use of locally available agricultural raw materials. Developing Countries including Tanzania have long promoted value added processing of primary products as a path to industrialization [1]. Agro processing not only stimulates value addition but also generates, direct and indirect employment, particularly in many areas of the country to absorb the surplus workforce.

A critically important role is played by small-scale firms, which constitute the lion's share of the private sector in Africa. Small scale enterprise account for more than 90% of all firms outside of the agricultural sector and 50–60% of the off-farm employment in Africa With this regard, promoting entrepreneurship in small scale enterprises and stimulating their growth is viewed as a key instrument in poverty reduction efforts both by development agencies and policymakers.

Despite their large employment contribution, Small scale firms are characterized by low productivity and constitute an insignificant share of the commercial output in most African economies. Small agro processing firms often operate in the informal part of the economy and they do that side by side with a small number of very large firms that are mostly foreign owned, capital intensive and have better access to geographically wider markets (Bigsten and Söderbom, 2006). The dualistic nature of the private sector in Africa is an indication of the "missing middle", where we do not often see small firms gradually growing into middle size firms and eventually larger ones.

According to SMEs policy, Tanzania intends to attain strong economy by year 2025 [2]. The Tanzanian economic survey (2012) shows that in recent years the Tanzania's economy grew fast, but absolute poverty and inequality stubborn are still present. This is contrary to facts that, Small scale enterprises widespread ownership provides more equitable

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distribution of income and contributes to poverty reduction [3] claimed that, during periods of overall economic growth the Small Scale Enterprises tend to perform better. Unluckily the performance of most Tanzanian SMEs is relatively at low rate compared to the transitions and developed economies countries. This is supported by the estimates of MIT, (2012) showing that, Tanzanian SMEs have greatest potential for further employment generation despite the fact that it contributes about a third of GDP (Olomi, 2006), employed 20% of labour force, and 94.7% of school leavers (URT, 2009). Thus, this paper objectively believes there is a need of understanding the performance of micro and small scale agro food processing enterprises while reflecting on strong economic hope of Tanzania.

Numerous studies assess the influence of geographical location to small firm's performance [4]. report growth performance of micro and small scale enterprises (MSEs) in Tanzania in terms of revenue and capital investment. Hoogestra and Dijk (2004) reveal that location of the firm influence performance but that the effect differs by type of the economic activity. Gill et al.,. [5] report that the factors like location, perceptions of lack of expertise, family-business role conflict, and lack of management skills affect firms' performance. Similarly Eriksson and Lindgren (2009), reveal that firms belonging to networks of local job mobility (localized mobility clusters) significantly outperform other similar firms within the local labour market. Also concentration of similar and related firms does not explain any considerable part of the variations in firm performance. Labour market externalities derived via local job mobility produce significantly more powerful effects for the involved firms as compared to the degree of co-location, diversity and scale.

[6] found that managers of firms which are part of clustered industries tend to perceive more benefits and opportunities for inter-firm co-operation in marketing activities. Additionally, significant differences between clustered firms in urban areas and non-clustered firms in rural areas industries in terms of their co-operation behavior. The findings shed light on strategies for the enhancement of inter-firm cooperation in marketing, of particular value for marketers in small-and-medium sized enterprises hence improving performance. Brett et al.,. (2008) found that firms in geographic regions with industry clustering have been hypothesized to possess performance advantages due to superior access to knowledge spillovers and resources. Also found that firms located within geographic clusters absorb more knowledge from the local environment and have higher growth performance.

Ponzeto et al. [7] argue that employment is strongly predicted by smaller average depending on firm size and location [8]. find that within industrial clusters: finer division of labour lowers the capital barriers to entry; closer proximity makes the provision of trade credit among firms easier. With less reliance on external financing, more small firms emerge within clusters, leading to higher levels of export and total factor productivity. Vial [9], confirmed that as the number of neighboring firms increases performance increases. Also, the proximity to larger firms in the same province benefits smaller firms. This positive effect that geographical concentration has on performance is explained by access to valuable natural resources, workers, higher demand, knowledge spillovers, and lower transaction costs, which may help managers and policy-makers in their investment decisions, as well as contributing to the dearth of existing research and its contradictory nature.

Several studies suggested how to measures firm's performance. According to Ibidunni et al., (2014), firm's performance can be measured in terms of assets or employment or sales revenue. However, growth measurement in terms of assets and employment can lead to biased results if the firm consists of a mixture of capital-intensive and labour intensive firms (employment is biased against capital-intensive firms and assets are biased against labour intensive firms). So, sales revenue can be a suitable indicator of firm growth.

According to MIT and UNIDO, (2014) the evaluation of performance can be done through the overall diagnostic of SMEs which consists of five steps which are analysis of external sources of competitiveness, analysis of product markets and strategic positioning, diagnostic of managerial skills and social aspects, diagnostic of technical capacities and quality, including energy efficiency and environmental issues and financial diagnostic. Further, the performance of small agro food processing firms can be attained through rationalized production cycles and improved resource efficiency, Optimized financial management and accounting practices, enhanced human resource management, compliance with international standards and technical requirements, expanded and consolidated market share through improved marketing operations.

The evaluation of performance of small agro processing firms entails by evaluating the value of processed products in relation to the investment made within a firm [10,11]. However, different scholars including [12]; Sangosanya (2011) have used other methods to evaluate a firms growth, which included measuring the value of products in terms of growth of sales, profits, inputs used, value of assets and the number of working days. For instance Ref. [13], evaluated the growth of firms by using the value of output computed from sales [12]. used the number of working days as an indicator of firm's growth. This is often used for firms with good records for labour working days [13].

[14] suggest that quality of human capital measured in terms of education levels, experience and skills are important indicators of firm's growth. Delmar et al. (2003) conclude that firm growth can be expressed by different measures depending on the purpose of investigation and subject of data. Jansen (2009) propose that among these measures, sales and employment are the most frequently used in empirical analysis. Sales is the most general of the alternative measures, as all commercial firms need to have sales to survive as business owners use it in making business decisions. According to Shephred and Wicklunnd [15] sales often precede the other indicators because an increase in sales necessitates increase in assets and employees and results in rising profits and market share. Employment is considered as an important measure because most of the studies on government policy measure growth in terms of employment. In this study, the value of processed products is measured by selling price and average gross sales per worker.

2. Surveyed firms by products

2.1. Edible oil

Tanzania's edible oils sector has received government and media attention in the past year due to its promising but unfulfilled potential. According to the Tanzania Central Bank, the country produced 1.6 million tons of edible oil in 2018, representing a 75% decrease in production from the previous year. Multiple factors were at play in the reduction, however, the primary reason was the inability of the processors to source sufficient quality seeds at the right price. Supply dynamics were compounded by challenges around fees and taxes for manufacturers that slowed down the industry at the top and trickled down the value chain.

2.2. Cereal milling

Milling sector in Tanzania is composed of two different sections – large scale mills and very small-scale mills at village level. There are very few medium size mills that are usually functioning below their installed capacity, but there is potential for sector needs to grow further. The large-scale milling sector is controlled by two main companies: Salim Bakhresa and Co Ltd and Azania. Their activities are mainly oriented on wheat milling even if they offer diversified products.

On the other side, the small-scale millers are present all over the country. Their activities vary in function of the regional agriculture products. Majority of Tanzania's population use these mills for the household consumption. This study concentrates on mills for small-scale industry.

2.3. Fruits and vegetables

The fruits and vegetables processing industry in Tanzania is still in its infancy stage in comparison to South Africa, Zimbabwe and Kenya (Commonwealth Secretariat, 1997). There are currently very few fruits and vegetables processing plants and small scale fruits and vegetable processing in Tanzania. Taking into account the size of the country as well as the geographical dispersed nature of potential agro-ecological zones producing fruits and vegetables, the processing activities are inadequate to address the need of reducing post-harvest losses in Tanzania.

