EFFICIENCY OF LISTED MANUFACTURING FIRMS IN DAR ES SALAAM STOCK EXCHANGE: DATA ENVELOPMENT ANALYSIS MODEL

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ABSTRACT

The aim of this paper is to measure the efficiency of listed manufacturing companies in Tanzania, the study covers the year 2010 to 2014. The study employed a non-parametric approach, known as Data Envelopment Analysis (DEA) to measure efficiency under input oriented with constant returns to scale (CRS) and variable returns to scale assumptions (VRS). The study also employs Pearson correlation to test positive correlation between inputs and outputs variables. Data was extracted from respective annual financial reports of the manufacturing firms listed at Dar es Salaam stock exchange (DSE) before the year 2010. Three critical inputs variables (raw materials, staff expenses as well as plant and machinery) and two output variables (net sales and earnings after tax) were employed to measure relative efficiency of 6 listed manufacturing. Findings revealed that Tanzania Cigarette Company (TCC) was performing relatively better in terms of pure technical efficiency (PTE) and scale efficiency (SE) with an average efficiency score of 98% and 99 % respectively. While, Tanzania Oxygen Limited (TOL) experienced difficulties in terms of PTE and SE with an average efficiency score of 72% and 45% respectively. Results of average annual performance in the years 2010, 2011 and 2012 were better compared to the remaining years. Result for returns to scale indicates that there was no firm which consistently experienced increasing return to scale (IRS) throughout the period under review, which implies that none of the firms has the room to enjoy economies of scale throughout the period under review. Findings have significant bearing on policy issues relating to size of manufacturing firms in the country. Firms indicating decreasing returns to scale (DRS) should revisit their size versus production scale so as to improve the scale efficiency. The findings from this study can also enrich the ongoing agenda of promoting industrialization in Tanzania particularly, on issues relating to size and production scale (optimality).

Keywords: *Efficiency, Manufacturing Firms, Data Envelopment Analysis (DEA), Tanzania*

1. INTRODUCTION

Tanzania is one of the East African countries, others include Kenya, Uganda, Rwanda, Burundi and South Sudan. In terms of economic power, the country ranks the second after Kenya. Tanzania economy has evolved through various stages of development over time. Soon after political independence in 1961, the country continued to pursue a private sector-led, capitalist economic system, where by almost all major means of production including industries, agriculture, mining, banks and others were in the hands of private investors. In 1967, the country took completely different direction following the Arusha Declaration in 1967, which established the Ujamaa (African Socialism) Policy. With ujamaa policy all major means of production were put under state ownership, control and management. In the manufacturing sector, Tanzania adopted an Import Substitution Industrialization (ISI) strategy, which created a number of state-owned enterprises (SOEs), and introduced development initiatives for small scale industries. Due to inadequate production capacity which could satisfy local market there was excessive shortage of the products in the market which led to the economic crisis.

In the mid-1980s, Tanzania re-embraced a private sector- and market-led economic system which paved the way for the privatization of SOEs; several reforms which allowed the private sector to play a major role in productive economic activities; and both local and international trade were liberalized, including importation of manufactured goods. Generally, these economic reforms have made noticeable differences in manufacturing sector performance especially since the 1990s. Nevertheless, the share of the manufacturing sector to GDP and its growth rate has remained relatively stagnant over the past decade. While some manufacturing subsectors have grown constantly over time, others have remained inert (Wangwe et al, 2014)

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Ha-Joon Chang's contended on the importance of manufacturing for economic growth, he claims that; "History has repeatedly shown that one of the most important aspect that distinguishes rich countries from poor ones is basically their higher capabilities in manufacturing, where productivity is generally higher, and, most importantly, where productivity tends to (although does not always) grow faster than in agriculture and services" (Chang, 2007). Like in other countries, manufacturing sector in Tanzania has a great role to play in promoting economic growth and competiveness. The contribution of the sector to the country's overall gross domestic products (GDP) averaged around 8 percent over the last decade. The sector is currently the third most important to the Tanzania economy behind agriculture and tourism. However, the sector has experienced fluctuations over the years under different financial conditions and macroeconomic policies. It experienced the lowest real GDP growth rates in terms of contributions in the year 2014, however there was an improvement in the year 2010 to 2013 as shown in Table 1.

