Technical Efficiency of Micro and Small Enterprises in Kenya

By

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Declaration

I certify that this Research Paper is my original work and has not already been presented for a degree award in any other university.

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Approval

This Research Paper has been submitted for examination with our approval as University supervisors.

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Abstract

Over the years, the role of Micro and Small Enterprises (MSEs) in economic development has become apparent. In order to formulate appropriate policy measures to improve the development of MSEs, it is important to examine their level of efficiency.

This paper provides an assessment of technical efficiency levels among Micro and Small Enterprises (MSEs) in Kenya and investigates sources of technical inefficiency. Cross sectional data was obtained from the National MSE Baseline survey conducted in 1999 by the Central Bureau of Statistics (CBS) in conjunction with K-Rep Holdings and the International Center for Economic Growth (ICEG). To estimate technical efficiency and identify the sources of inefficiency among MSEs the study uses the Cobb-Douglas stochastic production frontier approach. The one-stage estimation procedure of Battese and Coelli (1995) is adopted.

The results indicate that MSEs in Kenya are on average technically efficient. The average efficiency score is 72%. More than 50% of the firms have efficiency levels of 70% and above but there are other firms that are highly inefficient with efficiency scores of as low as 0.3%. Results of the inefficiency effects model reveal that, the owner's age, level of education and training are negatively related to technical inefficiency. Access to infrastructure is also negatively related to technical inefficiency. Sourcing startup capital from financial institutions was found to have a positive relationship with technical inefficiency.

Improving Education, availing credit to the MSEs and improving infrastructure would go along way in assisting the MSEs improve their efficiency thus increasing output.

Acronyms

CBK	Central Bank of Kenya
DEA	Data Envelopment Analysis
GDP	Gross Domestic Product
ICEG	International Center for Economic Growth
ILO	International Labour Organization
KIRDI	Kenya Industrial Research and Development Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
Ksh	Kenya Shillings
MSEs	Micro and Small Enterprises
NCSE	National Council of Small Enterprises
NGO	Non Governmental Organization
RPED	Regional Program on Enterprise Development

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CHAPTER ONE

1.0 *INTRODUCTION*

1.1 Background

The role of Micro and Small Enterprises (MSE) sector in Kenya's economic development is today recognized in terms of training, employment and income generation (Government of Kenya, 2005). However, this has not always been the case. Until the 1970s most developing country governments, Kenya included, paid little attention to small scale enterprises, and instead promoted industrialization through policies that favoured large firms(ILO,1972)). But since the 1970s there has been growing recognition that the earlier emphasis on large scale industrialization has had only moderate success in generating employment growth and alleviating poverty and that enhancing the development of Small scale enterprises maybe an effective way of fostering growth and equity (Batra and Tan, 2003).

The study of micro and small enterprises (MSEs) under the popular name, informal sector, dates back to the ILO (1972) report on employment, incomes and equality in Kenya. The ILO report viewed the informal sector as an engine of redistributing earnings opportunities in Kenya and other developing countries. It argued that because the formal sector is capital intensive, it is incapable of absorbing more than a small fraction of the rapidly growing labour force. Almost 40 years later, the situation in

Kenya is as the ILO report predicted. The formal sector generates very few jobs while the informal sector has expanded rapidly. (See: Government of Kenya, 2010, 2011). Consequently, the ILO message is still relevant that, if the problems of unemployment and poverty are to be alleviated, policies should be put in place to assist the growth of productivity in the informal sector and encourage development of linkages between formal and informal sector.

In the literature, there is no universally accepted definition of micro and small enterprises (MSEs). The more commonly used definition is based on the number of employees engaged by the enterprise, although the turnover, the degree of formality, or legitimacy of the enterprise; capital investment; and degree of skills per worker can also be used(Mukras, 2003).For example the Zimbabwean government, defines micro-enterprises as those enterprises that use family as well as hired labour of up to 5 workers; small scale enterprises are defined as those enterprises which employ between 5 and 20 hired workers; and medium scale enterprises employ 20 or more workers, have a capital value of Z$2 million, fixed assets valued below Z$2 and Z$3 million and an annual turnover of up to Z$2 and Z$15 million(Mukras, 2003).

In Kenya, the 1999 National Micro and small enterprise baseline survey defined MSEs as enterprises in both formal and informal sectors employing 1-50 workers (CBS, ICEG, K-Rep holdings, 1999). This paper shall adopt this definition. According to this survey, these enterprises cut across all sectors of the Kenyan èconomy and provide one of the most prolific sectors of employment creation, income generation and poverty reduction.

