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TRADE FACILITATION, ICT AND MANUFACTURED EXPORT PERFORMANCE IN TANZANIA: WHAT IS THE MISSING LINK?

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ABSTRACT

This study focuses on testing the hypothesis that application of ICT at firm level and trade facilitation policies has a causal impact on the quality and quantity of manufactured exports, productivity and investment. The study findings based on production function estimates show a strong positive correlation between unobserved time invariant firm characteristics with the level of application of ICT, exports and productivity performance. Following the estimates based on GMM, when we control for firm fixed effects, the results suggest a strong positive correlation between unobserved firm fixed effects and both ICT and trade facilitation. Further findings of the study are that trade facilitation policies measured by government policies on prices, facilities on access to imported raw materials, preferential trade access and overall trade policy changes have significant influences on firm level performance of exports and productivity. Therefore, the potential missing links for the workability of trade facilitation and productivity are access to credit, skilled labour, demand deficiency and trade policy certainty. To halt stagnation of Tanzanian manufacturing exports and growth, via trade facilitation such as firm level factors, must be addressed.

Key words Information Communication and Technology, Trade facilitation, Export

INTRODUCTION

This study assesses the missing links between ICT and trade facilitation in influencing exports and productivity of Tanzanian manufacturing enterprises. It focuses on testing the hypothesis that application of Information and Communication Technology (ICT) at firm level and adaptation of appropriate trade facilitation policies have a causal impact on the quality and quantity of manufactured exports, productivity and investment. The main argument is that, despite the remarkable and impressive record of Tanzanian economic performance and efforts to attain a knowledge economy, performance of the manufacturing sector has stagnated. Low levels of technology usage, inadequate and low levels of

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application of ICT and inappropriate trade policies can partly explain the observed poor performance of the sector. Thus it is anticipated that, while remarkable efforts have been made, something is inhibiting the progress in the application of ICT and trade facilitation. Whether there are missing links is the question addressed by this study. The study's theoretical framework is based on the human capital theory that equates labour quality, quantity and capital. The motivation of the study is that about a decade ago Tanzania adopted comprehensive economic reforms that aimed at rescuing the economy after it collapse in the 1980s, during when Tanzania strived to achieve state-led development. To facilitate development the government controlled all the markets and directed various projects. Investment was targeted, as the government tried to allocate resources directly through systems of control such as business licences. Import substitution was the dominant industrial strategy.

Empirical studies conducted on the sector (see for instance, Kahyarara, 2005, Harding et al, 2002, Teal and Mans, 2003) confirm that trends in Tanzanian manufacturing performance and exports reflect three periods of industrial development in post-independent Tanzania, namely: a period of expansion, 1974-1980, a period of collapse 1981-1985 and a period of adjustment, privatisation and restructuring, 1991-2000s. The 1990s were characterised by a slight recovery in productivity, but it has not recovered to the levels observed in the 1970s. The study by Kahyarara (2005) found that learning in the form of firm-specific training has a strong effect on firm-level productivity. In the current era of globalisation, trade facilitation and ICT are playing a crucial role in interlinking enterprises across internal as well as external value chains and reshaping their business models to strengthen competitive performance (Verma, 2005). The application of ICT is not limited to shop floors only but it is also used widely in non-production processes such as procurement, product design, business development, and after-sales support. These areas are considered as important non-price factors of competitiveness. In Tanzania, exports of manufactured industrial products have experienced mixed growth rates from the late 1990s to the turn of the new millennium.

Currently, the manufacturing sector is grappling with the rapid changes that are taking place globally in terms of ICT and financial systems while transitioning from a centrally controlled to a free market economy. To address the problems hinted at above, this study examines the missing aspects in the role of ICT, the manufacturing sector in exporting and trade facilitation in significantly affecting manufacturing performance that will ensure sustainable economic growth and the improved wellbeing of Tanzanians. The selection of the title of this study is based on the fact that after a disappointing performance of the Tanzania manufacturing sector, government policy changes were introduced in the late 1980s to revamp the manufacturing sector as explained above. One of the major policy shifts after the reforms was a move to emphasise export-led industrialisation instead of import substitution, to encourage private sector participation, firm-level investment in

human capacity, and wage bargaining to introduce new production techniques. Nonetheless, after two decades of reforms, a persistently low level of performance of manufactured exports a low level of total factor and labour productivity, inadequate application of ICT, stagnated labour absorption capacity and lack of significant innovations have remained among the most critical challenges facing the Tanzanian manufacturing sector. In fact, sector performance has remained below its 1970s level. What has gone wrong with the policy designed to enhance Tanzanian manufacturing? There could be several explanations for this. One problem is that firms mostly export unprocessed and semi-processed products which do not add much to the value and volume of exports. But more importantly, the lack of sufficient knowledge and exposure to trade facilitation skills contributed greatly to this underperformance. The effect of ICT on firm performance is symbolic, with the performance effect of training described in previous studies (see for example, Soderbom (2003), Holzer, 1993, Hashomoto, 1981, Bigsten (2000)).

Trade facilitation is generally understood to involve reducing all the transaction costs associated with the enforcement, regulation and administration of trade policies, and reforms in this area are designed to reduce the costs involved in the cross- border movement of goods and services (Staples, 2002). In a narrow sense, trade facilitation has often been defined as the process of simplifying and harmonising international trade procedures and practices, where trade procedures and practices are the activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade[i]. The lack of a well designed framework for trade facilitation has significantly contributed to the poor performance of manufactured exports in most developing countries and, hence, to the failure to tap into lucrative markets such as AGOA in US and the EU. Some of the notable causes identified in the literature, according to UNESCAP (2004), include, among others, complex and bureaucratic trade documentation procedures and unclear legal instruments.