Generally industrialization is linked to economic growth, more importantly manufacturing can play a catalytic role in transforming the economic structure of agrarian societies. There is positive relationship between growth in gross domestic products (GDP) and growth in manufacturing (UNIDO Report 2009).

Table 1: Contribution of Manufacturing Sector to the GDP of Tanzania

YEAR	2010	2011	2012	2013	2014
GDP %	7.53	9.73	9.85	9.92	5.6

Source: *Africa Development Group (2014)*

In the World Bank's the Ease of Doing Business 2014 rankings, Tanzania dropped from 136 the year before to 145 out of 189 countries. This is not necessarily a sign that the business environment is getting worse in Tanzania other countries are doing more in terms of improving the business environment. A more detailed analysis of the various enablers (or constraints) for the manufacturing sector in Tanzania reveals the following: *First*, with regard to the legal and regulatory environment, issues related to access to land/tenure and construction permits, corruption, and inconsistent rules across the various regions of the country constitute constraints for the manufacturing sector to prosper.

Second, although Tanzania has a comprehensive set of good manufacturing-related policies in place, examples of these include trade as well industrialization policy. However, difficulties and delays in implementation have been the major challenge regarding the implementation of the strategy. At times, targets and deadlines have been too optimistic. The 2011 Integrated Industrial Development Strategy (IIDS) recognizes this, and focuses, over a period of 15 years (until 2025) on the further development of (agricultural, gas and mineral) resource-based manufacturing. *Third*, the manufacturing sector enjoys a range of incentives from the Government, and stakeholders consider these to be both helpful and important. At the same time, incentives for the manufacturing sector could be improved further if predictability was to be enhanced. At present, there are some incentives which are provided on a short-term basis, which makes it difficult for companies to take long-term (investment) decisions. To mention few examples of this incentive may include subsidies and attractive conditions targeting the manufacturing firms.

Fourth, a large number of support institutions exist in Tanzania. While this is laudable, it also has some disadvantages. For example, stakeholders were of the view that most institutions do not offer effective support to the manufacturing sector. This may be a result of Government funding being too thinly spread across a large number of individual institutions. On the positive side, stakeholder satisfaction with some institutions, such as Tanzania Private Sector Foundation (TPSF) and TANTRADE, was high. There are also some institutions which support the supply chain or the process (linking one sector with another), for example the Tanzania Agricultural Development Bank (TADB), which supports the agriculture as well as the processing which is part of the industrialization. There is thus a need for a more detailed review of the institutional support network for the manufacturing sector.

The manufacturing sector in Tanzania, as in other East African countries, generally has remained comparatively underdeveloped and characterized with less diversification (*Africa Development Group, 2014)*. The country has recently turned to a more interventionist policy based on systematic planning. The government of Tanzania has recently put the industrialization as one of its main agendas; this comes after substantial efforts of government in improving key pre-requisites for industrialization (such as infrastructures, communication networks, energy sector). Most of manufacturing firms listed at DSE are dominated by the previous stated owned firms which were later on either fully

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or partially privatized to the private sector. The aim of privatization was to increase efficiency as well as productivity of these firms. Therefore this study aims at showing performance of the listed manufacturing firms by examining minimum inputs that can be employed given the outputs generated, or examining the maximum outputs that can be generated by listed manufacturing firms given the inputs employed. Few prior researches in the content of listed manufacturing firms and context of Tanzania have taken into account efficiency for deeper analysis. It is therefore crucial to benchmark the performance of listed manufacturing companies operating in Tanzania.