3. Methodology

3.1. Description of the study area

The study was conducted in Dodoma, Morogoro and Singida regions in Tanzania. The areas play an important role in agro processing activities in Tanzania. These regions were purposively selected to represent other regions in the country where agro food processing plays an important role in their economies. From Dodoma and Singida two districts were selected, from Morogoro one district was selected. From Dodoma region, Dodoma Urban and Kondoa districts were purposively selected for collection of detailed data on individual agro food processing firms because these districts have substantial presence of agro processing activities. The same reasons apply for Singida Urban and Iramba District in Singida region and Morogoro Municipality for Morogoro region. Dodoma Municipality, Morogoro Municipality and Singida Municipality are regional headquarters; hence an ideal investor's choice for locating firms because of good services. Iramba and Kondoa Districts were selected to represent rural areas having dispersed agro processing firms and extensive agricultural production activities that supply raw materials to agro food processing enterprises.

3.2. Data sources and sample size

The study uses cross-sectional and time series data. Time series data were collected from different secondary sources including SIDO, TRA District trade officers and other published sources in order to capture performance trend of small agro processing firms over time. The primary data were obtained from small agro food processing firms. The target population is composed of agro processing firms employing at most 100 workers, which is in line with classification of SMEs in Tanzania. Some assumptions were considered before developing the sampling frame. The first assumption is firms with more than 100 workers are excluded in the sample frame because of the interests and the classification of SME in Tanzania which stipulate that small enterprises are mostly formalized undertakings engaging between 5 and 49 employees or with capital investment from TZS 5 million to TZS 200 million [2]. The aim is to have industrial units of similar structure in terms of costs, investment, output and employment. The second consideration is certain criterion has to be employed to limit the number of location in the survey. In this case four criteria were applied in the selection of investigated location. They are a) the number of firms in the cluster, b) the nature of technology applied by the firms in the location, c) firms with similar products and d) the type of network. The third assumption is firms must be operating in a defined geographical area in order to evaluate the impact of clustering on firm's performance. In central Tanzania sunflower oil processing small firms was identified. Stratified sampling methods were used because the sub-population varies considerably. Each stratum was sampled independently because stratification helped to enhance the representativeness of the sample. In sampling, few enterprises from each stratum were randomly selected to form the investigative sample. In this case, examination of parameters for each sub-domain within the population can be obtained separately. Structured questionnaires designed to obtain data on output performance and prices were used as instruments for data collection from processors, and workers.

The data were obtained from 1028 registered small agro-processing firms within the selected districts from which the sample for this study was drawn. The sampling unit was an individual small agro-processing firm. The sample size was determined using the formula by Bartlet et al. (2001) and Malangalila (2009) who stated that for social sciences a sample size of about 10% to 13% is adequately representative. This study used 13% of registered firms. Purposive sampling was used to select key informants of agro food-processing firms. The use of managing directors/owners managers as key informants in this kind of study is a convention of small firms' research. SIDO regional and district officers, district trade and industry officers were used as a source of information.

3.3. Statistical and econometric analyses

3.3.1. Testing of hypotheses

The first null hypothesis in relation to the objective of the study states that coefficient for corresponding variable for geographically concentrated firms and dispersed firms were equal, implying that clustered firms perform better than dispersed firm. Mathematically the null hypothesis and alternative hypotheses can be presented as

$$H1;\ \beta_S ci > \beta_s di \quad (1)$$

$$H_0;\beta_S ci = \beta_s di \quad (2)$$

Where;
$\beta_S ci$ = The coefficient for the sth variable in geographically concentrated firms
$\beta_s di$ = The coefficients for the sth variable in dispersed firms

The study determined performance by comparing clustering and non-clustering basing on cost minimization. Survival costs were used to determine sunk costs which are the difference between survival costs and total costs of successful design. (See Appendix 3 and 4 for evaluating cluster performance).

3.3.2. Empirical analysis

3.3.2.1. Value of product as a measure of agro processing performance. The mean value of monthly sales per worker during normal and seasonal production was analyzed following testing the null hypothesis (Ho) that no significant difference exists between the average values of sales per worker in clustered and non-clustered firms. The mean value of monthly sales per worker during normal and seasonal production was computed using.

NMGS per worker (Z) = Av. Price (Pi) x NMPO per worker (Y_1i)
SMGS per worker (Zi) = Av. Price (Pi) x SMPO per worker (Y_2i)

Monthly production output per worker in clustered and non-clustered firms were determined by using.

NMPO per worker (Yi) = NMPO (Yi)/No of Labour (Xi)
SMPO per worker (Yi) = SMPO (Yi)/No of Labour (Xi)

$$Z = \frac{\textit{The difference between the mean of the first sample}\left(\overline{X}_1\right)\textit{ and the second sample}\left(\overline{X}_2\right)}{\textit{The standard error of the difference of the mean}} \tag{3}$$

$$= \sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}} \tag{4}$$

This is based on the theorem that the standard error of the differences between the mean of two independent variables is equal to the square root of the sum of their variances

$$Z = \frac{\left(\overline{X}_1 - \overline{X_2) - (\mu_1 -}\right)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_1^2}{n_2}}} \tag{5}$$

$H_0 \mu_1 = \mu_2$ Hence, $(\mu_1 - \mu_2) = 0$
Therefore

$$Z = \frac{\left(\overline{X}_1 - \overline{X}_2\right)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_1^2}{n_2}}} \tag{6}$$

$$\sigma \overline{x}_1 - \overline{x}_2 = \sqrt[s_p]{\left[\frac{1}{n_1} + \frac{1}{n_2}\right]} \tag{7}$$

If $\sigma_1^2 = \sigma_2^2$Where. $S_P = (n_1 - 1)S_1^2 + (n_2 - 1)S_2^2$

Comparative approach is adopted to analyze the differences in performance of firms in clustered and dispersed agro food processing firms. In making deduction, assumptions such as price and boom period were considered. The analysis was classified in to normal and seasonal production with the aim of generating the scenario where seasonal production became a proxy for boom period. Hence, changes in employment and variation in sales volume can be reflected in the analyses. Price range was determined, median price was taken as unit price and assumed to be constant. The average gross sales per month were calculated by multiplying the unit price by average production output. Hence, the arithmetic mean and standard deviation of output per worker and gross sales per worker were calculated.

Thereafter; statistical tests on difference between two sample statistics were performed in order to determine if differences in performance are significant. This allows the researcher to make inference on the impact of location on small scale agro food processing enterprises performance. Furthermore, a linear correlation was performed using the product moment method to investigate if sales volume is correlated with employment intake. The price of raw material is considered to be the same since all supplies came from rural/urban economy of the same income basket. Technology is also considered to be the same because all sampled firms use locally constructed machines. Morogoro engineering cluster which manufacture local processing machines was visited in order to examine the kind of machines manufactured.

For determining firm's performance enterprise employment intake the study used the following equation:

$$EEI = \frac{\textit{Arithmetic mean of total labour intake}}{\textit{Total number of firms in the investigative sample}}\ X\ 100 \tag{8}$$

where EEI is Enterprise Employment Intake in percentage.

3.3.2.2. Firm's value of product growth model for measuring structural change. To estimate value of product growth of the processed products a log –linear transformation of the form in equation (9) was used

$$Y_i = b_o + B\sum_{j=1}^{k} X_{ij} + \varepsilon_i \tag{9}$$

$y_i = LnY_i$

$X_{ij} = LnX_{ij}$

$\delta_1 = Ln\delta_i$

b_{ij} = for i = 1,2,3 … … … n being respondents
j = 1, 2, 3 … …..k being variables

Expanding the components of equation (9), we get equation. For convenient we drop the notation 'i' representing the ith firm.

$$LnY_i = \delta_0 + \delta_1 X_1 + \delta_2 X_2 + \delta_2 X_2 + \delta_3 X_3 + \delta_4 X_4 + \delta_5 X_5 + \delta_6 X_6 \tag{10}$$

where.