Proper dissemination of trade-related information is another crucial component of the trade facilitation matrix. Its influence is felt in two main areas namely, the processing of trade documentation for trade transactions and the timely dissemination of trade procedures to the trading community. In addition to trade documentation and regulatory issues, there are also issues pertaining to transportation and fees. These include not only just the physical aspects like building roads, railways and ports but also the development, upgrading and integration of the entire transport network, both in the physical sense as well in as the software. The inefficient trade financing and credit infrastructure also hampers trade, for without such mechanisms trading capacity will be sorely restricted as it would be conducted using limited financial and risk-hedging instruments. In essence, given all these imminent challenges, there is increasing worry about the dismal performance of manufactured exports in Tanzania given the role that this has played in boosting economic growth and poverty reduction in the Newly

Industrialized Asian Economies (NIAEs)[ii]. The long-term performance of Tanzanian manufacturing is discussed below.

Government Policy on ICT, Trade and Manufacturing Sector Performance

For over two decades after independence, Tanzania strived to establish import substitution and state- run industrialisation. Through the infant industry argument, Tanzanian manufacturing firms were well protected against competition from foreign producers through a restrictive trade policy, the imposition of local content requirements, technological transfer requirements and ceilings on profit repatriation. Suffice it to say that investment in equipment and machinery, for instance, was particularly low in the 1960s. Initially the manufacturing sector generated significant growth, especially in the 1970s, but from the late 1970s onwards this growth halted. The declining trend, especially after 1979, might be due to the economic crisis marked by a foreign exchange crisis and input constraints. Total factor productivity growth rate fell significantly between 1974 and 1983. During this period when the sector enjoyed high rates of effective protection and the absence of competition, but suffered from decreased capacity utilisation that resulted in declining efficiency and increased costs (Ndulu, 1986). It was also the period of rapid industrialisation and the highest growth rate of capital stock. After 1991 the total factor productivity level declined further. This collapse coincided with transition from a state-led economy to a market-based economy. Some major steps taken were the relaxation of the regime of trade and payments, the liberalisation of exchange and interest rates, the abolition price controls on commodities, and increased domestic and foreign private sector competition. During this period inefficient companies closed down as the government's role in direct production was substantially reduced.

The remaining companies were subjected to privatisation and further restructuring. The economic reforms adopted in the mid-1980s resulted in their recovery, the signs of which were a positive growth rate and increased participation of the private sector in production. Total factor productivity seemed to have regained a positive growth rate after the mid-1990s. Nevertheless, as in many other developing countries, trading in broad international markets has not resulted in a significant response from elastic demand-induced improvements in productivity, investment and exports. The greatest puzzle is that, even after the comprehensive reforms, manufacturing exports remain a small proportion of total country exports. Even in the domestic market, Tanzanian manufacturers have been facing stiff competition from cheap imported manufactured products. There is thus credible evidence that the quality of Tanzanian exports and/or the cost of production erodes competitiveness in the market. Either low productivity induced by technological factors and policy limits mass production that can permit aggressive marketing beyond the domestic market, or a high volume can only be achieved through low quality production. Of course there are many factors that can potentially cause all

these problems, but technological factors have for decades been considered to influence the quality of products produced by labour and capital inputs. Controlling for trade and industrial policies, there is usually a causal effect between the skills and technological levels and the products produced. A proper industrialisation policy that designs linkages to address this problem is therefore of the utmost importance.

To address this problem may be particularly relevant at the moment, as the current stage of Tanzanian industrialisation is associated with substantial changes in manufacturing organisation and technology, and poorly integrated markets. Most of the large-scale firms have either been privatised or closed down, and many new firms of different sizes have entered the market. Where they can export remains an unsolved riddle, especially in the Tanzanian manufacturing context. To this end, the overall objective of this study is to identify the gaps in the role of trade facilitation, ICT and manufacturing export performance in Tanzania. In other words we seek to shed some light on the relationship between trade facilitation and ICT and their potential impact in boosting manufactured exports. In order to do so the study addresses the following questions. After over two decades of reforms, to what extent has policy targeted trade facilitation have influenced the performance of Tanzania manufacturing sector? While ICT played significant role during industrialization in many Asian countries (including the Asian Tigers), do we have any prospects for this instrument in playing any significant role in Tanzania industrialization? After the crush of industrialization via import substitution, manufacturing export has been directed towards enhancement of export led growth. Is there evidence of export-led growth via robust manufacturing export growth in Tanzania?. By addressing these questions the people aims to expose the missing objects that account for stagnation of Tanzanian manufacturing even after the reforms. Policy recommendations will be developed to assist the manufacturing sector development that will spark into export led growth.

RESEARCH QUESTIONS, OBJECTIVES AND CONTRIBUTION

The general objective of this paper is to assess the role of Information and Communication Technology and trade facilitation in influencing productivity, investment and export performance of Tanzania manufacturing enterprises.

The specific objectives of this paper are:

- To provide research inputs in the ongoing economic reforms and in particular the recovery of Tanzanian manufacturing.
- To raise awareness on the roles played by manufacturing in the growth of exports and by ICT and trade facilitation at local and national level to aid policy formulation.
- To identify the constraints that hinder effective use of ICT, trade facilitation and manufacturing sector exports.

- To establish a mechanism to ensure that export-led growth of the Tanzanian economy is based on substantial and rapid growth in manufacturing, the integration of ICT and the positive effects of trade facilitation.

Study Contribution

The contribution of this paper is to critically discover the missing links that would facilitate the role of manufacturing, ICT and trade facilitation in exported growth. In fulfilling the above objectives, we endeavour to identify the barriers to manufacturing sector exports by comparing the features of exporters with non-exporters, and to assess the role of regional export markets vis-a-vis European and US export markets in Tanzanian manufacturing sector exports, the extent of ICT use in Tanzanian manufacturing, the impact of ICT on productivity and growth of Tanzanian manufacturing and the role of trade facilitation in enhancing the exports of manufacturing firms that are major exporters. This will undoubtedly make a contribution to our understanding of the role of the ICT, manufacturing sector exports and trade facilitation chain in the context of Tanzania's manufacturing performance.

This will further provide a good understanding of the preconditions for export-led growth of the Tanzanian economy, together with evidence about the effects on manufacturing productivity of export and trade facilitation on overall economic growth. Lastly, we seek to provide possible explanations with respect to the stagnation of the Tanzanian manufacturing sector even after comprehensive reforms implemented the late 1980s, as well as to identify policy actions that could potentially enhance manufacturing sector performance and establish a linkage between economic growth and export-oriented industrialisation. This will ultimately help to open up a dialogue with relevant stakeholders, including policy makers, on how best Tanzanian manufacturing can take advantage of the fast-growing application of ICT, the potential of export led growth and trade facilitation schemes.