The MSEs Sector plays an important role in Kenya's development process. According to estimates from the 1999 baseline survey, there were about 1.3 million MSEs employing an estimated 2.4 million people (CBS, ICEG and K-Rep, 1999). The informal sector in particular has continued to grow. Employment within the sector increased from 6.1 million persons in 2004 to 7.9 million persons in 2008(Government of Kenya, 2009), accounting for 79.8% of the total persons engaged in employment. The sector also contributes up to 18.5% of the country's Gross Domestic Product (GDP).

1.2 Structure and Composition of the MSE Sector in Kenya

1.2.1 Structure of MSE Sector

The 1999 MSE baseline survey estimates that Kenya has about 1.3 million MSEs, employing some 2.4 million people. About 26% of the total households in the country are involved in non-farm business activity. Estimates from the survey also indicate that the number of enterprises per 1000 residents of the population to be about 43 MSEs. This compares with 37 in Botswana, (Daniels and Fisseha, 1992), 64 in Lesotho, (Daniels and Fisseha 1991), 66 in Zambia, (Milimo and Fisseha, 1985), 83 in Niger (Daniels and Fisseha, 1990), 78 in Zimbabwe, (McPherson, 1991).

MSEs in Kenya can be differentiated in terms of their location, sex of the entrepreneur or the sector of the economy in which they fall. The total number of MSEs and their employment is shown in table 1.1 by location.

Table 1.1: Total Number of MSEs and Their Employment

Stratum	% of National Population	MSEs Number	%	Workers Number	%	Mean
Nairobi and Mombasa	9.7	204,280	15.8	394,838	16.9	2
Other major towns	6.2	157,133	12.2	279,133	11.8	1.8
Rural Towns	2.1	81,320	6.3	135,349	5.6	1.6
Rural areas	82	845,879	65.6	1,551,930	65.7	1.8
Total	100	1,289,012	100	2,361,250	100	1.8

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, ICEG)

About 66% of the Kenyan MSEs are located in rural areas. However while the concentration of MSEs is higher in the urban areas, the aggregate or relative number of MSEs is higher in the rural areas. The average size of the MSEs in Kenya is 1.8 persons at the national level. This is because many operators of MSEs are own account workers, that is, the owner is the only worker.

The ownership of Kenyan MSEs is almost equally divided at the national level between men and women. Table 1.2 shows the sex distribution of MSEs in Kenya. Men account for about 52% and women account for 48% of all entrepreneurs. From the table, 68% of all the MSEs owned by men are in the rural areas and almost 63% of all the MSEs owned by women are also in the rural area.

Table 1.2: Sex Distribution of Respondents (or owners) of MSEs

Locations	Men			Women			Total
	No.	Col%	Row%	No.	Col%	Row%	No.
Urban	213,262	31.8	48.3	227,886	37.2	51.7	441,148
Rural	457,465	68.2	54.3	384,961	62.8	45.7	842,427
Total	670,727	100	52.3	612,848	100	47.7	1,283,575*

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, ICEG)

Note: *The slight difference of this total from the one shown in table 1.1 is due to some missing Observations for the 'sex of respondent' variable

MSEs in Kenya are mainly found in four subsectors: manufacturing (13.4%), trade (64%), services (14.8%) and construction (1.7%). Other activities account for 7.7%. This distribution is shown in table 1.3.

Table 1.3: Sectoral and Urban-Rural Distribution of MSEs

Sector	Urban			Rural			Total	
	Number	Col%	Row%	Number	Col%	Row%	Number	Percentage
Manufacturing	45,019	10.2	26.1	127,745	15.1	73.9	172,764	13.4
Trade	273,738	61.5	33.1	552,410	65	66.9	826,149	64.1
Bars/Hotels/Restaurants	24,888	5.9	32.5	51,789	6.5	67.5	76,677	6
Services	92,937	21	48.6	98,398	11.6	51.4	191,335	14.8
Construction	6,551	1.5	29.7	15,537	1.8	70.3	22,087	1.7
Total	443,133	100	34.4	845,879	100	65.6	1,289,012	100

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, ICEG)

From table 1.3 it is clear that a large share of MSEs (73.9% of manufacturing, 66.9% of trade, and 70.3% of construction) of MSEs is in the rural areas. It is only in the services sector that the MSEs activities are divided almost equally between urban and rural locations.

