Labour Productivity Performance of Small Agro-Processing Firms in Mbeya and Morogoro, Tanzania

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Abstract
This paper examines human capital factors affecting labour productivity in small agro-processing firms. Labour productivity is a measure of a firm's efficiency that is affected by different factors, among them includes human capital factors represented by education, experience, and training. A survey of 107 agro-processing firms was conducted in Mbeya and Morogoro Regions, Tanzania. Descriptive statistics and regression analysis was employed in estimating the effect of factors on labour productivity. Results show that the trend of labour productivity among different types of small agro-processing firms varies. Animal feed, cooking oil and milling firms tend to have higher labour productivity than bakeries and milk processing firms. Moreover, the experience of workers, education of managers and female managers has a positive effect on labour productivity in small agro-processing firms. Contrary to expectations, the number of workers with education above standard seven has a negative effect on labour productivity. Through these findings the study recommends investment in physical and human capital factors for the growth of labour productivity and employment creation.
Key words: Labour productivity, Small Agro-processing firms, Tanzania

1. Introduction

Productivity measures the rate at which the output of goods and services produced per unit input, which includes labour, capital, raw-materials and others (Isinika 1995). Productivity is computed by combining inputs such as labour and capital refer to as multifactor or total factor productivity – TFP of a firm (Kohli 2004). This is computed as the ratio of output to the combined input including labour and capital. Meanwhile, partial productivity is computed based on a single input such as yield which is a ratio of output per unit area (e.g Tons/ha) (Isinika 1995). The total factor productivity of a production process is affected by innovation, investment, research, development, trade, firm size, government policy and inflation (Khan 2006). Meanwhile, labour productivity is influenced by education level, experience, skills, training, age, gender and technology.
The productivity of a firm depends on the relationship between labour as an input that is affected by education, experience, skills, training, age and gender of a firms' employees relative to the amount of goods and services produced (Afrooz & Rahim 2010). Labour therefore is a key variable in firm's productivity.

Improvement in the productivity of labour will have occurred if the same volume of work produces a larger quantity of goods or, the same quantity of goods can be produced by a smaller volume of work. Alternatively stated, a certain amount of output is produced by less labour (in monetary terms) (Laurentiu 2009).

Different scholars have studied labour productivity in agro- processing firms. This includes Mwakapugi et al. (2010), who examined job creation and labour productivity gains through expanded electrification and established that limited physical capital investment as a hindrance for growth of labour productivity. The estimated labour productivity growth rate of 3.14 annually in small agro-processing industries which is remarkably small compared to other African countries where it is reported to be 5..32 rates (ILO, 2011). Similarly, World Bank (2007) reported the average of 3,000 USD of labour productivity per annum, which is smaller than that of other African countries estimated as 4,800 to 14,000 USD. This calls for research to establish the underlying causes of this performance and propose solutions for the prevailing growth and inefficiency within the sub-sector, for the purpose of improving processing efficiency.

Only a few studies have been conducted in Tanzania on this subject. Mwakapugi et al. (2010) studied the potential of job creation and labour productivity through expanded electrification in small agro-processing industries, but they did not include human capital factors affecting labour productivity. Niringiye et al. (2010) studied human capital and labour productivity in manufacturing firms, but they did not link with influences of labour productivity on employment generation.

This study analyzed the performance of labour productivity in relation to employment generation. Time series and cross-sectional data were used to examine human capital factors affecting labour productivity in small agro-processing firms in Mbeya and Morogoro regions.

2. Conceptual Framework

This part provides a conceptual framework to facilitate the analysis for the labour productivity performance among small agro processing firms in Mbeya and Morogoro regions in Tanzania. Labour productivity is defined as real output per unit of labour input. According to Allan et al. (2002) Labour productivity can be measured in two main ways: as gross output per worker or as gross value added per worker. The measurement of the value of output could be based on the price of the good in the local market multiplied by the volume of goods sold. Hence the value of output produced at a given time divided by the number of hours spent in production to get output per hour of labour input, hence a measure of labour productivity. The method is useful to the industries with outstanding records of all permanent, temporally, part time workers and good records of working hour per employee. Alternatively, especially when data for hours worked are not available or are of low quality, labour productivity is computed in terms of value of output produced at a given time divided by the number of persons employed to produce the output (Isinika 1995, Khan 2006 & Freeman 2008).