Table 1: Policy Research Questions and Potential Policy Decisions

Policy Question (s) to addressed	Policy Decisions to be Made
Does ICT has any role in the process of Tanzania industrial development?	Establish national framework for identification and use of ICT in Tanzania manufacturing
Can the integration of trade facilitation and ICT use assist the recovery of Tanzania manufacturing sector?	Enhance use of ICTs in trade facilitation process for industrial goods
To what extent can ICT and trade facilitation assist in raising the current manufacturing growth rate?	Encourage expansion of manufacturing based on promoting investment in ICTs that will enable attainment of manufacturing growth target of 15% as planned in the national objectives
Are there productivity effects of ICT and trade facilitation for exporting firms in Tanzania?	Provide fiscal and non-fiscal incentives to manufacturing firms that raises productivity per head based on investment in more use of ICTs and implementation of trade facilitation.
What factors explain stagnation of Tanzania manufacturing?	Identify and promote use of ICTs in trade facilitation as a strategy to recover manufacturing growth.

LITERATURE, THEORETICAL AND ANALYTICAL FRAMEWORK

Theoretical Framework

Literature and research on the theoretical links between trade facilitation, ICT and exports of manufactured goods or trade growth has gained prominence over the last two decades with the former gaining stronger dominance in the recent past. Existing literature tends to follow the definition of trade facilitation by Wilson, Mann and Otsuki (2005), who quantified the impact of four different measures (port efficiency, customs environment, regulatory environment and e-business usage). On the other hand, Engman (2005) used the WTO definition of trade facilitation (the simplification and harmonisation of international trade procedures) by paying attention only to what happens around the border. Furthermore Martínez-Zarzoso and Márquez-Ramos (2007) argued that other studies focused instead on the effects of single measures of trade facilitation (information technology, port efficiency, institutions' quality).

Given the complex relationship that exists between trade, growth and development, as well as the growing attention being paid to trade facilitation in multilateral bodies, there have been a number of recent efforts to quantify the importance of trade facilitation to trade flows. However, little progress has been

made, and this is primarily because of the dearth of empirical measures relating to trade facilitation. While recent studies such as the one by Messerlin and Zarrouk (1999) tried to provide the links that exist but did not attempt to provide quantification of the links, Maskus, Otsuki, and Wilson (2001) tried to address some of the more important empirical methods and challenges in quantifying the gains of trade facilitation in the area of harmonised regulations.

It is also worth noting that ICT knowledge is one form of human capital accumulation at firm level. Some empirical works in the human capital literature have also made an attempt to proxy for specific versus general training through analysing different effects of on-the-job versus off-the-job training (Lynch 1991, 1992), or by looking at the different effects of company versus school training (Loewenstein and Spletzer 1997), when analysing earnings or wage growth and mobility. Other authors have focused on examining the employers' willingness to invest in general training (Bishop and Kang 1996). It is apparent from recent literature that, while a conceptual separation between general and specific training is a useful tool of analysis, in reality much of job training is a mixture of general and specific training. Katz and Ziderman (1990) and Acemoglu and Pischke (1998a) pointed out that asymmetric information can mean that training that would otherwise be general is in effect specific. Despite the difficulty in categorising training as general or specific, more data with explicit information regarding job training has led to the availability of evidence regarding the empirical relationship between training and earnings, the relationship between mobility and training and other aspects such as sharing in the cost of investment and determinants of training.

There are authors who have measured directly the effect of accumulating human capital through training (e.g., Lynch (1992), Barron, Black and Loewenstein (1989), Booth (1991), Lynch (1991), Gritz (1993), Krueger and Rouse (1998), Bartel (1995), Holzer et al (1993) and others.). Lynch (1992) analysed the effects of on-the-job versus off-the-job training. In this study it was found that on-the-job training raises wages at the current employer but not at future employers. With regard to mobility, Lynch found that individuals with on-the-job training are less likely to leave their current employer, while individuals with off-the-job training are more likely to leave. Other studies have tested whether job training might be a form of investment in specific human capital that reduces workers' incentive to quit a job and firms' incentive to fire a worker. Among the authors that address this issue, Lynch (1991), Gritz (1993) and Parent (1999) find that company training reduces the probability of young workers leaving their jobs. In contrast, Krueger and Rouse (1998), who focus on personnel files from two large U.S. companies, and Veum (1997), who uses a larger data set, conclude that trainees are equally as likely to quit as non-trainees.

Bartel (1995) analysed the link between training, wage growth and performance, using evidence from company-level information. A significant relationship

between formal on-the-job training and the subjective performance ratings of professional employees is reported in this study. Other studies that have tested and confirmed a positive correlation between training and productivity include those by Barron et al. (1989), Holzer et al (1993), Bartel (1994) Koning (1995), Boon and ven der Eijken (1997) and others. Barron et al. (1989) report a 3% rise in productivity being associated with a 10% increase in training. In Hozler et al (1993), a faster growth in labour productivity is associated with the receipt of training grants.

Wilson *et* al. (2003) suggest that policy tools and reform measures to accelerate export growth and economic development through trade facilitation were at the forefront of the debate during the early 2000s. Their study shows that the expansion in world trade, reductions in tariff rates of protection, and the application of ICT to speed transactions, among other factors, have combined to raise the importance of reducing barriers to trade. However, most studies have focused mainly on quantification of the benefits of trade facilitation and how they can help inform the policy-making process in developing country economies and on the policy emphasis within the institution as well as on an analysis of the benefits associated with improvements in trade facilitation. Various analytical techniques have been applied in the course of determining the benefits associated with trade facilitation. The first one is the Wilson *et al*. (2002) approach that examines a set of indicators of different types of trade facilitation measures, rather than measuring trade facilitation simply as a change in import prices, international transportation costs, or productivity of the transport sector. The second approach is the gravity model[iii] of bilateral trade flows, developed by the World Bank to model cross-border trade. Recent studies in this area include, among others, those by Engman (2005), Evenett and Keller (1998), Feenstra, Markusen, and Rose (1998) and Frankel (1997). Third, the simulation approach offers several perspectives of the potential benefits of improvements in trade facilitation. In essence, it allows us to analyse the implications for trade among a group of countries or a region as a whole and to examine an individual member's exports to other members.