1.2.2 Constraints facing MSEs

Although the MSEs Sector has grown to become a major source of employment, its growth and development is hampered by a number of constraints. Shortage of markets has been cited as the leading constraint especially in Kenya's manufacturing, trade and services sub-sectors (Mukras, 2003). According to the 1999 MSE baseline survey, 34.1% of the entrepreneurs cited difficulties arising from market saturation or low demand for products as a constraint (CBS, ICEG, K-Rep, 1999). Market saturation can be attributed to entrepreneurs producing similar products either because of lack of sophisticated technology or because of risk avoidance. It can also be attributed to cheaper and technologically superior imports (Government of Kenya, 2005).

Lack of access to adequate credit is another severe constraint to MSE growth and development in Kenya. This is because formal financial institutions perceive MSEs as high risk and commercially unviable (KIPPRA, 2001). Daniels, Mead and Musinga (1995) found that only a small minority of MSEs in Kenya had benefited from any form of credit, and that most MSEs relied on personal savings and re-investing of profits to finance their enterprises.

Other obstacles to MSEs Development and growth include poor access to information, low levels of skills, weak management and limited technological capabilities (Government of Kenya, 2005). In Kenya, most entrepreneurs have either no formal education or only primary schooling. This is a constraint in that education has an important bearing on the performance of MSEs and levels of income. The more educated the entrepreneur and his workers are, the better decisions they are able to make and the faster they are in applying new technologies thus improving their incomes. Table 1.4 shows Levels of education attained by entrepreneurs in percentages.

Table 1.4: Levels of Education Attained by Entrepreneurs (%)

Education	1995	1999
None	20.4	10.6
Primary	55.3	54.4
Secondary	23.2	33.1
Higher	.1.2	1.8

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, ICEG)

From the above table it is clear that the MSE entrepreneur of 1999 was more educated than the MSE entrepreneur of 1995. The survey attributed this to rising levels of unemployment among secondary school and university graduates who find themselves in the MSE sector by default.

1.2.3 Earnings in the MSE sector

Contrary to popular believe that incomes from MSEs are very low, estimates from the 1999 MSE baseline survey showed that salaries and wages are not as low as often thought. Table 1.6 and 1.7 illustrate this point. Entrepreneur's income was on average 2.5 times higher than the legal minimum wage in 1999(see Table 1.5). The average monthly salary in the MSE sector was 2.7 times the legal minimum wage (see Table 1.6).

Table 1.5: Average Monthly Income of MSE Entrepreneurs (Ksh)

	Manufacturing	Trade	Services	Mean
Women	3,634	3,455	12,872	4,344
Men	5,507	5,519	17,523	7,627
Both	4,869	4,370	15,730	6,008
In multiples of legal minimum wage				
Women	1.5	1.5	5.4	1.8
Men	2.3	2.3	7.4	3.2
Both	2.1	1.8	6.7	2.5

Source: National MSE Baseline Survey 1999 (CBS, k-Rep, and ICEG)

Table: 1.6: Average MSE Monthly Salaries (Ksh)

Manufacturing	Construction	Trade	Services	Urban	Rural	Mean
3,771	5,192	7,852	13,130	10,973	1,845	6,496
In multiples of the legal minimum wage						
1.6	2.2	3.3	5.6	4.6	0.8	2.7

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, and ICEG)

According to the survey however, the average woman's income is less than a man's with a ratio of 57 %,(CBS, K-Rep, ICEG, 1999).

Education is positively associated with earnings as expected. The National MSE Baseline survey of 1999 found that the highest proportion of entrepreneurs with the highest levels of revenue was in the post graduate group while the highest proportion of those with the lowest revenues was found among those with no education. Table 1.7 shows this relationship between revenues and levels of education.