In this study labour productivity performance is examined through three stages including; (i) Computation of labour productivity per worker of each firm. (ii) Generation of labour productivity trends of studied firms and (iii) analyzing factors affecting labour productivity performance.

3. Methodology

The study was conducted in Mbeya and Morogoro regions of Tanzania which play an important role in agro-processing activities. These were selected purposively to represent other regions in the country because of their standing in relation to the present and past performance of small agro-processing firms and their agrarian nature. The two regions are also relatively more active agro-industrial activities and extensive agricultural production activities that supply raw material to agro-industries.

The analysis used in this study includes descriptive and empirical analysis. The descriptive analysis involved graph, percentages and correlation analysis of labour productivity in small agro-processing firms. The empirical model has been used on human capital factors affecting labour productivity.

Data for this study was collected from 107 agro-processing firms, from both Morogoro and Mbeya regions in Tanzania represented about 12% of registered firms. Time series data on a number of workers in each studied firms, physical capital and value of processed products collected from Tanzania Revenue Authority (TRA), Small Industries Development Organization (SIDO) and from Local Government Authority (LGA) offices. Cross sectional data was collected from workers and managers of each firm regarding to level of education of workers and managers, experience, training, sex and location of firms. This data complemented the time series data. Tools for data collection included structured questionnaires and discussion with key informants. Based on analysis described above data were compiled, summarized and analyzed using Excel software for data management at initial stage, Stata software and statistical package for social sciences (SPSS) were used for descriptive, correlation and regression analysis.

Multicolinearity among independent variables was tested using the variance inflation factor statistic (VIF), the variable with higher than 5 (VIF) was dropped down to fix multicolinearity (Greene 2003). The autocorrelation and heteroskedasticity corrected by running regression with Newey-West standard errors (Wooldridge 2002, Greene 2003 & Hoechle 2007).

3.1 Empirical model

Labour productivity is indicated as;

$$\text{LP} = \frac{Y}{H} \quad \text{or LP} = \frac{Y}{L} \tag{1}$$

Where LP= Labour productivity,

Y = Volume or value of output produced at a given time,

H = Hours spent in the production of outputs and

L= Number of workers involved in production of output.

The equation (1) is expanded basing on the model developed by Cörvers (1997) and Niringiye et al. (2010) with slightly modification, hence computation of factors affecting labour productivity using a Cob-Douglas model as presented in equation (2).

$$y = ak^{\alpha}_{i} l_i^{*\beta} e_i \tag{2}$$

Where; y =Value of output, a=Technology used in production, k=Capital, l^*=efficiency unit of Labour, e_i = an error term for the i^{th} firm.

The overall labour efficiency (l^*) of a firm is presumed to be influenced by a number of factors presented as ($x^{\theta s}_{n,i}$) in equation (3). These includes; the manager's education, experience, and training. Other factors include; the number of workers with different level of education and their experience. There are other non-human capital factors such as the value of capital invested in processing firm, wages, sex of a manager, location of a firm

whether is in rural or urban and the region of a firm whether is in Mbeya or Morogoro region.

The efficiency of labour presented by l^* is expanded to equation (3)

$$l_i^* = x_i x_{n,i}^{\theta s} \quad (3)$$

Where; l_i^* = Overall labour efficiency of i^{th} firm, x_i = factors affecting labour efficiency, n = the n^{th} factor for n = 1, 2, 3….k, θs = A parameters reflecting the contribution of factors to the efficiency of a unit of labor.