Following the various definitions and analytical techniques used by other studies, the main point of departure of the current study focuses on assessing the combined effects of both ICT and trade facilitation with the view of ascertaining their impact on the export performance of the Tanzanian manufacturing sector.

Analytical Framework

The empirical and theoretical framework for assessing the extent to which learning, ICT and trade facilitation can influence exports and the productivity of the Tanzanian manufacturing sector is discussed here. In particular, the human capital theory forms the main theoretical base of this paper's analysis. It considers the skills acquired by a worker through education and other forms of learning, for instance, job training and learning by doing as a stock of homogenous human

capital that influences productivity at the workplace. The main question addressed in empirical studies on the effect of technology on productivity and labour quality induced by the type of inputs (see Denison (1962) Griliches (1963) Nelson and Phelps (1966) (Bartel, 1994, Bartel, 1995, Black and Lynch, 1996), Dearden, Reed and Van Reenen (2000), Thomas Zwick (2002), Lillard and Tan (1986) and others) is whether technology, education or training have any effect on production and exports.

The approach to estimating the learning effect on production has treated technology as a separate variable in the production function. Specifically, various forms of learning and technologies are treated as an adjustment for quality of labour when estimating production functions as follows:

$$Q = (e^{a}L)^{b}K^{1-b} f\epsilon \quad \ldots\ldots\ldots 1$$

Where Q is real value added, L is effective labour, e measures labour quality, a is elasticity of effective labour, K is capital and f is firm-specific productivity factor. The contribution of effective labour to production is influenced by the capability of a worker in performing a given job. Since worker capability might be affected by the fact that a worker uses a computer, or skill or stock of human capital, a more skilled worker applying ICT is expected to have greater capability than an unskilled one, controlling for other factors of production including trade facilitation policies.

Empirical studies (see for example, Soderbom and Teal (2002), Griliches (1963) and Lorraine et al (2000), that have provided measures of labour quality at firm level have used a weighted schooling-based labour quality index and a proportion of skilled or trained labour among the employees as proxies for labour quality. The schooling weight assigned to each worker has been regarded as an increasing function of a worker’s educational attainment. The proxy’s coefficients are then regarded as the coefficients of labour quality. In this paper we use weighted average proxies of a proportion of workers who have either received or are currently receiving ICT-related training. The trade facilitation and training programmes are estimated directly as observable firm-level attributes.

Model Specification

To address the key research questions raised above, we estimate a firm-level production function. In particular, we estimate both real value-added and gross output production functions. In the value-added production function, we use value added as a dependent variable, and ICT, Trade facilitation and exports among the inputs (independent variables). Other inputs to be considered are log of physical capital, weighted average learning variables (human capital), log of number of employees, proportion of trained workforce and other control variables. In estimating the gross real output production function we introduce more inputs

(independent) variables, including raw materials and indirect costs along with the weighted learning variables.

The value-added production function is specified as follows:

$$V_{jt} = \alpha_0 + \alpha_1 InK_{jt} + \alpha_2 InL_{jt} + \alpha_3 InICT_{jt} + \alpha_4 TF_{jt} + \alpha_5 C_{jt} + \mu_j + \varepsilon_{jt} \ldots\ldots\ldots\ldots(2)$$

Whereby j and t are firm and time subscripts,

InV = log of value added, InK = log of physical capital, InL = log of a number of workers available in a firm, ICT = variable for capturing the effect of ICT on firm-level performance, TF = captures the effect of trade facilitation in the form of weighted averages of export and trade facilitation, C =observable firm characteristics such as firm location, sector ownership, age, exports and others. μ = Fixed effects and; ε = error term.

The variable μ represents fixed effects, i.e. omitted variables that may be correlated with explanatory variables and ε is the error term. The real value added is the deflated value of total manufactured output minus indirect costs and minus raw materials used in producing the output. The capital stock is a real capital stock series based on an initial observation of the replacement value of the firm's plant and machinery, which is augmented by subsequent investments in plant and machinery made by the firm. The RPED surveys reveal that various forms of training that result in the acquisition of ICT exist at firm level. Such ICT training might be organised by employers within a firm, or employees are sent for training outside the firm, or it might be firm-specific and general training acquired through learning by doing (work experience and tenure) and other related forms of job training. The study analysis is supplemented by an assessment of the effect of ICT in relation to training programmer organised by the company.

This means that two measures of ICT are estimated. The first one is a measure of whether a company has a training programme. Under this measure, surveyed firms are requested to indicate if they have any in-house training programme, or one to train workers outside their current jobs. In assessing the trade facilitation effect, the study uses firm-level information on the perceived effectiveness of macroeconomic policies and trade policy reforms on the companies performance as revealed by the managers of the companies covered in the RPED surveys. Control variables in the production function are firm age, exports, location, sector and ownership. The firm age variable is based upon the year in which the firm originally started up its operations. The export variable is a dummy for whether a firm exports. The firm location variable is categorised into 6 towns, Morogoro, Dar-es-Salaam, Tanga, Arusha, Mwanza and Moshi, where the surveys were conducted. Sector variables are the four main manufacturing sectors covered in the

surveys of food, textiles, metal and wood. The ownership variable is derived from a direct response as to whether a company is wholly or partially owned by Tanzanians or foreigners, private foreign, private Tanzanian, publicly owned or joint venture between public and private.

The gross real output production function is specified as follows;

$$InY_{jt} = \alpha_0 + \alpha_1 InK_{jt} + \alpha_2 InL_{jt} + \alpha_3 ICT_{jt} + \alpha_4 FT_{jt} + \alpha_5 InRM_{jt} + \alpha_6 InIND_{jt} + \alpha_7 C_{jt} + \mu_j + \varepsilon_{jt} \quad \ldots\ldots (3)$$

Whereby j and t are firm and time subscripts, InY =log of real gross output $InRM$ =log of raw materials $InIND$ = log of indirect costs. Other variables are as defined in the second equation.