LnY_i = Natural log of value of product in (TZS)
X_1 = Number of years in operation
X_2 = Costs of energy per firm
X_3 = Costs of water per firm
X_4 = Nature of the firm
X_5 = Value of capital invested per firm
ε = error term

For structural stability a chow test was run for clustered, non-clustered and the combined sample based on the following set of equations

$$\text{Combined sample } LnY_1 = \delta_{01} + \delta_1 X_1 + \delta_2 X_2 .... + \delta_6 X_6 \tag{11}$$

$$\text{Clustered firms } LnY_2 = \delta_{02} + \delta_{21} X_{21} + \delta_{22} X_{22} ..... + \delta_{26} X_{26} \tag{12}$$

$$\text{Non clustered } LnY_3 = \delta_{03} + \delta_{31} X_{31} + \delta_{32} X_{32} ..... + \delta_{36} X_{36} \tag{13}$$

In time series data a concern for structural stability termed as chow test was done to test for structural change based on statistical difference between corresponding parameters estimates for clustered, non-clustered and the combined sample as a whole. The formulas that manipulate error sum of squares from regression run over different periods to generate a test statistic. The F- test for structural change is given in equation.

$$F\left(k, n_1 + n_2 - 2k = \frac{(ESS_R - ESS_C - ESS_{NC})/k}{(ESS_C + ESS_{NC})/(n_1 + n_2 - 2k)}\right. \tag{14}$$

where:

ESS_R = The sum of squared error for the entire sample
ESS_C = the sum of squared error for clustered firms
ESS_{NC} = the sum of squared error for non-clustered firms
n_1 = the number of observation for clustered firms ($n_1 = 72$)
n_2 = the number of observation for non-clustered firms ($n_2 = 62$)
k = the number of regressors, including the constant ($k = 6$)

Table 1
Mean monthly sales per worker during normal production.

Firm	Mean	S.D	t-value	P-value
Clustered (n = 31)	4778.2	5586.5	3.675	0.000
Dispersed (n = 31)	13185.1	20229.1		

The null hypothesis being tested is that there is no structural difference between clustered and non-clustered firms. If the null hypothesis is rejected; it means that the sales growth of small agro food processing firms is different between clustered and non-clustered firms. This is justified by comparing the calculated F –value with the critical value from corresponding F- Table.

4. Results and discussion

4.1. Performance of clustered small agro – food processing firms with dispersed firms

The objective of this paper was to compare performance of clustered (geographically concentrated) small firms with their counterparts of dispersed. Agro – food processing firm's performance was measured in terms of sales per worker and employment creation.

Findings in Table 1 show that the differences in mean monthly value of sales per worker in geographically concentrated and dispersed firms during normal periods are statistically significant at 1% with *t*-value of 3.675. During the normal production (6 months production period according to SIDO) the mean sales per worker in clustered areas are higher than those firms in dispersed area. This is contrary to Ref. [16] who found that there is some association between the location of firms and performance. Firms located in clustered are normally expected to be more profitable than those in dispersed areas [17]. The idea is that in dispersed areas, firms face higher costs for factors of production such as land and labour. This therefore will increase their cost of processing and make it become onerous for to them to do business. Even with urban areas, the location between uptown and downtown does impact on the growth and survival of the firm. Clustered areas generally have a mix of both large and small firms in their vicinity, space constraints often lead to a majority of downtown businesses being small in size and scope [16]. One advantage of being in urban areas is that firms are better positioned to take advantage of changes in market condition.

Table 2 shows that during the seasonal period, (3 months production period according to SIDO) the difference in mean monthly sales per worker is significant with *t*-value of 1.637 (P = 0.1). The difference in mean monthly sales per worker can be caused by many factors which affect firm's performance such as inadequate raw material, high costs of production and demand. A detailed computation is presented in Appendix 1.

Based on 13% of all 1028 agro-food processing firms in the study area were selected for the study. Using the sampling method proposed by Boyd et al. (1981) with the formula:Where *c* is five percent of agro processing firms, *N* is the total number of agro processing firms in the study area n is the number of selected agro processing firms. The total sample was estimated to be 134 which is 13% of the registered firms in the study area.

The statistical analysis was done for 62/62 firms in both groups due to the facts that most of the available data required was for less than 62 firms for geographically concentrated firms and 62 for non-clustered firms that is why we decided to use only 62 firms for both.

The response from authors is as follows; Based on 13% of all 1028 agro-food processing firms in the study area were selected for the study. Using the sampling method proposed by Boyd et al. (1981) with the formula: n = N Where C is five percent of agro processing firms, N is the total number of agro processing firms in the study area n is the number of selected agro processing firms. The total sample was estimated to be 134 which are 13% of the registered firms in the study area. The statistical analysis was done for 62/62 firms in both groups due to the facts that most of the available data required was for less than 62 firms for geographically concentrated firms and 62 for non-clustered firms. In addition initially the study used 1028 registered firms of which 13% is 134 agro-processing firms. The fact is that some analysis of the study used all 134 agro processing firms. But depending on type of data in this paper we remained with 62 (31 + 31) active firms for clustered and non-clustered agro-food processing firms respectively. That is why we decided to use only 62 firms for both.

The findings are further explained by the survival strategies as a means of improving performance. Small firm's survival is often determined by risk taking, flexibility and creativity. This can be in the form of selecting the most appropriate strategy and technology by maintaining a persistency quality assurance that can influence a particular market segment. Otherwise the ability to remain in the market will be low whereby the probability to remain in the market depends on the number of successful designs that capture a given market. A detailed computation is presented in Appendix 2.

Table 2
Mean monthly sales per worker during seasonal production.

Enterprise	Mean	S.D	*t*-test	P-value
Clustered (n = 31)	4778.2	5586.5	1.637	0.051
Dispersed (n = 31)	13185.1	12632.4		

4.2. Firms employment intake

Employment creation in small agro – food processing firms is important for economic growth and higher income for the processors to move into higher productivity activities. The results in Table 3 show that during normal production there is 2.99% point difference of firms employment intake between firms in clustered areas and those located in dispersed areas. There is a percentage point difference of 1.22 during seasonal period. This is an indication that under a favorable economic environment employment intake in small agro food processing firms will increase. The findings are contrary to those of [18] who found that formal small firms account for just 9% of employment intake, informal household and micro firms 15%, and that, with 70%, most people was employed in family farming. The key justification, though, is more often that small enterprises are especially effective at creating new jobs [19]. also found that in countries where jobs increased, small firms accounted for nearly a half of new jobs and SMEs accounted for three quarters of jobs-again both figures rising in low income countries; both large and significantly larger than employment shares (see Table 4).

The findings complements the results suggested by Ref. [20] that firm performance may be achieved at the same time as job creation through development of labour intensive enterprises such as agro –processing firms. Also similar findings can be traced by Ref. [21] that improving in the manufacturing sector including agro –food processing firms is able to create jobs quickly, because the skills required are quite minimal. Firm employment intake is important for quick wins through the relocation of firms for absorbing surplus labour and developing more capital intensive industries to developing countries in Africa such as Tanzania where wages are markedly very low.

In competitive viewpoint, small agro food processing firm's survival is often determined by risk taking, flexibility and creativity. This can be in the form of selecting the most appropriate strategy and technology or by maintaining a persistence quality assurance that can influence a particular market segment. In this study, the respondents were asked to explain how they compete in the local markets. The answers were

Table 3
Small Agro-food processing firms by Firms Employment Intake by location and seasons.