General objective of this study is to examine efficiency of listed manufacturing firms in Tanzania. Specifically, the study aims at:
i.   Determining the extent to which manufacturing firms in Tanzania can use the minimum inputs to produce the given level of outputs or produce maximum outputs at given level of inputs
ii.   Determine how does the size of the firm relate to the efficient utilization of the resources

The study is significant since it aims to uncovering the performance (in terms of the resource utilization) in one of the key sectors in the Tanzania economy. The result of the study may be applied as the yard stick in revisiting the cost structure of inefficient manufacturing firm in the country. Regulatory bodies and ministry may also use the findings in setting the guidelines and standards of firm's size and resources utilization so as to ensure sustainability in performance of the manufacturing sector in the country. The study will contribute to the existing body of knowledge on efficiency performance of the manufacturing in Tanzania. It will also stimulate prospective researchers to replicate studies measuring efficiency in other sectors of the economy using firms which are listed in Dar es Salaam Stock Exchange (DSE). *Section two* of this paper covers literature review, *section three* describes methodology used in the data collection and analysis. Findings and discussion are presented in *section four,* while *section five dwells on* conclusion and recommendations.

2.   LITERATURE REVIEW
Efficiency measurement is one of the key aspects when one assessing firm's performance. As contended by Memon and Tahir (2012) business entity nowadays, has to remain efficient in order to perform and sustain its business operation.

Firms' efficiency is very important as it forms part of organizational performance. For the firm to withstand business challenges both domestically and internationally organizations such as manufacturing companies must reach to their optimal performance (Mohamad and Said, 2010).

Efficiency of any firm can be measured by considering one of the following: maximization of output, minimization of cost or maximization of profits. A firm is considered technically efficient if it is capable of generating maximum outputs from given level of inputs or minimize inputs used in the production of given level of outputs. The objective of any manufacturing firms is to avoid waste which is an outcome of inefficiency. Initially, before 1978 ratio was widely involved in the analysis of firms' efficiency and major weakness was that it could only support single inputs-outputs. Data Envelopment Analysis (DEA) is a linear programming approach which gauges efficiency of each decision-making unit (DMU) obtained as a result of maximum of the ratio between weighted outputs and weighted inputs, of which the interpretation it implies that the fewer the inputs employed in producing the given output, the more efficient the production (Charness , Coopers and Rhodes,1978). DEA has several advantages: (1) it is able to handle multiple inputs and outputs given in different measurement units; (2) as non parametric approach it does not require any assumptions about the distribution of inefficiency (3) it is suitable particularly well with small samples (Maudos et al., 2002).

In the new approach introduced by Charnes et al., (1978) known as constant return to scale (CRS) Data envelopment analysis (DEA) model supports multi input-output data, and therefore address the problem of measuring firms' efficiency using ration analysis. Banker *et al.,* (1984) further extended the model to variable return to scale (VRS). Since then, it has been applied by various researchers in different areas of interests including manufacturing firms. Returns to scale refers to how the firm produces its outputs, it relates the increased production with the factors contributed in production over the period of time. Variable return to scale (VRS) implies that there is no proportional change in outputs and inputs variables (Reddy, 2105) and therefore it is based on either increasing return to scale (IRS) or decreasing return to scale (DRS). Increasing returns to scale(IRS) occurs when the output increases by a larger proportion than the increase in inputs during the production process while decreasing return to scale (DRS) occurs

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when the outputs increases by a lesser proportion than the increase inputs during the production process (Banker et al., 2004). On the other hand constant return to scale (CRS) implies that there is proportional change in inputs and outputs variables, and CRS assumption is only suitable when all DMUs are operating optimally.

Literature revealed that DEA has been widely used in examining efficiency in manufacturing sector, for example; Thore et al., (1994) used Data Envelopment Model (DEA) to examine the production efficiency of U.S computer manufacturing firms. The study findings point out that few companies were able to stay at the productivity efficiency throughout the study period. Wang (2003) study the performance of Taiwan's Steel Industries for the period 1970-1996, using DEA and the findings indicate that technical efficiency along with industrial evolution is generally influenced by policy measures engaging in market liberalization and adaptation to advanced technology. On the other hand, Eslami et al., (2009) in a study on 18 Iranian companies producing automobiles and automobile parts, found that, 8 companies were efficient in 2005, out of which only 4 companies remained efficient in 2006.