Table 1.7: Gross Monthly Revenue Returns by Level of Education (%)

Ksh	None	Nursery	Primary	Secondary	Under Graduate	Post graduate	Other
Below 2,000	23.2	65.5	19.6	10.1	4.4		31.3
2,001-5,000	24.5	12.1	21.5	17.3	4		24
5,001-10,000	21.4	17.1	22.1	22.4	4.4		
10,001-20,000	19.9		17.4	20.7	20.6	10.4	20.5
20,001-50,000	4.7	5.6	12.7	17.6	4.1	9.6	3.8
50,000+	6.4		6.7	11.9	62.6	80	20.5

Source: National MSE Baseline Survey 1999 (CBS, K-Rep, and ICEG)

1.2.4 Government policy and reforms

Since the ILO (1972) Mission to Kenya, the Kenyan government gradually recognized the important role of the MSE sector. This is evidenced by measures put in place geared towards promotion and development of the MSE sector. One of the most notable policy papers is sessional paper No.2 of 1992 on *Small Enterprise and Jua Kali Development in Kenya* (Government of Kenya, 1992). The paper emphasized the need to create an enabling environment through an appropriate legal and regulatory framework; and put in place support and facilitative measures to promote the growth of the sector. The Jua

Kali sector has grown over the years and although it still faces the constraints mentioned in subsection 1.2.2, it has continued to manufacture cheaper products for the lower income earners.

The most recent policy paper on MSEs is Sessional paper No.2 of 2005 on *Development of Micro and Small Enterprises for Wealth and Employment Creation for Poverty Reduction* (Government of Kenya, 2005). It puts MSEs at the center of Kenya's economic growth and Development. It advocates institutional changes that include strengthening the capacity of the Department of Micro and Small Enterprise Development in the Ministry of Labour to play an oversight function; and establishment of a broad-based and independent National Council for Small Enterprises (NCSE) to advise on appropriate policies for the MSE sector and to mobilize resources for the same. The policy recognizes that critical to the success of the sector is its integration into the national economic grid. The policy also stated that a Micro and Small Enterprises (MSE) Act would be legislated to provide the appropriate legal framework to support the growth and development of the sector.

MSEs have also been given priority in Kenya's Vision 2030. Among the flagship projects for manufacturing sector is the development of concept, piloting and creation of at least 5 small and medium enterprises Industrial parks in order to make Kenya a middle income earning country by the year 2030 (Government of Kenya, 2007).

Many MSEs in Kenya access credit from Micro Finance institutions. Consequently, the government in efforts to support the MSEs sector, enacted the Micro finance Act of 2007 which seeks to control and audit micro finance institutions through the Central Bank of Kenya. The Act is aimed at protecting entrepreneurs who are out of the scope of formal banking services from unscrupulous individuals or organizations. The government also unveiled projects such as Youth Enterprise development fund (founded in June 2006), women Enterprise development fund (founded in December 2007), and business research incubator training through Kenya Industrial Research and Development Institute (KIRDI) among others for purposes of supporting the MSE sector.

1.3 Research Problem

The Micro and Small enterprises (MSEs) sector has become an increasingly important part of the Kenyan economy. It generates many jobs each year and earnings for millions of Kenyans. However, in order for MSEs to create decent jobs and become a force for economic growth and poverty reduction, they need to be highly productive.

The productivity of MSEs maybe increased through greater input use or through increased technical efficiency in use of available inputs. However, in the face of increased population and stiff competition from the global market, the scope to increase productivity by bringing more resources into use becomes more and more limited. Consequently, improving technical efficiency could be an important means for MSEs to increase productivity in a liberalized and competitive environment.

In spite of the increasing importance of MSEs in the Kenyan economy, their levels of technical efficiency remain largely unknown. It is also unclear how various characteristics, such as ownership structure and human capital of MSEs influence technical efficiency levels. Technically efficient MSEs would maximize output given available inputs, contributing to output growth and decent jobs. On the other hand, technically inefficient MSEs would incur unnecessary cost and wastage resulting in low returns on inputs and inability to compete effectively in the market. This would retard their ability to generate employment and incomes.

The purpose of this study is to assess the levels of technical efficiency of MSEs in Kenya, and investigate factors that are likely to influence technical efficiency levels in the MSE sector. The research questions addressed are: (i) to what extent are MSEs in Kenya technically efficient? (ii) What factors are likely to influence technical efficiency levels among MSEs in Kenya?

1.4 Objectives of the Study

The main objective of this study is to assess technical efficiency of MSEs in Kenya and investigate factors that influence their technical efficiency levels.

The study seeks to achieve the following specific objectives

i. Estimate the level of technical efficiency of Kenya's MSEs.

ii. Identify the key determinants of technical efficiency levels of Kenya's MSEs.

iii. Draw policy implications for improving technical efficiency of MSEs in Kenya.