Location	FEI (%)	
	Normal	Seasonal
Clustered	12.9	8.1
Dispersed	9.9	6.9
PPD	2.99	1.22

Key: FEI= Firms Employment Intake, PPD= Percentage Point Difference.

Table 4
Correlation coefficient between output, employment and total sales.

Non clustered		Normal		Seasonal	
		Production	Employment	Production	Employment
	Employment	0.4810*	NA	0.3514**	NA
	Total sales	0.9879*	0.4335*	0.9401*	0.3245
Clustered		Normal		Seasonal	
		Production	Employment	Production	Employment
	Employment	0.0503	NA	0.9893*	NA
	Total sales	0.9970*	0.0001	0.6125*	0.5231*

Note: ** = significant at 1%, * = significant at 5% level.

consistent with the problems small firms face in terms of ability to remain in the market. This was determined by looking at innovative activity as a survival strategy.

Value of product is among the measurement of productivity of small scale firms. To investigate the differences between the mean monthly sales per worker in both normal and seasonal production periods was carried out. A sample of 31 agro – food processing firms in dispersed area and 31 agro – food processing firms in clustered areas were subjected to significant testing to investigate if the difference in performance is statistically significant. The response revealed that their major competitive instrument is the ability to introduce as many designs as possible in the market.

Basing on the above argument respondents were asked to mention how many designs of processed products they introduced in the market and how many are successful designs in a year. Further they were also asked to give an estimate of the cost of introducing new product designs this helped the researcher to estimate the value of total cost of designs successful in the market. The difference between the total costs of new product design introduced in the market and the total cost of successful designs in the market represents the value of investment individual agro – processing firms have to forego in order to stay in the market (sunk costs).

4.3. The relationship between employment intake, output and sales volume small agro food processing enterprises

The correlation coefficient of the sales volume and employment intake in small agro food processing enterprises shows that there is high positive correlation statically significant at 5% during the normal production. For dispersed enterprises, with standard error estimates of 0.9879 there are 48% chances that an increase in sales volume during the normal production period more workers will be employed. Hence the number of workers employed during normal production period is closely associated with sales volume of the firm. At 0.9401 standard error estimates, there are 35% chances that employment intake will increase during normal period and falls thereafter. The implication here is that under favorable macroeconomic environment, creation of new markets and skill development the potential of micro and small agro food processing firms as a means of job creation will be enhanced.

The correlation coefficient of the sales volume and employment intake in small agro food processing enterprises shows that there is positive correlation significant at 5% during the normal production. For clustered enterprises, with standard error estimates of 0.9970 there are 5% chances that an increase in sales volume during the normal production period more workers will be employed. Hence the number of workers employed during normal production period is closely associated with sales volume of the firm. At 0.6125 standard error estimates, there are 98% chances that employment intake will increase during normal period and falls thereafter. The implication here is that under favorable macroeconomic environment, creation of new markets and skill development the potential of small agro food processing firms as a means of job creation will be enhanced. The findings revealed some convectional results similar to previous studies in terms of employment creation.

Table 6
Structural change for sales growth of small agro processing firms (2013–2014).

Explanatory variable	Expected signs	Whole sample	Clustered	Non- clustered
		Coefficient	Coefficient	Coefficient
Constant	(+/−)	21.267***	12.937***	28.678***
		(7.010)	(3.260)	(7.200)
Number of years in operation	(+)	0.061***	0.07***	0.146***
		(2.140)	(2.890)	(2.050)
Costs of energy per firm	(+)	−0.369***	−0.378***	−0.398**
		(-2.540)	(-2.080)	(1.920)
Costs of water per firm	(+)	−0.904	−0.634**	−0.382
		(-0.320)	(-1.740)	(-1.040)
Nature of the firm	(+)	0.216	0.112***	−0.994***
		(0.800)	(3.270)	(2.500)
Value of capital invested per firm	(+)	0.125**	0.034	0.164**1.730)
		(1.960)	(0.430)	
N		134	72	62
Adjusted R^2		0.641	0.482	0.302
Computed F-Values		5.56***	4.65***	6.28***
Durbin -Watson		1.33	1.71	1.47
VIF		1.20	1.14	1.31
Chow Test		3.83		

Dependent variable = value of sales, symbols * significant at 0.1, ** at the 0.05 and *** at 0.01 levels. Numbers in parenthesis are t-values.
Source: Own survey.

Table 5
The aggregate mean monthly sales per worker in clustered and dispersed agro-processing firms (000 000TZS).

	Dispersed			Clustered		*t*-test value
MMO per Worker (projected)	MMO per worker (realized)	MMO per worker (shortfalls)	MMO per worker (projected)	MMO per worker (realized)	MMO per worker (shortfalls)	2.90 Prob. Value
5.9	2.9	3.0	8.5	4	4.5	
(2.9)	(1.6)	(2.7)	(3.45)	(3.2)	(3.29)	1.96

Note: Output shortfall is the difference between the monthly projected sales and monthly real sales (in TZS), the figures in the bracket are the standard deviation. Key: MMS = Mean Monthly Output.
Computations are shown in appendix 11–12.

4.4. The aggregate mean monthly output per worker in clustered and dispersed agro-processing firms

Table 6 shows the mean monthly sales/output per worker in clustered and dispersed small scale firms (see Table 5). The mean monthly projected output per worker for clustered and dispersed firms is 5.9 and 8.5 respectively. The mean monthly realized output per worker is 4 for clustered and 2.9 for firm located elsewhere. This indicates a mean monthly output shortfall per worker of 3.0 and 4.5 in clustered and dispersed firm's respectively. The empirical result shows that difference in output shortfall in clustered area and those located elsewhere is statically significant at $p < 0.05$. The average monthly output per worker for firms in clustered area is significantly higher than those operating elsewhere. If the relatively high product supply in the cluster area leads to relatively large output, then there could be other explanatory factors which contributed to higher performance in clustered areas. The factors be first, joint action initiatives by firms in the cluster that resulted to minimal output shortfall; second, efficient technological application by firms in the cluster areas that tend to increase output per worker and reduce the output short fall per worker (Appendix 3 and 4).

4.5. Survival costs in sampled dispersed agro processing firms

The findings are further explained by the survival strategies as a means of improving performance. Small firm's survival is often determined by risk taking, flexibility and creativity. This can be in the form of selecting the most appropriate strategy and technology by maintaining a persistency quality assurance that can influence a particular market segment. Otherwise the ability to remain in the market will be low whereby the probability to remain in the market depends on the number of successful designs that capture a given market.

Fig. 1 shows that non-clustered small agro – food processing firms, the sunk costs is relatively low. This suggests that the difference between the sunk costs and survival costs are converging to zero. The implication here is that like dispersed firms, clustered agro – food processing firms also depend on other factors outside good quality products. Lower sunk costs can be explained by factors such as inability to identify niche markets and inability to comply with specifications and develop a scenario of quality consciousness along the production system. The Figure further shows that the cost of staying in the market by sampled dispersed agro food processing firms is very high because the total value of successful designs in the market is low. Because the survival costs and sunk costs are very close the findings suggest that small agro – food processing firms are operating under very high costs with low profits. Generally, the survival costs for clustered firms were lower than dispersed firms. To maintain annual profitable value of sales, small agro – food processing firms must introduce many designs of products with high quality. A detailed computation is presented in Appendix 5.

4.6. Survival costs in clustered/geographically concentrated agro processing firm

In competitive viewpoint, small agro food processing firm's survival is often determined by risk taking, flexibility and creativity. This can be in the form of selecting the most appropriate strategy and technology or by maintaining a persistence quality assurance that can influence a particular market segment. In this study, the respondents were asked to explain how they compete in the local markets. The answers were consistent with the problems small firms face in terms of ability to remain in the market. This was determined by looking at innovative activity as a survival strategy.