Abokaresh and Kamaruddin (2011) study efficiency of 21 Libyan manufacturing firms before and after privatization from 2000 to 2008. The pre and post-privatized effect indicates no significant variation in technical efficiency. Average technical efficiency of all firms in the years (before privatization) was 49.5 per cent, whereas, after privatization 62.3 per cent. In line with that, state-owned firms improved only 9.3 per cent after privatization and private firms increased only 15.3 per cent after privatization, though in all circumstances there was no significant effect. Tahir and Memon, (2011), apply DEA in analyzing the efficiency of top manufacturing companies in Pakistan using both the Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) Banker, Charness and Cooper (BCC) model to find the average overall technical efficiency, technical efficiency and scale efficiency. The findings under Charness Coopers and Rhodes (CCR) method indicated that only one company is considered technically efficient while the average overall technical efficiency varies from 0.64 to 0.99.

In a study by Haron *et al.,* (2012) DEA model was applied to measure efficiency performance of small, medium and large manufacturing companies from 2009 to 2011. Net sale, earnings after tax, raw material, staff expenses and plant and machinery are used from 30 selected companies. The findings indicate that companies with high DEA efficiency also have good performance. Moreover, the small-sized manufacturing companies were the best performing companies in terms of relative efficiency (83 per cent), followed by large-size manufacturing companies (69 per cent) and finally medium-sized manufacturing companies (68 per cent).

In Kenya Ngui and Muniu (2012) carried out a study on firm efficiency differences and distribution in the manufacturing sector, covering food, metal and textile, using an unbalanced panel data .The findings indicated that technical efficiency distribution for each subsector changed not only in relation to itself, but also in relation to the other subsectors across the two periods of analysis. Findings from a similar study by Haron and Chellakumar, (2012) to measure efficiency performance of manufacturing firms in Kenya, show that in year 2009, the overall technical efficiency (OTE) for large sized company is 61 percent, medium-sized company is 65 percent and small-sized company is 78 percent. In 2010, the OTE for large-sized company is 67 percent, 71 percent for medium sized company and 87 percent for small-sized company. In 2011, the OTE for large-sized company is 78 percent, 68 percent for medium sized company and 84 percent for small-sized company. The findings indicated that small-sized companies are more relatively efficient with 83 percent as compared to medium and large companies with 68 per cent and 69 per cent, respectively.

3. METHODOLOGY
3.1 Research Design
The study employs data set extracted from six manufacturing firms listed at Dar es salaam stock exchange (DSE) in Tanzania, over the period 2010 to 2014. Similar to study by Haron and Chellakumar, (2012), descriptive statistics approach is used to explain and summarize the value of variables as well as efficiency scores. The companies' efficiency was examined over the period of five (5) years (2010 -2014). Dataset was generated from respective firm's annual financial report and analysis is made by using the *Max DEA 5*. The companies included in this study are Simba Cement, Twiga Cement, Tanzania Oxygen (TOL), Tanzania Breweries Ltd (TBL) and Tanzania Cigarette Company (TCC).

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3.2 Model and Variables Selection

Data Envelopment Analysis (DEA) has been widely applied in measuring performance in different organizations (both manufacturing and services) especially where there are multiple inputs and outputs (Charnes, *et al.,* 1978). DEA is the piece-wise linear convex hull methods to frontier estimation, initially proposed by Farrell (1957). The method has been productively employed in many countries in Asia, Africa and Europe.Charnes *et al,.* (1978) proposed the Charness Cooper and Rhodes model (*CCR model)* that assumes input-oriented and Constant Return to Scale, in subsequent articles different authors such as Banker *et al.,* (1984) considered an alternative set of assumptions and proposed the *Bankers Charness and Cooper Model (BCC model)* that assumes variable returns to scale (VRS). The variable return to scale model was proposed to allow computation of scale efficiency. It was built on the assumption that change in inputs would lead to disproportionate changes in outputs. Scale efficiency is given by the ratio of constant return to scale efficiency (TE_{CRS}) to the ratio of variable return to scale efficiency (TE_{VRS}). Inputs and outputs employed in the study are presented in **Table 2** below.