We control for firm age, size, sector, location, ownership and whether a firm exports. However, there are limitations in estimating the effect of learning and ICT on productivity and exports. The problems of endogeneity, specification of production function and input measurement are likely to affect the estimates. The Ordinary Least Square (OLS) estimates will be biased if unobserved firm fixed effects that are correlated with the determinants of productivity, i.e. the regressors are omitted. There is also the potential for a problem with simultaneity when estimating the productivity effect of training using a production function. One source of this simultaneity is that inputs are not really independent variables and are chosen by firms in some behavioural fashion (Griliches and Mairesse, 1998). In this study, we use panel data and estimate fixed-effect models to control for fixed effects that might be the potential source of the estimation problem.

Data Source and Type

Both primary and secondary data sources were used. The secondary data was collected from university libraries, National Bureau of Statistics publication unit, the Central Bank, the Tanzania Revenue Authority, Ministry of Industry and Trade and the Planning Commission. The primary data came from the Regional Programme of Enterprise Development. These surveys were first conducted by the World Bank and Helsinki University in the early 1990s, and later carried on by the Centre for the Study of African Economies at Oxford University. The surveyed firms are located in the major industrial towns of Tanzania, namely Dar-es Salaam, Mwanza, Arusha, Morogoro, Tanga and Moshi.

The interviews in the RPED surveys were conducted on two levels; firstly with firm managers/owners to collect the firm-level information of ownership of the firm, employment, production costs, profit, value added, investment, financing, etc; secondly, individual interviews with a representative sample of the firms' employees (up to 10 workers from each firm).

Table 2 below describes the distribution of the primary data used in this paper. To account for firm size effects the data presented considered three categories of firm size, i.e. small, medium and large with small having less than 30 employees, medium having 31 to 99 employees and large having over 99 employees. The firm sector categories considered are textiles, food, metal and wood. The data reported in Table 2 show that real log of value added per employee, log of gross output per employee, log of capital per employee and weighted average of schooling increase with firm size. Since the differences between productivity and capital intensity are of significant importance in productivity differentials we focus on these variables.

The average log of value added, gross output and capital per employee are also presented in Table 2. These results also suggest that all three values increase with firm size, and vary considerably with firm sector. In particular, large firms have higher value added per employee, higher gross output per employee and a higher amount of capital per employee. Sector-wise, the food sector has the highest value added per employee, amount of capital per employee and gross output per employee. Based on the findings, the food sector has higher labour productivity than other sectors, while the wood sector has the lowest labour productivity. The results further indicate that, although the weighted averages of schooling and tenure are about the average sizes reported for the whole sample, there is a slight increase moving from small to medium to large firms. We also find that average work experience does not differ very much with firm size.

Table 2: Summary Statistics Of The Learning Variables, Production Inputs And Output By Firm Size And Sector

	Firm Size			Sector			
Variable	Small	Medium	Large	Food	Textile	Metal	Wood
N	218	203	141	180	160	122	100
Log value Added	7.74	9.12	10.93	11.35	9.64	9.15	8.96
	(0.93)	(1.34)	(1.34)	(2.39)	(2.33)	(1.9)	(1.5)
Log Capital	9.42	12.4	12.31	12.2	10.18	9.72	9.42
	(2.36)	(1.47)	(3.56)	(2.89)	(3.35)	(2.76)	(2.36)
Log Labour	2.52	3.96	5.63	3.58	2.93	2.58	2.64
	(0.42)	(0.32)	(0.87)	(1.62)	(1.25)	(0.41)	(0.87)
Log Real Output	10.23	12.42	13.01	8.13	8.21	8.64	8.18
	(1.46)	(1.47)	(2.64)	(0.61)	(0.68)	(0.74)	(0.71)
Log of Raw Materials	9.42	11.7	12.21	12.21	10.14	9.64	9.14
	(1.61)	(1.73)	(2.73)	(2.48)	(2.57)	(2.06)	(1.69)
Log indirect cost/employee	5.51	6.34	6.93	7.14	5.73	5.82	5.19
	(1.22)	(1.34)	(1.36)	(1.26)	(1.08)	(1.24)	(1.13)
Log Real Output/employee	7.68	8.43	8.50	9.22	7.85	7.89	7.36
	(1.14)	(1.40)	(1.33)	(1.20)	(1.07)	(1.22)	(0.90)
Log Real Value Added/employee	6.55	6.96	7.59	7.79	6.65	6.64	6.30
	(1.13)	(1.26)	(1.48)	(1.25)	(1.o4)	(1.28)	(0.99)
Average Years of Experience	4.35	4.26	4.69	4.70	4.45	4.46	4.32
	(2.39)	(2.46)	(2.28)	(3.00)	(2.77)	(2.24)	(2.71)
Average Years of Education	7.98	8.09	8.53	8.27	8.45	8.72	7.64
	(1.85)	(1.52)	(1.88)	(1.73)	(1.87)	(1.81)	(1.84)
Average Current Training	0.03	0.02	0.03	0.04	0.05	0.06	0.06
	(0.09)	(0.08)	(0.11)	(0.02)	(0.03)	(0.03)	(0.04)
Average Past Training	0.12	0.12	0.17	0.09	0.09	0.05	0.06
	(0.22)	(0.21)	(0.29)	(0.06)	(0.06)	(0.02)	(0.02)
Average Years of Tenure	6.63	6.55	6.11	5.87	6.39	6.4	6.01
	(4.31)	(4.6)	(4.18)	(4.22)	(4.47)	(3.83)	(4.59)

Note: Figures in parenthesis are standard deviations; N is the number of observation. The variables of time effects reported control for time, size and sector effects. Value added and output per employee is expressed in Tanzanian shillings.

The weighted average of schooling, tenure, job training and age are derived from firm-level information about individuals highest level of education completed, the occupational specialisation, work tenure, whether an individual received job training, and experience. Each value is weighted by the proportion of workers in a given occupational category in each firm to obtain a weighted average for each firm. The occupational categories included are managers, administration, sales, clerical supervisor, technicians, production workers and support staff.