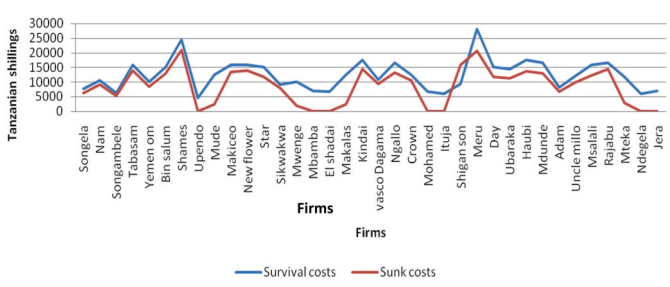

Fig. 1. Survival costs in sampled dispersed agro processing firms.

Value of product is among the measurement of productivity of small scale firms. To investigate the differences between the mean monthly sales per worker in both normal and seasonal production periods was carried out. A sample of 31 agro – food processing firms in dispersed area and 31 agro – food processing firms in clustered areas were subjected to significant testing to investigate if the difference in performance is statistically significant. The response revealed that their major competitive instrument is the ability to introduce as many designs as possible in the market.

Basing on the above argument respondents were asked to mention how many designs of processed products they introduced in the market and how many are successful designs in a year. Further they were also asked to give an estimate of the cost of introducing new product designs this helped the researcher to estimate the value of total cost of designs successful in the market. The difference between the total costs of new product design introduced in the market and the total cost of successful designs in the market represents the value of investment individual agro – processing firms have to forego in order to stay in the market (sunk costs). A detailed computation is presented in Appendix 6.

Fig. 2 shows that the sunk costs are relatively close to each other. A high sunk cost suggests that agro – food processing firms are competing in the market under high investment costs. Low sunk costs suggest that the revenue and income of agro – food processors will be high. In other words, if the sunk costs are very low, agro – food processing firms are therefore surviving in the market based on the combination of different factors. The factors include using high quality inputs, improved workers' productivity, and access to better market, better information technology, external consultants, managerial networking, and product diversification and employees skills development.

4.7. Trends of small agro processing firm's growth in terms of average gross sales per worker: 2005–2014

The trend of growth for small agro processing firms measured by sales volume per year has been increasing but at a decreasing rate as indicated in Fig. 3. The value processed products in Morogoro Region shows an increasing growth trend being higher than those of Singida and Dodoma Regions. This trend is contrary to similar trends reported by MPEE (2007a) and MPEE (2007b) which indicated a declining trend of agro processing firms for Singida and Dodoma while the trend for Morogoro was increasing. This difference in findings is probably due to the method used to evaluate performance of firms. The MPEE (2007a) and MPEE (2007b) reports evaluated growth in terms of firms in terms of number of firms established while this study evaluated growth in terms of average gross sales per worker and enterprise employment intake.

For Dodoma District, the sales volume of processed products decreased from 2005 to 2009 followed by a subsequent increase in

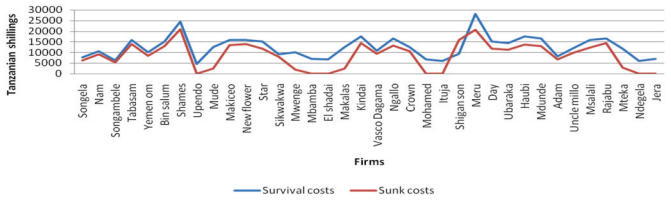

Fig. 2. Survival costs in clustered/geographically concentrated agro processing firm.

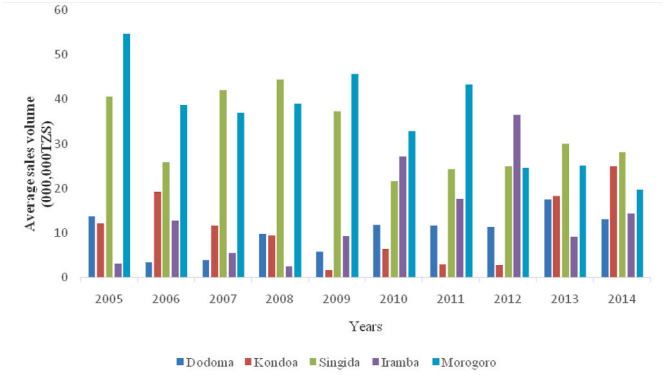

Fig. 3. Trends of small agro processing firm's growth in terms of average gross sales per worker: 2005-2014
Source: SIDO-Tanzania.

2010–2013, there after decreased in 2014. In the case of Kondoa District the average gross sales per worker of processed products, increased from 2005 to 2006 before decreasing from 2007 to 2012. The sales recovered in 2013 and 2014. There was a slight increase of AGSPW in Singida district from 2005 to 2008 and alternating subsequent decrease from 2009 to 2012. Thereafter the value increased between 2013 and 2014. For Iramba District the average sales volume per worker was decreasing and increasing at different times at whole period of 10 years. The average gross sales per worker of processed products for Morogoro District decreased from 2005 to 2007 before increasing in 2008 and 2009. From 2011 to 2014 the value decreased.

The fluctuation of values of gross sales per worker in different years in the study area may be was due to low implementation of monetary policy and restrained fiscal policy that lead to varying percent of food inflation which contributed to undulating supply of foodstuffs following varying food production and distribution (ICC, 2005; IMF, 2006). As can be seen in Fig. 3 the value of gross sales per worker per year was higher in Morogoro district was higher than that of other districts probably because Morogoro being near Dar-es Salaam, a major market for agricultural produce has more price effects than other far away districts in the study area. Since transport and other costs are lower. Fluctuating in gross sales per worker experienced among all districts may be attributed to poor harvest due to climate change hence lowering supply Minot, (2010) cited by Kipene, (2014). Further this may be caused by increase in the total costs of product designs introduced in the market by the firm and the total costs of successful designs in market by the firm contributed the differences in value of products.

The other reason is probably due to Morogoro Municipality is having a good number of food processing industrial clusters such as fruits and vegetable cluster initiatives, Morogoro food processing cluster, Morogoro Metal work engineering cluster which manufacture different food processing machines and, cereal mill cluster. This may cause a decrease in the total costs of product designs introduced in the market by the firm and the total costs of successful designs in market by the firm contributed the differences in value of products.

4.8. Structural change for sales growth of small agro processing firms

The study examined the performance of small agro processing firms in terms of clustered and non-clustered. The parameters based on *t*-test and chow test was done. According to equation (9) three models were done and diagnostics and specifications test were performed such as multicollinearity for combined sample VIF1.20, for clustered VIF, 1.14 and for non-clustered. In the presence of heteroscedasticity and autocorrelation the heteroskedastic and autocorrelation consistent (HAC) using Newey-West standard errors of the VCE method was used (Newey and West 1957).

The adjusted R^2 value of the combined sample was 0.61 compared to 0.48 for clustered firms and 0.30 for non-clustered. The implication here is that about 61% of the variation in sales growth in the whole sample was accounted by variation in the independent variables so does 48% for clustered and 30% for non-clustered firms. The constants for entire sample, clustered and non-clustered firms was 21.26, 12.93 and 28.21 respectively significantly from zero ($\alpha < 0.01$).All variables exhibited prior signs and three variables had a significant effect on variation of sales growth (See Table 6).

The parameter estimates for the combine sample, clustered and non-clustered sample was compared to check for their similarity this was the null hypothesis. The alternative hypothesis was that the parameter estimates for clustered and non-clustered firms were statistically different from each other and also different from those of the combined sample. The computed F- value for the Chow test was 4.53 being greater than the critical value of 3.83 for 4° of at ($\alpha < 0.05$) level of significance. Therefore the null hypothesis was rejected, meaning that the parameter estimates for clustered and non-clustered are significantly different from each other. This signifies the existence of structural difference of sales growth between the two locations.