Table 2. Meaning of Input and Output Variables as Used in Previous Studies

Outputs	Operational definitions
Net sales (Y1)	Net sales are amount of sales generated by a company after the deduction of returns, allowances for damaged or missing goods and any discounts allowed. (2010-2014). (*Haron and Chellakumar, 2012; Hajiha and Ghilavi, 2012; Abokaresh and Kamaruddin, 2011; Zhou et al., 2011; Sharma, S. 2008; Wang. 2008; Lin, et al., 2005)*
Earnings after Tax (Y2)	Earnings of the business: is computed by subtracting taxes paid from net income before taxes (2010-2014)*(Abokaresh and Kamaruddin, 2011; Ling and Kamil, 2010; Qian and Dawai,2009)*
Inputs	**Operational definitions**
Raw materials (X1)	Materials or substances used in the primary production or manufacturing of goods (2010-2014) *(Haron and Chellakumar, 2012; Mazundar and Rajeev, 2009; Sharma,2008; Ari and Baki, 2007, Wu, 2005)*
Salary and wages (X2)	The remuneration paid or payable to employees for work performed (2010-2014) (*Haron and Chellakumar, 2012; Mazumdar and Rajeev, 2009; Sharma, 2008).*
Plant and Machinery (X3)	The fixed assets used to produce goods for a company (2010-2014). *(Ajia Ghilavi, 2012; Haron and Chellakumar, 2012; Mazumdar and Rajeev, 2009; Sharma, 2008).*

Inputs (raw materials, salary and wages as well as plant and machinery) are resources used to produce outputs, while the outputs (such as net sales and earnings after tax) are expected result of the inputs conversion (in this case manufacturing process). In this study we assume an input-oriented model with variables returns to scale (VRS) and Constantan Returns to Scale (CRS) to measure efficiency scores of manufacturing firms in Tanzania. With inputs oriented model, the assumptions is that managers have no control over outputs, which implies that firms' outputs are given and it can be produced by varying level of inputs. Inputs oriented model is applied together with the ratio models to show that an inefficient unit is made efficient by the proportional reduction of its inputs while its outputs proportions are held constant. For example, suppose the efficiency score of a unit is 0.9 in input oriented model, it implies the unit could reduce the input use in 10% and still produce the same quantity of output.

TE can be calculated by solving the following DEA LP problems.

Min λ_j, such that:

$$\sum_{j=1}^{n} \lambda j Y r j \geq Y r o,\ (\text{r=1}\ldots\ldots\text{.n})$$

$$\sum_{j=1}^{n} \lambda i X i j \leq \theta X i o,\ (\text{i= 1 , 2})$$

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$$\sum_{j=1}^{n} \lambda j = 1, \lambda j \geq 0 \ (j = 1 \ldots . n)$$

The objective of the Linear Programming problem is to find the *Min λj* that particularly minimizes inputs vector to Ө *Xio*, while guaranteeing at least the output level of *Yro*.

Generally it worth to note that technical efficiency indicates the comparison between the amount of input employed in production with the level of output produced. The firm is said to be technically efficient if fewer input produces more output. On the other hand the firm is said to be productive efficient if is able minimize inputs' cost to produce maximum level of output. In most cases this occurs when Marginal cost (MC) equals the minimum average cost.

4. THE STUDY FINDINGS AND DISCUSSION

Correlation between inputs and outputs is strong and positive at 1 percent level of significance, this implies that variables satisfy the requirement of the DEA model. The constant return to scale (CRS) of one implies that the manufacturing firm has the best scale, while the increasing return to scale (IRS) of one indicates that inputs contribute to a more than proportionate increase in output. On the other hands decreasing return to scale (DRS) of one implies that an increase in inputs leads to a less proportionate increase in output. The results show that over the study period under the CRS assumption the average efficiency of listed manufacturing firms in Tanzania is 0.652 (65.2 percent), which means the listed firms were inefficient by 34.8 percent. The result also reveals that listed manufacturing firms could increase outputs by 34.8 percent using the existing level of inputs.