EMPIRICAL RESULTS

In this section we report the empirical results of this paper, which are based on an estimate of the gross output production function. We first estimate the production functions based on OLS and gradually improve the estimates to account for the problem of omitted variables. The gross output production estimates are shown below in table 3. Based on the results reported in columns 1-4, constant returns to scale are accepted at 5 percent critical value (all p-values are greater than the critical level). We therefore focus on describing the results based on gross output per employee. The results reported in columns [1-3] show that learning characteristics in the form of average years of experience along with ICT measured as receiving on-the-job training have a positive impact on firm-level productivity. These results are stable when control variables of firm characteristics of exports and age in column [2] and location, ownership and sector in column [3] are added. In particular, the results show that attending ICT-related courses currently has a negative effect on productivity. A possible interpretation of this observation is that, if firms have a higher inclination to train when they have a productivity disadvantage, job-related training offered by the firm is likely to be one of the measures to improve and maintain productivity levels. But the time spent in training leaves employees with less to work time. This can have adverse effects on productivity in the short run. In addition, there may be direct training costs, which may affect the level of production. The results also show that input variables of raw materials and indirect costs per labourer have a substantial impact on productivity.

Table 3: Regression Results Of The Estimates Of Learning Effect On Gross Output

	OLS1	OLS2	OLS3	FE (Within)
Column	[1]	[2]	[3]	[4]
Log of Capital	-0.005	-0.002	0.006	0.002
	(0.15)	(0.25)	(0.60)	(0.08)
Log of labour	0.143	0.145	0.143	0.150
	(6.95)***	(7.19)***	(6.92)***	(2.85)***
Log of Raw Materials	0.576	0.577	0.568	0.523
	(20.90)***	(21,06)***	(20.26)***	(19.25)***
Log of Indirect Costs	0.298	0.293	0.292	0.271
	(11.14)***	(10.79)***	(10.67)***	(7.77)***
Weighted Average ICT Training1	0.003	0.003	0.021	0.051
	(2.11)**	(2,70)**	(2.81)**	(0.75)
Weighted Average ICT Training2	-0.172	-0.171	-0.171	0.135
	(2.31)**	(2.27)**	(2.27)**	(0.88)
Average Years of Education	-0.008	-0.008	-0.007	0.018
	(1.00)	(1.09)	(0.93)	(1.76)*
Average Years of Tenure	0.005	0.006	0.006	-0.006
	(1.83)*	(2.00)**	(1.78)*	(1.02)
Average Years of Experience	0.009	0.008	0.008	0.018
	(2.50)**	(2.38)**	(2.64)***	(2.72)***
Exports		0.015	0.024	-0.053
		(0.32)	(0.54)	(0.41)
		-0.002	-0.002	0.004
Firm Age				
1993	-0.156	-0,160	-0.220	0.035
	(2.82)***	(2,91)**	(2.85)***	(0.31)
1994	-0.187	-0,194	-0.251	0.049
	(2.93)***	(3,04)***	(2.99)***	(0.46)
1995	-0.181	-0,185	-0.231	0.016
	(2.86)***	(2.94)**	(2.87)***	(0.16)
1997	-0.067	-0.072	-0.142	-0.106
	(1.29)	(1,37)	(2.01)**	(2.06)**
1998	-0.040	-0.046	-0.115	-0.085
	(0.86)	(0.97)	(1.78)*	(1.72)*
1999	0.013	0.002	-0.012	0.049
	(0.19	(0.03)	(0.18)	(0.84)
CONTROL VARIABLES				
Location	NO	NO	YES	YES
Ownership	NO	NO	YES	YES
Sector	NO	NO	YES	YES
Firm Fixed Effect	NO	NO	NO	YES
Observations	562	652	562	562
R-squared	0.98	0.98	0.98	0.81
	0.27	0.25	0.42	0.38

Absolute values of t-statistics are in parentheses. Significance at the 1 per cent, 5 per cent and 10 per sent level is indicated by ***, ** and * respectively. CRS test is an F-test for constant returns to scale that the coefficients on inputs sums to unity. The weighted average of schooling, tenure, job training and age are derived from firm-level information about individuals' highest level of education completed, the occupational specialisation, work tenure whether an individual received job training and

experience. Each value is weighted by the proportion of workers in a given occupational category in each firm to obtain a weighted average for each firm. The occupational categories included are managers, administration, sales, clerical supervisor, technicians, production workers and support staff.

Nonetheless, our OLS results reported in columns [1-3] do not control for the estimation problems we mentioned earlier such as fixed effects. If the determinants of productivity in our estimated production function are correlated with firm-specific effects, then such OLS results will be biased. To account for these problems, we utilise panel dimension of the data and control for the firm fixed effects. The results are shown in column [4] of Table 3. The results show that all input variables, i.e. physical capital, labour, raw materials and indirect costs, still have a positive effect on gross output. The results suggest a downward bias of the workforce experience and education coefficients estimated earlier by OLS. After the firm fixed effects are controlled for, the coefficient on both ICT job training measures disappears. We interpret this as evidence that the ICT effects on productivity work through firm-specific characteristics. The firm fixed effects are not the only factors that cause the estimated production function to be biased.

To account for other potential sources of bias, the study estimates Generalized Method of Moments (GMM) based panel models. In GMM estimation approach, we utilise information from the level equation of our production function to create lagged input values that are used as instruments. In addition, we estimate the production equation using Instrumental Variable (IV) techniques. The additional instruments in our equation are input prices. Both the GMM and IV results are reported in Table 4 below. We first discuss the tests for over-identification. As we can see at the bottom of the table, the test for over-identification is insignificant in all models, signalling the validity of our instruments. The results in columns [1-3] are for the IV estimates, while the last three columns report GMM estimates. According to the results, there are no significant differences in the estimates reported in table 4. However, the IV estimates point some biases in the OLS estimates, particularly for the coefficient on raw materials per employee and exports. These IV results indicate a more significant effect of productivity exports, while the OLS indicated a negligible effect. In both GMM and IV estimates, there is still significant evidence of the effect on productivity of average years of experience of the workforce. The coefficient on average education now has the correct sign, suggesting a positive effect, effect of education on productivity but it is not statistically significant.