The results on Table 6 show that if the costs of energy increase by one percent, the value of growth of sales was likely to decrease by 0.36 for the whole sample, by 0.37 in clustered compared to 0.39 in non-clustered firms. Similarly, if the cost of water increase by one percent, the sales growth decrease by 0.90% for the whole sample while for clustered firms decrease by 0.63% and for non-clustered decrease by 0.38%. Likewise, firms that operated for long time are likely to increase growth by 0.11% for clustered and 0.99% for non-clustered firms. The number of years in operation since its start up show significant results for entire sample, clustered and non-clustered firms at ($\alpha < 0.01$), respectively.

4.9. Firms own assessment for market constraint and competition

The agro –processing sub-sector faces different challenges and constraints which limit the potential for performance, generating more jobs and increasing labour productivity. Results in Table 7 indicate the constraints facing small agro-processing firms in general as responded by firm managers.

Limited capital was a leading constraint, mentioned and ranked highest by 33.8%. Low prices of products were mentioned by 15.1% of firm managers. Lack of access to the market was mentioned by 29.8% of firm managers. Another constraint mentioned was inefficiency promotion about 12.7%. Poor implementation of policies was mentioned by 8.6%. Limited access to energy but electricity in particular and high costs of energy (electricity and fuel) was seen as constraints especially in rural areas where there are dispersed firms. Dispersed firms incurred up to 30% higher costs for operation compared to similar firms operating in geographically concentrated areas because they were not connected to reliable s of power. They had to use expensive fuel instead, which also had to be transported at very high cost due to poor rural roads. All these constraints forced about 90% of the small agro-processing firms to operate below their capacity, and only part of the year.

Table 7
Marketing constraints facing small agro-processing firms.

Pressing constraint	Frequency	Percent
Limited access to capital	53	33.8
Low prices of products	26	15.1
Lack of access to market	35	29.8
Inefficiency promotion	16	12.7
Poor implementation of policies	11	8.6
Total number of respondents	134	100

5. Conclusion and policy implications

5.1. Conclusion

This paper examined the performance of small agro food processing firms in the study area. The paper contributes to the concern whether firms in dispersed areas perform poorly than geographically concentrated firms. Specifically the paper assessed (i) the influence of sales volume on small scale agro food processing performance (ii) Enterprise employment intake and agro food processing performance (iii) The relationship between employment intake output and sales volume in small agro food processing enterprises and (iv) constraints faced by small agro food processing enterprises in the study area. Based on the results and discussion, the paper makes the following conclusion small agro food processing firms have capacity to create employment. This means that under a favorable economic environment employment intake in small agro food processing enterprises will increase. Therefore employment creation and income generation by small scale agro food processing firms is higher during normal economic activities and lower during seasonal economic activities. The ranges of product quality as reflected by price ranges in both clustered and dispersed firms are very low. There are differences in mean output per worker in both normal and seasonal production periods. In seasonal production period, the difference in mean output per worker between firms in clustered and dispersed areas is smaller compared to normal production period. Based on the conclusions, the following recommendations are made, first based on these findings as presented in the main text and summarized under conclusions, a number of recommendations are made as follows; In the study area, clustered firms were more likely higher than those in scattered firms elsewhere. To improve the performance of agro - processing firms it is recommended that the education system should put more emphasis on the development of managerial and intellectual assets of its human resource in processing activities in both clustered and dispersed firms. The paper further established that if adequate and reliable power was provided, investment in small agro processing firms had a large potential for employment creation.

Apart from low performance in scattered firms stated above, the study also indicates that majority of small agro food processing firms are susceptible to competition with other firms. This calls for improving critical technologies such as access to and cost of appropriate packaging technologies, capacities to ensure and certify product quality and ability to publicize their products to potential clients in order to increase the possibility of high consumption of processed. Further product, process and market innovation should be implemented by increasing new products hence agro - processing firms can survive under very close supervision of the government and private partnership.

5.2. Policy implications of the study

The findings show that improving small agro food processing clustered firms indeed stimulates the domestic production of edible oils, fruits and vegetables and other agricultural and related industries, and service sector commodities. The improvement in small agro processing enterprises should go together with production improvement interventions in the agricultural sector. Agricultural production improvements increase domestic outputs and enable the processing industries of these commodities to achieve economies of scale due to the availability of adequate raw materials from the agricultural sector. In addition, the government needs to collaborate with other development partners through projects that are geared toward agro processing improvement, particularly in the rural areas. Thus, to achieve competitiveness, increased support is needed, especially for farmers and processors, in terms of capital and the creation of a favorable business environment.

The paper is important for development policy as firstly, it provides analysis of growth constraints of small agro processing firms in Tanzania. Secondly, it provides empirical evidence on the impact of clustering on small agro food processing firm's activities in country, and lastly the paper is a reflection of author's academic and practical knowledge acquired in one of most successful industrialized economy of Tanzania.

Declaration of competing interest

The authors have participated in (a) conception and design, or analysis and interpretation of the data; (b) drafting the article or revising it critically for important intellectual content; and (c) approval of the final version. This manuscript has not been submitted to, nor is under review at, another journal or other publishing venue. The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

Appendix 1. Calculation of arithmetic mean for the gross sales per worker in clustered small agro food processing firms

Sample No	Price range (Po)	Mid price (Pi)	NMGS per worker (Zi)	SMGS Per worker (Zi)
1	170–350	260	32,500	44,200
2	200–750	450	104,998	10,800
3	2,2003,000	2600	26,000	36,400
4	900-1200	1050	87,496	25,200
5	250–500	375	52,500	49,998
6	2000–3500	1200	27,500	34,842
7	250–500	290	56,250	48,750
8	200–600	475	48,000	50,668
9	900–1500	400	36,531	13,200
10	180–400	450	46,400	47,500
11	250–700	425	47,500	59,370
12	200–600	450	50,000	50,668
13	200–700	2000	63,000	51,750
14	250–600	1900	51,000	4887
15	250–650	285	45,000	525, 0
16	1,5002,500	2000	22,000	7290
17	1,8002,000	1900	44,031	2090
18	170–400	285	42,700	3915
19	180–300	240	36,000	8690
20	300–600	450	75,001	8435

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(*continued*)

Sample No	Price range (Po)	Mid price (Pi)	NMGS per worker (Zi)	SMGS Per worker (Zi)
21	200–600	400	56,000	10,690
22	1,5003,500	2500	32,500	3800
23	2500–3000	2750	22,957	2610
24	350–750	550	61,850	6875
25	250–500	375	62,501	53,151
26	350–800	550	64,013	9350
27	2500–3000	250	24,700	3300
28	1500–3500	2500	25,000	29,165
29	400–600	500	70,000	7500
30	450–700	575	134,166	5780
31	400–600	500	62,500	8000
Total			148,626	411,238
ANMGS per worker			148,626/31 4794.3	
ASMGS per worker				411,238/31 13265.7
Price Range		Min = 170 Max = 3500		

Appendix 2. Calculation of the arithmetic mean for gross sales per worker in dispersed small agro food processing firms