Annual average constant return to scale (CRS) technical efficiency is 66 %, 66% and 67% for years 2010, 2011 and 2012, respectively, while 60% was attained in 2013 and 67% attained in 2014 (*Table 2*). Result of the annual average efficiency indicate that in the year 2014 firms under the scrutiny were experiencing average score of 67.02 percent, the highest compared to remaining years. This implies a slight improvement in TE performance over the period under review, evident by a change from 66% in 2010 to 67% in 2014. Tanzania Breweries Limited (TBL) and Tanzania Cigarette Company (TCC) were efficient in the year 2010 while in 2014 TCC 2014 was relatively better off. Considering individual firms TCC was efficient almost throughout the period under the study, except in 2011. Comparatively, TCC manifested the highest technical efficiency score of 97.9 percent during the period, compared to other listed companies in Tanzania. On the other hand Tanzania Oxygen Limited (TOL) had the lowest technical efficiency score of 32.4 percent compared to other firms *(Figure 1)*. The findings imply that in terms of technical efficiency TCC was inefficient by 2.1 percent and that it had a room to increase outputs by 2.1 percent using existing inputs, on the other hand TOL was inefficient by 67.6 percent, which is it could rise its outputs by 67.6 percent using existing level of inputs. Thus, there was no efficient firm in all three aspects of efficiency namely Technical, Pure and scale efficiencies.

Findings also show that technical efficiency score seem to increase but have relatively higher variations across companies as indicated by standard deviation of 23.6 percent, minimum and maximum values of 26.6% and 100% respectively

Table 3: Technical (CRS) Efficiency

FIRM/YEAR	2010	2011	2012	2013	2014	AVERAGE
SIMBA	0.496552	0.517032	0.652925	0.579352	0.629403	0.575052
TBL	1	1	0.795485	0.687282	0.58494	0.813541
TCC	1	0.895426	1	1	1	0.979085
TOL	0.326483	0.337992	0.337992	0.26672	0.353973	0.324632
TWIGA	0.615463	0.565416	0.577237	0.475448	0.452893	0.537291
MEAN EFFICIENCY	0.6610878	0.6592496	0.6699978	0.599368667	0.6702015	0.6519811

Source: Authors' own Calculations

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Under pure technical efficiency (PTE) result indicates that over the study period average efficiency of listed manufacturing firms in Tanzania is 0.931685 (93.1 percent), implying that listed firms in Tanzania, were inefficient by 6.9 percent, and could increase outputs by 6.9 percent using existing level of inputs. Specifically, annual performance under pure technical efficiency was 94.5%; 95.2%; 95.5%; in the year 2010, 2011, 2012, respectively, while in the year 2013 and 2014 the performance was 86.9% and 93.6% respectively Four firms out of six were found to be efficient in the year 2010, 2012 and 2014 while only one firm was efficient in the year 2013. Overall efficiency score for manufacturing firms in year 2013 was 86 percent, the lowest compared to the remaining years, while in the preceding year 2012 firms were experiencing the highest efficiency score of 95.5 percent. The result implies that for the listed firms to be efficient in the year 2013 and 2012 there is a need to increase outputs by 14 percent and 4.5 percent, respectively.

Comparatively, TWIGA Company manifested the overall highest pure technical efficiency score of 99 percent during the period under review, while Tanzania Oxygen Limited (TOL) recorded the lowest (72 percent) pure technical efficiency score compared to other firms *(Figure 1)*. Therefore, there was no technically efficient firm during the study period.

Table4: Pure Efficiency(VRS)

FIRM/YEAR	2010	2011	2012	2013	2014	AVERAGE
SIMBA	0.91483	1	1	0.955849	1	0.974136
TBL	1	1	1	0.929558	0.945722	0.975056
TCC	1	0.910032	1	1	1	0.982006
TOL	0.758595	0.803179	0.803179	0.568389	0.673568	0.721382
TWIGA	1	1	1	0.968389	1	0.993678
MEAN EFFICIENCY	0.9455708	0.95191	0.9549666	0.86941966	0.93654833	0.931685