1.5 Justification of the Study

Previous studies (e.g. Little, Mazumdar and Page, 1987; Cortes, Berry and Ishaq, 1987; Liedholm and Mead, 1987) contain mixed evidence on the degree of technical efficiency of MSEs. Additional research would therefore provide further evidence of levels of technical efficiency of MSEs and potential ways to enhance technical efficiency of MSEs.

Secondly, the results of this study would be valuable to policy makers and other stakeholders concerned with the role of MSEs in economic development. Although most researchers and policy makers agree on the importance of MSEs in employment creation and poverty alleviation, little or incomplete empirical information regarding the behaviour and economic performance of MSEs can hinder policy makers from devising appropriate policies to foster MSE growth and development.

Thirdly, improved productivity would improve the competitiveness of MSEs. This is important given the contribution the sector makes to the Kenyan economy as a major source of jobs, income and skills.

1.6 Outline of the Research Paper

The rest of this research paper is organized into 4 chapters. Chapter 2 contains a review of theoretical and empirical literature on technical efficiency and determinants of technical efficiency. Chapter 3 presents theoretical and empirical aspects of the modeling approach used in this paper. It also outlines data sources and estimation procedures to be used. Chapter 4 discusses the data that was used in the study and presents the results of the analysis and finally, chapter 5 presents the conclusion and policy implications for policy makers and stake holders in the MSEs Sector.

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter has been divided into two parts. The first part looks at the definition of technical efficiency and the economic theory behind technical efficiency. The second part reviews the empirical literature on technical efficiency.

2.1 Theoretical Literature

2.1.1 Concept of Efficiency

The economic literature on production efficiency typically distinguishes two types of efficiency: technical efficiency and allocative efficiency. A technically efficient firm produces the maximum output for a given amount of inputs, conditional on the production technology available to it. According to Kalirajan and Shand (1999) a measure of technical efficiency in the *i*th firm can be defined as:

TE= Y_i / Y_i^* where, Y_i is Actual Output and Y_i^* is Maximum possible output

Allocative efficiency on the other hand reflects the ability of a firm to apply the optimal amount of inputs to produce the optimal mix of outputs given the production technology and the prices it faces (Chirwa, 2003). A firm that is both technically and allocatively efficient is said to be economically efficient (Papadas and Dahl, 1991). Profit maximization requires a firm be technically efficient and allocatively efficient.

Farrell (1957) introduced a measure of productive efficiency where a firm's efficiency is measured relative to an efficient production frontier. The efficient frontier gives the output that a perfectly efficient firm could obtain from any given combination of inputs. These concepts can be illustrated graphically using a simple example of Farrell's output-oriented technical and allocative efficiencies. Output oriented measures indicate by how much output quantities can be expanded without altering the inputs quantities used.

Figure 2.1: Farrell's Output oriented Technical and Allocative Efficiencies.