Sample No.	Price Range (P_o)	Average price (P_i)	NMGS per worker (Z_i)	SMGS per worker (Z_i)
1	250–750	500	4000	4500
2	200–700	450	33,750	3600
3	300–850	575	4312	5170
4	300–650	475	3350	3565
5	200–850	525	6121	6615
6	300–750	525	4725	6478
7	400–700	550	4950	6050
8	1500–3000	2250	1685	27,000
9	1500–2000	1750	1450.0	13,125
10	2000–2500	2250	1575	22,500
11	2500–3000	2750	1650	22,000
12	2200–3000	2600	6636	26,000
13	250–700	475	3800	30,885
14	200–750	475	4035	42,750
15	2000–3500	2750	4000	27,500
16	200–800	500	3800	35,000
17	250–700	475	1500	4433
18	1500–2000	1750	3150	1750
19	1500–2500	2000	4500	18,000
20	200–700	450	4325	3748
21	250–750	500	4000	45,000
22	300–850	575	1850	4794
23	250–750	500	5500	3700
24	1500–3500	2500	6016	2000
25	400–700	550	5500	7150
26	1500–2500	2000	5816	1500
27	2000–3500	2750	1920	16,500
28	2500–3000	2750	2060	2017
29	250–700	475	4250	3958
30	200–800	500	3500	6250
31	300–800	550	4900	7700
Total			148,626/31	411,238/31
AMGS per worker			4794.3	
ASGS per worker				13265.7
Price range		Min = 200 Max = 3500		

Appendix 3. The aggregate mean monthly output per worker in dispersed firms (000 000 TZS)

Sample number	No. of workers	MMO (Projected)	MMO per worker (Projected)	MMO Realized	MMO per worker (Realized)	MMO Shortfall per worker

(*continued on next page*)

(*continued*)

Sample number	No. of workers	MMO (Projected)	MMO per worker (Projected)	MMO Realized	MMO per worker (Realized)	MMO Shortfall per worker
1	3	5 × 4 = 20	20/4 = 5	2 × 4 = 8	8/3 = 2.67	5–2.67 = 2.33
2	5	8 × 4 = 32	32/4 = 8	5 × 4 = 20	20/5 = 4	8-4 = 2
3	3	10 × 4 = 40	40/4 = 10	4 × 4 = 16	16/3 = 5.3	10–5.3 = 4.7
4	6	8 × 4 = 32	32/4 = 8	3 × 4 = 12	12/6 = 2	8- 2 = 6
5	7	15 × 4 = 60	60/4 = 15	10 × 4 = 40	40/7 = 5.71	15–5.7 = 9.3
6	5	12 × 4 = 48	48/4 = 12	6 × 4 = 24	24/5 = 4.8	12–4.8 = 7.3
7	7	7 × 4 = 28	28/4 = 7	3 × 4 = 12	12/7 = 1.7	7–1.7 = 5.3
8	6	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/6 = 2.67	7–2.67 = 4.33
9	3	10 × 4 = 40	40/4 = 10	6 × 4 = 24	24/3 = 8	10-8 = 2
10	8	12 × 4 = 48	48/4 = 12	5 × 4 = 20	20/8 = 2.5	12–2.5 = 9.5
11	9	8 × 4 = 32	32/4 = 8	3 × 4 = 12	12/9 = 1.33	8–1.33 = 6.67
12	5	6 × 4 = 24	24/4 = 6	3 × 4 = 12	12/5 = 2.4	6–2.4 = 3.6
13	3	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/3 = 5.33	16–5.3 10.67
14	2	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/2 = 4	6-4 = 2
15	4	5 × 4 = 20	20/4 = 5	3 × 4 = 12	12/4 = 3	5-3 = 2
16	4	3 × 4 = 12	12/4 = 3	2 × 4 = 8	8/4 = 2	3-2 = 1
17	2	5 × 4 = 20	20/4 = 5	2 × 4 = 8	8/2 = 4	5-4 = 1
18	2	4 × 4 = 16	16/4 = 8	1 × 4 = 4	4/2 = 2	8-2 = 6
19	2	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/2 = 4	6-4 = 2
20	5	4 × 4 = 16	16/4 = 4	3 × 4 = 12	12/5 = 2.4	4–2.4 = 1.6
21	5	3 × 4 = 12	12/4 = 3	1 × 4 = 4	4/5 = 0.8	3–0.8 = 2.2
22	5	4 × 4 = 16	16/4 = 4	2 × 4 = 8	8/5 = 1.6	4–1.6 = 2.4
23	2	3 × 4 = 12	12/4 = 3	2 × 4 = 8	8/2 = 4	3- 4- = −1
24	4	5 × 4 = 20	20/4 = 5	3 × 4 = 12	12/4 = 3	5-3 = 2
25	4	4 × 4 16	16/4 = 4	1 × 4 = 4	4/4 = 1	4-1 = 3
26	4	3 × 4 = 12	12/4 = 3	2 × 4 = 8	8/4 = 2	3-2 = 1
27	4	5 × 4 = 20	20/4 = 5	4 × 4 = 16	16/4 = 4	5-4 = 1
28	3	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/3 = 5.33	7–5.33 = 1.67
29	2	3 × 4 = 12	12/4 = 3	1.5 × 4 = 3	3/2 = 1.5	3–1.5 = 1.5
30	5	4 × 4 = 16	16/4 = 4	2.5 4 = 10	10/5 = 2	4-2 = 2
31	6	5 × 4 = 20	20/4 = 5	3 × 4 = 12	12/6 = 2	5-2 = 3
32	4	3 × 4 = 12	12/4 = 3	2 × 4 = 8	8/4 = 2	3-2 = 1
33	6	2 × 4 = 8	8/4 = 2	1 × 4 = 4	4/6 = 0.67	2–0.67 = 1.33
34	3	3 × 4 = 12	12/4 = 3	2 × 4 = 8	8/3 = 2.67	3–2.67 = 0.33
35	6	3 × 4 = 12	12/4 = 3	3 × 4 = 12	12/6 = 2	3-2 = 1
36	8	5 × 4 = 20	20/4 = 5	3 × 4 = 12	12/8 = 1.5	5–1.5 = 3.5
Total	162	840	214	437	105.88	115.23
Mean	4.5	23	5.9	12	2.9	3.2
SD	1.8	10.6	2.9	7	1.6	2.7

Appendix 4. The aggregate mean monthly output per worker in clustered firms (000 000TZS)

Sample number	No. of workers	MMO (Projected)	MMO per worker (Projected)	MMO Realized	MMO per worker (Realized)	MMO Shortfall per worker
1	15	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/3 = 5.33	7–5.33 = 1.67
2	12	10 × 4 = 40	40/4 = 10	5 × 4 = 20	20/12 1.67	101.67 = 8.33
3	9	10 × 4 = 40	40/4 = 10	4 × 4 = 16	16/9 = 1.7	10–1.7 = 8.3
4	2	8 × 4 = 32	32/4 = 8	3 × 4 = 12	12/6 = 2	8- 2 = 6
5	4	20 × 4 = 80	80/4 = 20	10 × 4 = 40	40/4 = 10	20-10 = 10
6	4	14 × 4 = 56	56/4 = 12	6 × 4 = 24	56/4 = 14	12-14 = −2
7	4	10 × 4 = 40	40/4 = 10	4 × 4 = 16	16/4 = 4	10-4 = 6
8	11	15 × 4 = 60	60/4 = 15	8 × 4 = 24	24/11 = 2.18	15–2.1 12.82
9	4	10 × 4 = 40	40/4 = 10	5 × 4 = 20	20/4 = 5	10-5 = 5
10	10	14 × 4 = 56	56/4 = 14	6 × 4 = 24	24/10 = 2.4	14–2.4 = 11.6
11	10	10 × 4 = 40	40/4 = 10	3 × 4 = 12	12/10 = 1.2	10–1.2 = 8.8
12	6	9 × 4 = 36	36/4 = 9	3 × 4 = 12	12/6 = 2	9-2 = 7
13	4	11 × 4 = 44	44/4 = 11	5 × 4 = 20	20/4 = 5	11-5 = 6
14	6	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/6 = 2.6	7–2.6 = 4.4
15	9	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/9 = 0.8	6–0.8 = 5.2
16	30	9 × 4 = 36	36/4 = 9	3 × 4 = 12	12/30 = 0.4	9–0.4 = 8.6
17	3	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/3 = 2.67	6–2.67 = 3.33
18	3	8 × 4 = 32	32/4 = 8	4 × 4 = 16	16/3 = 5.33	8–5.33 = 2.67
19	3	6 × 4 = 24	24/4 = 6	3 × 4 = 12	12/3 = 4	12-4 = 8
20	2	4 × 4 = 16	16/4 = 4	3 × 4 = 12	12/2 = 6	4-6 = −2
21	6	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/6 = 1.33	6–1.33 = 4.67
22	3	5 × 4 = 20	20/4 = 4	2 × 4 = 8	8/3 = 2.6	4–2.6 = 1.4
23	3	3 × 4 = 12	12/4 = 3	3 × 4 = 12	12/3 = 4	3- 4- = −1
24	3	10 × 4 = 40	40/4 = 10	4 × 4 = 16	16/3 = 5.33	105.33 = 4.67
25	3	7 × 4 = 28	28/4 = 7	3 × 4 = 12	12/3 = 4	7-4 = 3
26	3	5 × 4 = 20	20/4 = 5	2 × 4 = 8	8/3 = 2.67	5–2.67 = 2.33