By substituting l_i^* as defined in equation (3) into equation (2), the equation (4) is formed.

$$y = ak_i^{\alpha}(x_i x_{n,i}^{\theta s}) \quad (4)$$

The equation (4) was transformed to equation (5)

$$\ln \frac{Y_{it}}{L_{it}} = \ln A + \alpha \ln\left(\frac{K_{it}}{L_{it}}\right) + (\alpha + \beta - 1)\ln L_{it} + \beta\theta_{1,} \ln nX_{1,it} + ... + \beta\theta_{n,} \ln X_{n,it} + \varepsilon \quad (5)$$

By transforming equation (5) and substituting the human capital and other variables of factors affecting labour productivity the equation (6) was formed.

$$\ln\frac{Y}{L} = \alpha_0 + \alpha_1 \ln X_1 + \alpha_{2,} \ln X_{2it-1} + \alpha_{3,} \ln X_{3it-1} + \alpha_{4,} \ln X_{4it-1} + \alpha_{5,} \ln X_{5it-1} + \alpha_{6,} \ln X_{6it-1} + \alpha_{7,} \ln X_{7it-1} + \alpha_{8,} X_{8it-1} + \alpha_{9,} X_{9it} + \alpha_{10,} X_{10it} + \alpha_{11,} X_{11it} + \alpha_{12,} X_{12it} + \varepsilon_{it} \quad (6)$$

Where $\frac{Y}{L}$ = Labour productivity, X_1 =Ratio of capita per worker, X_2 = Number of workers with and below standard seven, X_3 = Number of workers above standard seven, X_4 = Number of workers with experience below 1 year, X_5 = Number of workers with experience equal and above 1 year, X_6 = Average wage per labour, X_7 = Manager's education level, X_8 = Manager's experience, X_9 = Manager's form of training, X_{10} = Sex of managers, X_{11} = Region of a firm location, X_{12} = Location of a firm whether located in urban or rural

4. Results and Discussion

4.1 Correlation analysis

The independent variables were tested and corrected by generalized linear regression based on Newey-West standard errors. This lead to failure in rejecting a null hypothesis which state that there is no positive serial correlation of explanatory variables. Further more, analysis was done to test whether the number of new firms established and number of employment generated per firm correlated with average labour productivity per year. Labour productivity in this case is measured as average value of processed products divided by number of

workers processed the products.

Table 1:

The Pearson's correlation index for the number of new firms established per year and the average labour productivity per year was 0.788, hence positive and significantly different from zero ($p < 0.05$). Similarly, a number of employment created per firm and average labour productivity per year was 0.494 positively significant different from zero ($p < 0.01$).

The result is supported by the arguments of (Pissarides & Vallanti 2003, Landmann, 2004) that labour productivity increases not necessary to reduce the number of employment within a particular firm but could increase the employment. The increase of employment could be due to increase of the profit that leads to more investment within and outside the firm that creates more vacancies for other employment posts within and outside a firm as long as the marginal productivity is positive.

Furthermore, it was observed that more than 80% of these industries operate below their installed capacity due to scarcity of raw-materials with negative effect on both productivity and employment sustainability. This has been confirmed by both managers and firm's owners that more than 50% of workers in processing firms are laid off between December and March due to scarcity of raw- materials. Lay off of workers was done to increase profit and labour productivity. This reflects the theory of marginal productivity, the firm will maximize profits where the marginal cost of employing an extra worker equals the marginal revenue than to its costs frontier, the firm's profit will increase, and hence it will be worth employing workers. But as more workers are employed, diminishing returns to labour will set in where each extra worker will produce less than the previous one and thus earn less for the firm that is lowering productivity.

Figure 1:

Figure 1 indicates the labour productivity performance of different firms. Animal feed, cooking oil and milling firms showed high labour productivity between 2005 and 2011. On the other hand, milk and bakeries processing firms reflect lower labour productivity than average labour productivity over the same period. However from 2002 to 2005 the labour productivity of animal feed firms was lower than average as bakeries processing firms. The milling firms have shown progressive increase in labour productivity since 2002 to 2010 when productivity started to decrease. The average labour productivity was 1900 USD per worker smaller than the one computed by World Bank (2007), for Tanzania in agro-processing firms was estimated at 3000 USD per worker. These differences might be due the composition of firm size in each study. Based on these differences the regression analysis was done specifically on small agro-processing firm as indicated in section (4.2)

4.2 Log linear regression analysis of factors affecting labour productivity performance

Several hypotheses were tested in this study. One of them is the average labour productivity per firm in small agro-processing firms is not affected by human capital factors. Using a two tailed t-test at 0.05 level of significance, the hypothesis would only be rejected when the p value < 0.05 or 95% confidence level (Mosha et al. 2008). Results of regression analysis between labour productivity in relation to a number of independent variables are presented in the Table 1.