Source: Authors' own Calculations

Scale efficiency (SE) result indicates that during the study period average efficiency of listed manufacturing firms in Tanzania is 0.6890304 (69 percent), which implies that listed firms were operating either before or above their optimal productive scale level by 31.1 percent. Specifically, annual performance under scale efficiency was 68.6%; 68.7%; 69%; in the year 2010; 2011; 2012respectively, while in the year 2013 and 2014 it was 67.4% and 70.4% respectively. TBL and TCC were efficient in the year 2010, while in 2014 TCC was the most efficient firm *(Table 4)*. Only one firm was efficient in the remaining years. Looking at individual firms TCC was efficient almost throughout the study period except in year 2011. TCC had overall average scale efficiency score of 99.7 percent, the highest compared to other firms. TOL experienced the lowest scale efficiency score of 45.3 percent *(Table 4)*.

Table5: Scale Efficiency

FIRM/YEAR	2010	2011	2012	2013	2014	AVERAGE
SIMBA	0.54278	0.517032	0.652925	0.606113	0.629403	**0.5896506**
TBL	1	1	0.795485	0.739364	0.618511	**0.830672**
TCC	1	0.98395	1	1	1	**0.99679**
TOL	0.430379	0.420818	0.420818	0.469257	0.525519	**0.4533582**
TWIGA	0.615463	0.565416	0.577237	0.490968	0.452893	**0.5403954**
MEAN EFFICIENCY	**0.686108**	**0.6879905**	**0.69246483**	**0.67420066**	**0.70438766**	**0.6890304**

Source: Authors' own Calculations,

Three firms namely SIMBA, TWIGA and TOL experienced decreasing return to scale (DRS) throughout the period under review. The root cause of recorded inefficiencies for the three firms was largely scale inefficiency. The implication is that SIMBA, TWIGA and TOL should improve their scale efficiency in order to become overall efficient. Firms were experiencing decreasing return to scale (DRS) signifying an increase in inputs lead to less proportionate

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increase in outputs. TWIGA and TCC recorded pure technical efficiency scores of 99 per cent and 98 per cent respectively.
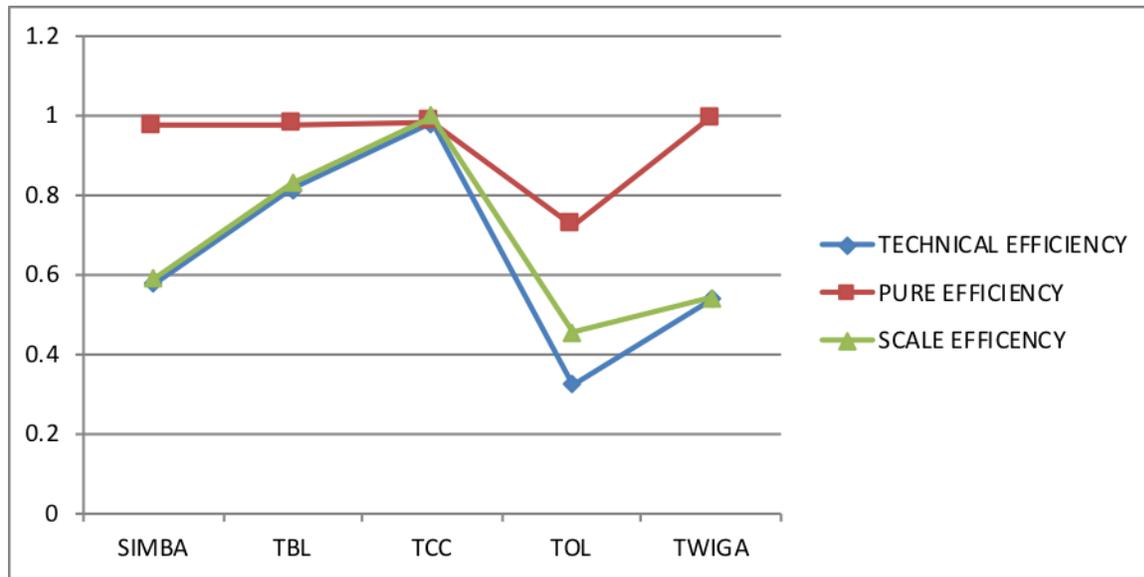