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Sample number	No. of workers	MMO (Projected)	MMO per worker (Projected)	MMO Realized	MMO per worker (Realized)	MMO Shortfall per worker
27	5	9 × 4 = 36	36/4 = 9	4 × 4 = 16	16/5 = 3.2	9-3 = 5.8
28	5	7 × 4 = 28	28/4 = 7	4 × 4 = 16	16/5 = 3.2	7–3.2 = 3.8
29	2	8 × 4 = 32	32/4 = 8	5 × 4 = 20	20/2 = 10	8-10 = −2
30	3	6 × 4 = 24	24/4 = 6	2.5 × 4 = 10	10/3 = 3.33	6–3.33 = 2.67
31	7	5.5 × 4 = 22	22/4 = 5.5	3 × 4 = 12	12/7 = 1.71	5.5–1.7 = 3.79
32	12	13 × 4 = 52	52/4 = 13	5 × 4 = 20	20/12 = 1.6	13–1.6 = 1.14
33	3	12 × 4 = 48	48/4 = 12	3 × 4 = 12	12/3 = 4	12-4 = 8
34	5	9 × 4 = 36	36/4 = 9	5 × 4 = 20	20/5 = 4	9-4 = 5
35	3	6 × 4 = 24	24/4 = 6	2 × 4 = 8	8/3 = 2.6	6–2.6 = 3.4
36	3	4 × 4 = 16	16/4 = 4	2 × 4 = 12	8/3 = 2.67	4–2.67 = 1.3
Total	220	1238	306.5	540	144.52	175.69
Mean	6	34.4	8.5	15	4	4.8
S.D	5.2	13.97	3.45	6.67	3.2	3.29

Evaluation of cluster performance.

Appendix 5. Calculation of average number of successful designs in the market as a survival strategy in sampled non clustered agro food processing firms (in 000 TZS)

Firms	Number of. designs	Number of successful designs	Costs of designs	Survival costs	TC of successful design	Sunk costs
Nyemo	2	2	1500	3000	1125	1875
Furaha	3	3	1750	5250	1400	3850
Lumumba	2	1	1550	3100	1007	2093
Dodoma	3	2	2250	6750	1800	4950
Three sisters	1	1	2500	2500	1500	1000
Jasma	1	1	2500	2500	2000	500
Amboni GR	3	1	3500	10,500	3500	7000
Shelui	1	2	15,000	15,000	4500	10,500
Msimamo	1	1	2500	2500	1000	1500
Mesh	2	1	1750	3500	2187	1313
Kwayo	2	1	2250	4500	1680	2820
Double FM	4	3	2500	10,000	3125	6875
Seeku	5	3	1500	7500	1125	6375
Inara	1	2	20,000	20,000	8000	12,000
SIDO Singida	2	1	1750	3500	3500	0
Yeo	2	0	2250	4500	4500	0
Muzijal	2	2	25,000	50,000	10,000	40,000
Sabina	3	2	2500	7500	3125	4375
Samba	3	1	1800	5400	1350	4050
Mwisi	2	2	2050	4100	3075	1025
Mangi	1	1	2500	2500	1875	625
Mkongori	3	3	22,500	45,000	45,000	0
Shawanans	2	3	25,000	50,000	35,000	15,000
Shaibu	3	2	2750	8250	3437	4813
Chaliange	2	1	3500	7000	7312.5	312.5
Magin Ltd	3	2	2500	7500	3125	4375
Singida Sushine	1	3	2050	2050	3075	1025
Turashash	3	2	2500	7500	3750	3750
Singida Superquality	3	1	2750	8250	3437	4813
Dodo sunflower	3	3	2050	6150	1537	4613
Atukuzwe	2	2	2000	4000	2000	2000
Double PON	2	1	2250	4500	3375	1125
Juhudi Group	3	3	2750	8250	2062	6188
Mafiki	2	2	29,000	58,000	8700	49,300
Nyota Njema	2	1	20,000	40,000	6000	54,000
Rulemo food	1	2	17,500	17,500	7000	10,050

Appendix 6. Calculation of average number of successful products in the market as a survival strategy in sampled agro food processing firm's cluster (in 000 TZS)

Firm	Number of. designs	Number of successful designs	Costs of designs	Survival costs	TC of successful design	Sunk costs
Songela	5	2	1500	7500	1125	6375
Nam	6	3	1750	10,500	1400	9100
Songambele	4	1	1550	6200	1007.5	5192.5
Tabasam	7	4	2250	15,750	1800	13,950
Yemen om	4	1	2500	10,000	1500	8500
Bin salum	6	3	2500	15,000	2000	13,000
Shames	7	4	3500	24,500	3500	21,000
Upendo	3	3	1500	4500	4500	0

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Firm	Number of. designs	Number of successful designs	Costs of designs	Survival costs	TC of successful design	Sunk costs
Mude	5	2	25,000	12,500	10,000	2500
Makiceo	9	6	1750	15,750	2187.5	13562.5
New flower	7	4	2250	15,750	1687.5	14062.5
Star	6	3	2500	15,000	3125	11,875
Sikwakwa	6	3	1500	9000	1125	7875
Mwenge	5	2	2000	10,000	8000	2000
Mbamba	4	1	1750	7000	7000	0
El shadai	3	2	2250	6750	6750	0
Makalas	5	2	25,000	12,500	10,000	2500
Kindai	7	2	2500	17,500	3125	14,375
Vasco Dagama	6	1	1800	10,800	1350	9450
Ngallo	5	3	2050	16,400	3075	13,325
Crown	5	1	2500	12,500	1875	10,625
Mohamed	6	3	22,500	6750	6750	0
Ituja	3	3	20,000	6000	6000	0
Shigan son	3	2	2750	9250	3437.5	15812.5
Meru	8	1	3500	28,000	7312.5	20687.5
Day	6	2	2500	15,000	3125	11,875
Ubaraka	7	3	2050	14,350	3075	11,275
Haubi	7	2	2500	17,500	3750	13,750
Mdunde	6	3	2750	16,500	3437.5	13062.5
Adam	4	3	2050	8200	1537.5	6662.5
Uncle millo	6	2	2000	12,000	2000	10,000
Msalali	7	3	2250	15,750	3375	12375.5
Rajabu	6	3	2750	16,500	2062.5	14437.5
Mteka	4	2	29,000	11,600	8700	2900
Ndegela	3	1	20,000	6000	6000	0
Jera	4	2	17,500	7000	7000	0

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