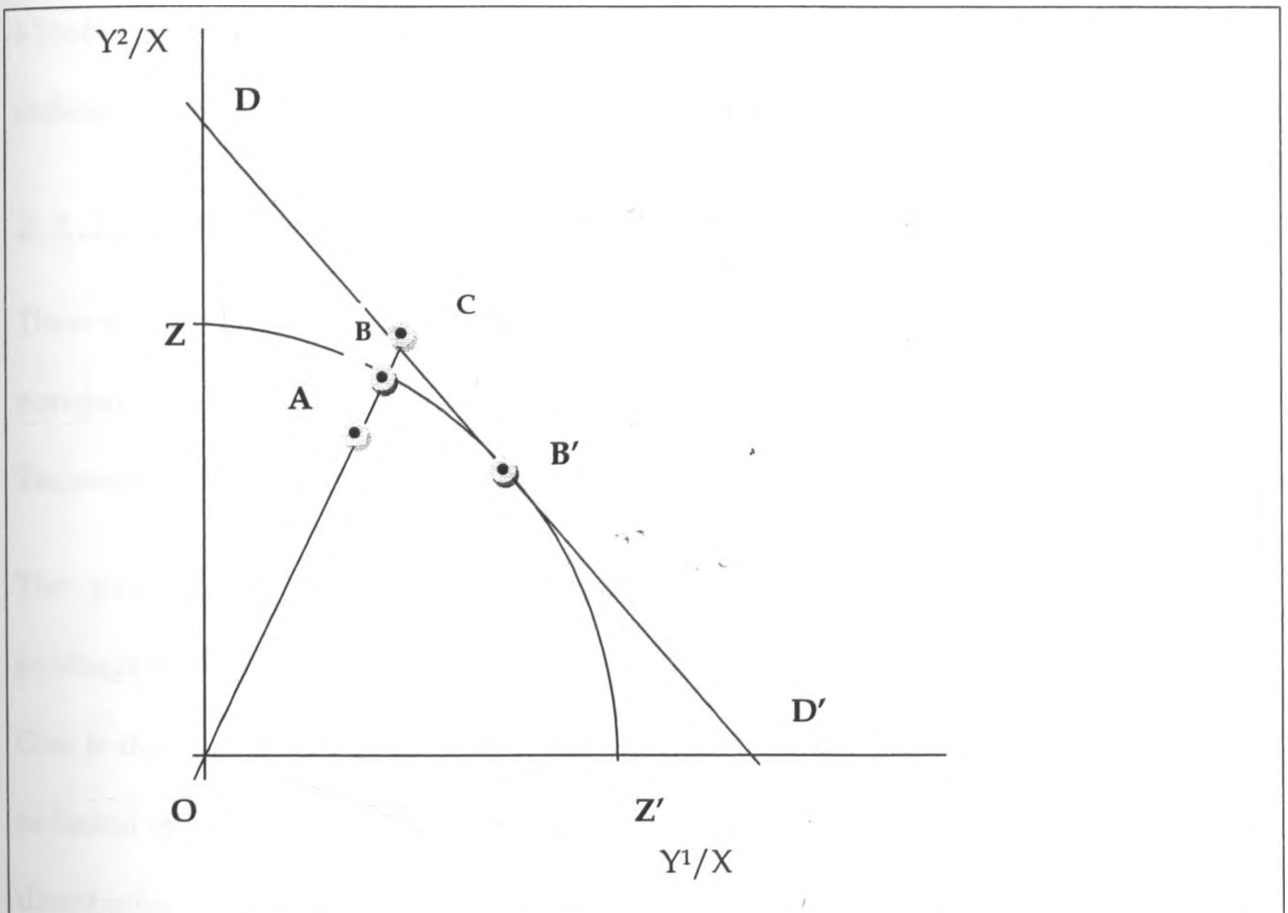


Figure 2.1 represents a case where production involves 2 outputs Y^1 and Y^2 and a single input X. Arc ZZ′ is the unit production possibility curve. Point A lies below the production possibility curve therefore point A is the inefficient point. Distance AB represents technical inefficiency, that is, the amount by which outputs could be increased without requiring extra input. Output-oriented technical efficiency can be given by the ratio: TE=OA/OB.

Line DD′ represents an Isorevenue line which is a line depicting all combinations of 2 products that will generate the same level of total revenue and with it we can define allocative efficiency as: AE=OB/OC. Lastly the overall economic efficiency can be defined as a product of these two measures. That is; EE=OA/OC= (OA/OB) x (OB/OC)

2.1.2 Approaches to measurement of technical efficiency

There are two main approaches used in estimation of efficiency frontier: parametric and non-parametric (Kalirajan and Shand, 1999; Kumbhakar and Lovell, 2003; Murillo-Zamorano, 2004; Coelli, et al., 2005).

The parametric method uses econometric technique by specifying a stochastic production function which assumes that the error term is composed of two elements. One is the typical statistical noise which represents randomness. The other represents technical efficiency which is commonly assumed in the literature to follow a one-sided distribution (Alvarez and Crespi, 2003; Murillo-Zamorano, 2004). In this approach a defined functional form of the production technology such as Cobb-Douglas or translog is used.

On the other hand, the non-parametric approach does not distinguish between technical efficiency and statistical noise. Unlike the parametric approach, no assumptions are made about the functional form of the underlying production technology. It is, considered as a non-statistical technique as the inefficiency scores and the envelopment surface are 'calculated' rather than estimated. The non-parametric approach is often associated with Data Envelopment Analysis (DEA) which is based on a mathematical programming model to estimate the optimal level of output conditional on the amount and mix of inputs (Murillo-Zamorano, 2004).

2.2 Empirical Literature

In this section studies on measurement of technical efficiency of micro and small enterprises are reviewed. In addition, reviews of studies on factors that influence technical efficiency are reviewed.