The results show that labour productivity within agro-processing firms is positively affected by various human capital factors, especially manager's education above form four, experience of both workers and managers and trained managers, whose coefficients are positive and significantly different from zero. If a processing firm is located in a rural area, this would have a significant negative effect on labour productivity.

Table 2:

If the manager's experience was above three years this had a positive significant effect on labour productivity where one percent increases in experience would increase productivity by 0.55%. This result is consistent with the notion of learning by doing that improves productivity (Chiang 2004 & Bessen 1998). Having more workers with form four education and above had a highly significant negative impact on a firm's labour productivity, as indicated by the coefficient for this variable (-0.685; p>0.002). This is inconsistent with a fundamental human capital theory, which purports that increase in the education of an employee should also increase their labour productivity (Olaniyan & Okemakinde 2008, Supachet 2010 and Afrooz & Rahim 2010). They argued that higher education contribute in growth of labour productivity since workers are capable to use the inputs more effectively. However, this theory contradicts with the assumption that most educated workers shun work that involves drudgery, even during initial stages of their employment, direct from schools. Moreover, a study of Pritchett (2001), revealed the same that, association educational capital growth with productivity is statistically significant and negative. This is probably the educated workers in small agro-processing firms are not motivated to manual works hence lowering labour productivity. The educational quality for agro – processing activities could probably be so low that created no human capital invested for processing agro-products.

The findings also show that firms that are located in rural areas have less labour productivity than urban areas. If the location of an agro-processing firm increased by one percent from urban, labour productivity would decrease by 0.41%, probably due to added transport cost, or even higher cost of some inputs. This coefficient is significant at ($P \leq 0.077$).

The coefficient on the variable female manager is 0.829 (P>0.015) which implies that if a male managers was replaced by a female manager, productivity would improve by 0.82%. This result is similar to that of Cordeiro et al. (1997) & Dezso et al. (2011) who established that women managers improves firms performance to extent that strategy is focused on innovation, starting new firms twice than men and growth in labour productivity. Contrary to that Suda (2002), argued that the labour productivity of women is challenged by triple roles of production, reproduction and community welfare that reduces productivity hence limiting employment opportunities for women. The observation in small agro-processing firms indicated women managers are fewer by 70% than men which reflect the dominance of men in managerial positions. For this case qualified women should be given priority in managerial positions as they have high contribution in productivity.

The ratio of physical capital added per worker indicated positive and significantly different from zero (P>0.007). One percent increase in ratio of capital added per worker would increase labour productivity by 0.28%. This reflects the contribution of physical capital factor in Labour productivity. It is supported by the argument of Singh (2001), that an increase of capital intensity causes a substantial increase of labour productivity. There fore, physical capital investment is important in improve of labour productivity.

The overall findings includes more than 80% of firms operates below their capacity due to scarcity of raw-materials hence negatively affecting employment creation in agro-processing firms. The education, experience, female managers, Physical capital, training and urban location of firms contributes positively to labour productivity and employment creation. However, workers education above form four has indicated negative contribution to labour productivity.

5. Conclusion and recommendations

The study used qualitative and quantitative methods to analyze human capital and other extraneous factors affecting labour productivity. The findings show that human capital factors that include manager's; training, education, experience and the number of workers with high experience contribute significantly to improving labour productivity of a firm. Furthermore, female managers also improve labour productivity more than their male counterparts.

However, an increase in the number of form four and above workers in an agro-processing firm decreases labour productivity, probably because most of the tasks are tedious and manual, which tend to be shunned by more educated employees.

The policy recommendation arising from these findings includes; a need to employ educated managers as well as training both managers and workers purposefully to improve labour productivity. Special strategy for financing small agro-processing firms for growth and increase labour productivity should be in place to contribute in employment creation. Technology investment in terms of machines and other innovations should be a priority to motivate workers with all levels of education. Qualified women should be given priority in managerial positions since they have been shown to have a highly significant impact on a firm's overall labour productivity. Production of mostly demanded raw-materials including sunflower oil seeds, paddy and milk should be expanded to satisfy demand of small agro-processing firms hence creating employment.