Table 4: GMM And Iv Regression Results Of The Estimates Of Learning Effect On Gross Output Per Employee

	IV-2SL	1V-2SL	IV-2SL	GMM	GMM	GMM
Column	[1]	[2]	[3]	[4]	[5]	[6]
Log of Capital Per Employee	-0.017	0.034	0.073	-0.014		0.034
	(0.25)	(0.45)	(1.01)	(0.21)	(0.46)	(1.00)
Log of Raw Materials per Employee	0553	0552	0.555	0578	0.576	
	(6.93)***	(6.81)***	(5.80)***	(6.85)***	(6.72)***	(5.76)***
Log of Indirect cost Per Employee	0.335	0.264	0284	0.322	0.255	0.284
	(3.61)***	(2.46)**	(2.55)**	(3.44)***	(2.38)**	(2.55)**
Weighted Average ICT Training1	0.036	0.003	0.045	0.035	0.012	0.045
	(0.71)	(0.73)	(0.62)	(1.00)	(0.81)	(0.51)
Weighted Average ICT Training2	-0.403	-0.314	-0.354	-0.370	-0.312	-0.351
	(2.49)**	(1.86)*	(1.39)	(2.23)**	(1.84)*	(1.37)
Average Years of Education	0.007	0.006	0.004	0.004	0.004	0.004
	(0.63)	(0.58)	(0.24)	(0.34)	(0.36)	(0.23)
Average Years of Tenure	0.005	0.005	0.003	0.005	0.005	0.003
	(0.78)	(0.79)	(0.52)	(0.92)	(0.91)	(0.53
Average Years of Experience	0.008	0.009	0.007	0.007	0.008	0.007
	(1.99)**	(2.24)**	(1.57)*	(1.73)*	(1.94)*	(1.55)*
Exports		0.125	0.055		0.112	0.054
		(1.64)*	(0.64)		(1.27)	(0.62)
Firm Age		-0.003	-0.003		-0.004	-0.003
CONTROL VARIABLE						
Location	NO	NO	YES	YES	NO	YES
Ownership	NO	NO	YES	YES	NO	YES
Sector	NO	NO	YES	YES	NO	YES
Firm Fixed Effect	NO	NO	NO	NO	NO	NO
Observations	562	562	562	562	562	562
R-squared	0.95	0.95	0.96	0.95	0.95	0.96
J-Hansen Statistics	0.37	0.39	0.39	0.37	0.39	0.10
(P-values of Overid-Test)						

Absolute values of t-statistics are in parentheses. Significance at the 1 per cent, 5 per cent and 10 per sent level is indicated by ***, ** and * respectively. . [a] Average training is the weighted average of the proportion of workers who either received any job training in the past or are currently receiving on the job training. [b] Average education in years is the weighted average of education derived from firm level about individuals' highest level of education completed. [c] Average Tenure in Years is the weighted average of length of tenure derived from firm-level information about the number of years spent in the current firm. [d] Average Experience in Years is the weighted average of years of work experience derived from firm level about the number of years that a worker has been in the labour market.

The average level of schooling of the workforce is not significant except when the firm fixed effects are controlled for. This shows a strong correlation between time in various firms, their characteristics and the effect of education on productivity. If, for instance, the production process requires simple technology that can be acquired through learning by doing, there will be fewer links between academic education and productivity. Previous studies have provided evidence of the effect of human capital on productivity in East Africa. The most comprehensive study conducted by Knight and Sabot (1990) found that literate and numerate workers are more productive than their peers. They also pointed out that longer educated workers tend to be more literate and numerate.

Qualitative Estimates of the Trade Facilitation Effects on Tanzanian Manufacturing Exports and Productivity

In this section, we provide an assessment of the qualitative responses of the managers of the enterprises regarding the effects of trade facilitation on exports and productivity in Tanzania. The qualitative responses are correlated using simple regressions to simplify interpretation. Thus, the analysis undertaken here is simple and qualitative in nature. It follows therefore, that the double q-approach hinted at earlier can partly be inferred here. The results are presented in table 5 below.

Table 5: Trade Facilitation Effects on Tanzanian manufacturing Exports and Productivity

Firm Performance	Price Control [2]	Access to Credit [3]	Trade Policy Uncertainty [4]	Insufficient Demand [5]	Skilled Labour [6]
Export	0.345	0.392	-0.306	-0.25	0.161
	(0.8)	(1.65)*	(1.82)*	(3.93)***	(2.86)**
Real Output	0.081	0.311	-0.135	-0.449	0.213
	(1.67)*	(4.21)***	(2.16)**	(2.10)*	(1.78)*
Value Added	0.152	0.24	-0.310	-0.470	-0.277
	(4.00)***	(3.92)***	(3.13)**	(2.40)*	(2.18)**
Profitability	0.805	0.107	-0.145	-0.068	0.123
	(1.41)	(1.72)*	(2.67)**	(0.41)	(0.52)
Capital	0.11	0.130	0.064	0.090	0.133
	(1.0)	(3.70)***	(0.80)	(2.31)**	(0.61)
Raw Materials	0.129	0.34	-0.63	-0.100	0.012
	(1.04)	(5.69)***	(1.17)	(1.86)*	(0.75)

Absolute values of t-statistics are in parentheses. Significance at the 1 per cent, 5 per cent and 10 per sent level is indicated by ***, ** and * respectively. The changes reported in this table are obtained by regressing each variable on the year dummies.

The table shows the correlation between the perceived firm level effects of various policy and administrative reforms on manufacturing performance. The specific areas of analysis considered are the effect of change in price control, access to credit, trade policy uncertainty, insufficient demand and skilled labour. The result in the first column indicates that price control has no effect on observed firm-level exports, real output capital and profitability. There is some positive effect of price control on firm-level value added. Such findings need some clarification. Several decades ago Tanzania had price controls which were abolished in the early 1990s. Nearly 30 percent of the firms' responses reported in this paper were surveyed in the early rounds of the survey. This partly reflects the positive effect of price control on productivity, but currently, when most of the firms have been privatised and the policy of price control abolished, there is less likelihood of observing a significant effect of price controls on firm-level export performance and productivity.