Figure 1: Trend of Average Pure efficiency and Scale efficiency

When compared to findings in the study by Memon & Tahir, (2011) technical efficiency of manufacturing firms in Pakistan decreased from 86% in 2008 to 84% in 2010, while technical efficiency of manufacturing firms in Tanzania increased from 66% in 2010 to 67% in the year 2014. As far pure efficiency is concern average efficiency score of manufacturing firms in Pakistan decreased from 90% in 2008 to 87% in 2010, this conforms to the case of Tanzania where manufacturing firms experienced a decrease from 94% in 2010 to 93% in 2014. Result also revealed that scale efficiency of Tanzanian manufacturing firms increased from 68% in 2010 to 70% in 2014 while in Pakistan manufacturing firms were experiencing constant scale efficiency over the study period (2008-2010). Result from the study by Memon & Tahir (2011) shows that 16% of the sampled manufacturing firms in Pakistan were scale efficient throughout the study period, which is contrary to the findings in this study where none (0 %) of the sampled firms is consistently operating under scale efficiency during the period under review. Unlike manufacturing firms in Pakistan where 16.3 percent were consistently operating under CRS in Tanzania none of the sampled firms is consistently operating under CRS. Nevertheless three firms out of six were consistently operating under DRS in Tanzania.

In a study by Haron and Chellekumar (2012) efficiency score of manufacturing companies in Kenya under CRS was 69.2 %, 92% and 79% in the year 2010, 2011 and 2012 respectively. While in Tanzania average technical efficiency score of manufacturing was 66 %, 65.9 and 66.9% in 2010, 2011 and 2012 respectively, which implies that there is a slight increase in terms of technical efficiency of manufacturing firms in the two countries. As far as pure and scale efficiency are concern in the year 2010 the efficiency score of the two measures were 77.6% and 79.8% respectively, it was also found that in the year 2011 the efficiency score were 95.8% and 95% respectively while in the year 2012 the result revealed efficiency score of 87.3% and 89.6% respectively. In Tanzania, pure and scale efficiency score of manufacturing firms in the year 2010 was 94.5% and 68.6% respectively, while in the year 2011 it was 95% and 68.7% respectively. findings also revealed that in the year 2012 efficiency scores of the two measures were 95.4% and 69.2% respectively, which implies that both pure and scale efficiency of manufacturing firms were increasing in the two countries during the same period (2010-2012)

5. CONCLUSSION AND RECOMMENDATIONS

This study aims at measuring efficiency of manufacturing firms listed in Dar es Salaam stock exchange (DSE), six (6) companies were examined over the study period which covers 2010 – 2014 (five years). The study employs a non-parametric approach with *two outputs and three inputs.* The study concludes that in terms of technical efficiency (TE) and scale efficiency (SE) TCC was performing relatively better compared to the remaining firms, this implies that over the study period TCC had relatively high ability to minimize the inputs to produce a given level of outputs, or it had relatively higher ability to produce maximum outputs with a given level of inputs. As far the scale efficiency, TCC

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also portrayed a relatively better performance in terms of scale of its activities. Pure technical efficiency indicates that TWIGA Company performed relatively better compared to other firms. While TOL manifested relative regress in terms of technical, pure as well as scale efficiencies. Compared to other studies, findings from this study show that average technical, pure and scale efficiency in Kenya and Tanzania were slightly increasing during the year 2010 to 2012. This is different with manufacturing firms in Pakistan which experienced a slight decline in ability of resource utilizations during the year 2008-2010.

This study recommends revisiting of efficiency level, cost structure as well as size versus level of activities of manufacturing firms in Tanzania so as to improve production. This is because none of the listed firms in the study was constantly efficient or operating at optimal size throughout the study period (2010-2014). There is a need for thorough examination of efficiency in the manufacturing sector as well as corresponding appropriate economic measures in order to spearhead companies' competitiveness and sustainable performance in the economy. For comparison purposes as well as testing robustness of findings from this study, further research, focusing on application of alternative efficiency model (such as Stochastic Frontier Analysis) is recommended. Further studies may also dwell on the use of more variables (inputs and outputs) as well as different study period.

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