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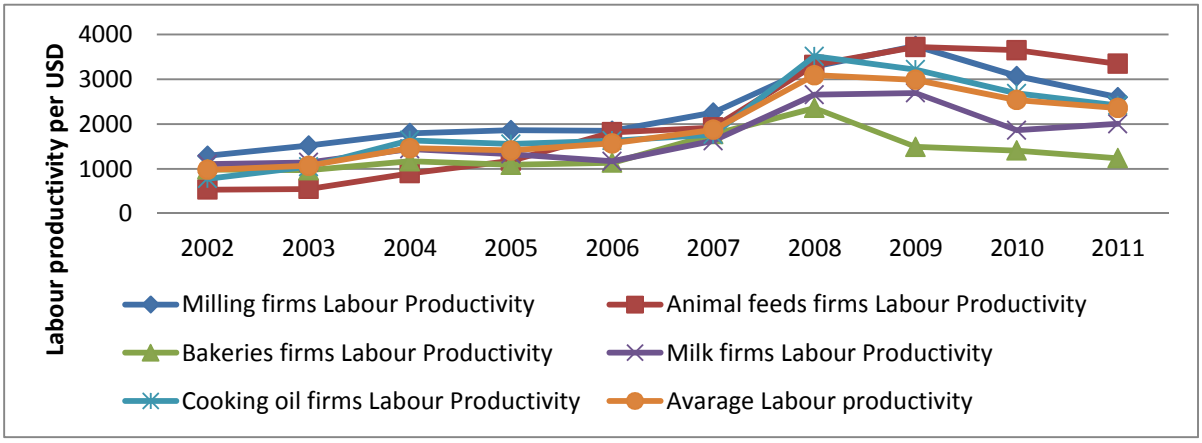
Table 1: Correlation matrix results for labour productivity performance

Correlated variables	Number of firms	Pearson	Significant
Average labour productivity per year Vs number of new firms established per year	87	0.788**	0.012
Average Labour productivity Vs number of employment created per firm	87	0.494***	0.000

** Correlation is significant at the 0.05 level and *** at the 0.01 level (2-tailed)

Figure 1: Trends of average labour productivity per worker of different types of firms



Source: TRA, SIDO and district council 2011

Table 2: The effect of human capital factors in labour productivity for small agro-processing firms in Mbeya and Morogoro regions (2002 – 2011)

Variable	Coefficient.	S.E.	t	P>|t|
Region	0.168832	0.2430403	0.69	0.489
Manager's education ≤ standard 7	0.053523	0.2822176	0.19	0.850
Manager's education > standard 7 to form 4	0.187961	0.4836833	0.39	0.699
Manager's education > form 4	1.37793*	0.7236867	1.90	0.060
Trained Managers	0.69303***	0.262412	2.64	0.010
No. of workers with experience < 1 year	0.45045**	0.2277356	1.98	0.051
No. of workers with experience> 1 year	1.04691***	0.2285795	4.58	0.000
Average wage per labour	0.18247	0.243432	0.75	0.456
Number of workers below form four	-0.304066	0.1848135	-1.65	0.104
Number of workers above form four	-0.68522***	0.2185157	-3.14	0.002
Ratio of capital added per worker	0.28241***	0.1024453	2.76	0.007
Manager's experience > 1 year to 3 years	0.398616	0.3991087	1.00	0.321
Manager's experience > 3 years	0.558053*	0.3284656	1.70	0.093
Sex of manager	0.82934**	0.33351349	2.47	0.015
Rural area location of firm	-0.405635*	0.2265738	-1.79	0.077
Constant	11.44754	3.75603	3.05	0.003
$R^2 = 0.4326$ VIF < 5 Durbin-Watson statistic = 1.761144 F-value = 6.12 Prob > F = 0.0000				

*** Significant at the 0.1 and ** Significant at the 0.05 level, and ***Significant at the 0.01 level**

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