Access to credit is another factor investigated by this study that might be one of the missing links. The anticipation here is that trade facilitation policies and application of ICT cannot be adopted smoothly by firms due to their inability to access credit that is important for financing increased development, acquiring of new technology and hiring specialised labour that can work with ICT. Based on the managers' responses from the RPED surveys, the paper correlates firm-level access to credit information with exports, size of output measured by both gross output and value added, capital and raw materials. Interestingly, the results indicate a substantially positive effect of access to credit on output, profitability, value added, capital and raw materials. The results suggest that companies in the Tanzanian manufacturing sector that can export are exposed to credit. On the other hand, lack of access to credit inhibits exports, the functioning of trade facilitation, profitability, capital size and raw material usage. A combination of these factors results in a small-sized manufacturing sector that offers very little to the market.

Policy uncertainty is another key factor that was considered to have an effect on observed firm-level exports, output, capital size, raw material usage, value added and profitability. The results strongly confirm that companies that find trade policy to be uncertain have problems in exporting. Firms, for instance, mentioned Tanzania's membership of COMESA, and the requirement of the from Tanzania Revenue Authority to pay VAT based on value that excludes other producers as some examples of trade policy uncertainties that affect firm-level exports. The results also confirm that trade policy uncertainty negatively impacts real output, profitability and raw materials. The results suggest that for a workable trade facilitation and application of ICT in the manufacturing sector the government needs to ensure that trade policies are predictable and stable for a considerable amount of time to allow firms to plan for exporting.

Export-led growth via the manufacturing sector is driven by the reliability and guarantee of the market. Given other factors, market size will be influenced by whether or not the exported products are in great demand. The results based on this aspect confirm that insufficient demand abroad for Tanzanian manufactured affects the ability of firms to export. However, the major factors behind this market deficiency are high transaction costs, low quality products and competition from local products. Firms interviewed indicate that in the export market consumers are motivated to buy local products first before they think of buying imports. The regional market is hard to penetrate as most neighbouring countries produce the same manufactured goods. Due to the low level of demand, the output, profits, raw material usage and the amount of capital are small.

Skilled labour is one of the major factors needed to ensure industrialisation that is based on high-level technology, usage of ICT and impressive export performance. The study uses qualitative responses to assess the influence of skilled labour on exports, firm-level profit, real output and usage of raw materials. The results indicate that skilled labour has a strong positive correlation with exports and output and that companies that export more have a high proportion of skilled labour. The results also suggest that firms with a high proportion of skilled labour produce more than firms with a lower proportion of skilled labour. Both of these are statistically significant. A positive correlation between skilled labour, profits, raw material usage and capital is also observed.

To sum up, the results confirm that Tanzanian manufacturing firms that export and perform better are positively influenced by access to credit, demand for their products in both local and export markets, predictability of trade policies and the proportion of skilled labour in their workforce. Therefore, based on such findings, the potential missing links for the workability of trade facilitation and productivity are access to credit, skilled labour, demand deficiency and trade policy certainty. To halt the stagnation of the exports and growth of the Tanzanian manufacturing sector, via trade facilitation, such firm-level factors must be addressed.

CONCLUSION

This study set out to assess the missing links between ICT and trade facilitation as a mechanism for enhancing the export of manufactured goods and the productivity of Tanzanian manufacturing enterprises. It focused on testing the hypothesis that application of ICT at firm level and trade facilitation policies has a causal impact on the quality and quantity of manufactured exports, productivity and investment. The study focused on a critical assessment of the role of the missing links in facilitating the export of manufactured goods of ICT usage and trade facilitation. In fulfilling the study objectives, the specific focus was on identifying the constraints to the export of manufactured goods. In doing so the study aimed at providing a good understanding of the pre-conditions for export-led growth in the

Tanzanian economy, together with evidence on the effects of export and trade facilitation on manufacturing productivity and their influence on overall economic growth.

To address the key research questions the study estimated a firm-level production function. The regression results indicated that attending ICT- related courses currently has a negative effect on productivity. A possible interpretation of this observation is that, if firms have a higher inclination to train when they have a productivity disadvantage, job-related training offered by the firm is likely to be one of the measures to improve and maintain productivity levels. But time spent in training leaves employees with less time on the job. This can have adverse effects on productivity. In addition, there may be direct training costs, which may affect the level of production. The results also show that input variables of raw materials and indirect costs per labourer have a substantial impact on productivity.

After the firm fixed effects are controlled for, the coefficient on both ICT job training measures disappears. We interpret this as evidence that the effects of ICT on productivity work through firm-specific characteristics. The firm fixed effects are not the only factors that cause the estimated production functions to be biased. The results were robust even after estimating the GMM and IV regressions. The results in the first column indicate that price control has no effect on observed firm-level exports, real output, capital and profitability. Based on the managers' responses from the RPED surveys, there is a substantially positive effect of access to credit on output, profitability, value added, capital and raw materials. The results strongly confirm that companies that find trade policy to be uncertain have problems in exporting.

The results based on this aspect confirm that insufficient demand abroad for Tanzanian manufactured goods affects the ability of firms to export. The results indicate that skilled labour has a strong positive correlation with export and output. Further findings of the study are that trade facilitation policies, measured by government policies on prices, facilities on access to imported raw materials, preferential trade access and overall trade policy changes, have a significant influence on firm-level performance in relation to exports and productivity. The key policy message of this study is that the potential missing links for the facilitation of trade and productivity are access to credit, skilled labour, demand deficiency and trade policy certainty. The study strongly recommends that such firm-level aspects are addressed to halt the stagnation of the exports and the growth of the Tanzanian manufacturing sector via trade facilitation

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ENDNOTE

[i] In some studies it is broadly referred to as reform of non-tariff barriers

[ii] These includes Hong Kong, South Korea, Singapore, Malaysian, Taiwan , Indonesia and Thailand

[iii] The gravity model was first developed by Tinbergen (1962) and Pöyhönen (1963) to explain bilateral trade flows by trading partners' GNP and geographical distance between countries.