Ajibefun (2007) analyzed technical efficiency of MSEs in Nigeria using the stochastic production frontier. He used cross sectional data collected from the northern, southern and southern regions of Nigeria. The subsectors included were the block making, metal-fabricating and saw milling subsectors. The results indicated that technical efficiency varied across enterprises, across scales of operation and across regions. His results also indicated that while the level of education, level of investment and number of employees positively and significantly affect the level of technical efficiency, age of enterprise, as well as age of enterprise operator negatively influences the level of technical efficiency.

Admassie and Matambalya (2002) examined the level of technical efficiency among SMEs in Tanzania using a Cobb-Douglas stochastic production frontier. The data analyzed were drawn from a sample of 148 SMEs selected randomly from three major commercial corridors in Tanzania based on their economic significance, and the region's share of the SME sector. These were the Lake Zone, the Coastal Zone and the Arusha Region. The sample included firms from food processing, textile and tourism subsectors. They found that the sample of Tanzanian SMEs was characterized by high levels of technical inefficiency, which reduce their potential output levels significantly.

Batra and Tan (2003), analyze technical efficiency and its correlates among SMEs using data from six developing economies; three from East Asia and three from central and Latin America. They found that while technical efficiency increases with firm size, there is substantial overlap in the distribution of efficiency across firm sizes, with some small firms operating at the same or higher levels of efficiency than some large firms. Therefore indicating that, small firms are not inherently inefficient.

Alvarez and Crespi (2001) explored the factors that explain the observed differences in technical efficiency in small firms in Chile. Plant survey data for 1,091 small firms was analysed using non-parametric deterministic frontier methodology. They found that, owner characteristics like level of education and job experience are not related to technical efficiency. They did however find a positive relationship between input quality variables for example workers' experience and capital modernization and efficiency. With regard to size their study led to conclude that there is no absolutely positive relationship between size and efficiency. Their study showed that there is a positive relationship between product differentiation and efficiency. Additionally more innovative firms that introduced new products achieved a higher efficiency than the more traditional firms.

Nikaido, (2004) estimated a stochastic production frontier to measure the technical efficiency of small scale industries in India. He also analyzed the impact of firm size and geographical agglomeration on the measured technical efficiency. The study used industry state-wise data from the second census of small scale industries in India of 1992. His study showed that geographical agglomeration and clustering of firms has a positive effect on technical efficiency but firm size has a negative effect on efficiency.

Similarly, Seema, and Milind, (2010) analyzed the technical and scale efficiency of 26 state -wise enterprise clusters using input oriented Data Envelopment Analysis in India. They used data from the third all-India census of small scale industries of 2001-

2002. For their analysis, they used the Banker, Charnes and Cooper (1984) model (popularly referred to as the BCC model) to estimate the technical and scale efficiencies of these states as the Decision Making Units (DMUs). Their findings showed that only seven states were technically efficient while the rest were either moderately or technically inefficient. To improve technical efficiency and scale efficiency they proposed better credit facilities, improved infrastructure, proper marketing, technological innovation and better management abilities.

Radam, Abu, and Mahir (2008) examined the technical efficiency of 7360 Small and Medium enterprises in Malaysia using the stochastic frontier model. The results showed levels of inefficiency in Malaysian small and medium enterprises. They however found the small enterprises to be more efficient than the medium enterprises and the micro enterprises to be the least efficient of the three categories of enterprises. This finding might suggest that there is no absolute relationship between size of firm and technical efficiency. They attributed the inefficiency to resource wastage and leakage which can be corrected by better managerial technical training.

Gokcekus, Anyane-Ntow and Richmond, (2001) analyzed data from 242 micro-enterprises in Ghana's wood product industry using a stochastic production frontier. They found that there is a positive relationship between schooling and on-the-job training on technical efficiency. Their study also revealed that a change in the apprentice or being a member of a trade association or being registered has no effect on technical efficiency.

Bigsten, Kimuyu, and Lundvall (2004) estimate a stochastic frontier mode and compare technical efficiencies of informal and formal manufacturing firms in Kenya. They found the overall efficiencies to be low. Specifically however, they found African-managed formal firms to be less efficient than both the Asian-managed formal firms and African-managed informal firms. According to this study, infrastructure, capacity building, credit delivery and supporting networks are positively related to technical efficiency.

2.3 Overview of the Literature

Most studies discussed in the literature review employed the Cobb Douglas Stochastic Production Frontier to analyze the technical efficiency of micro and small enterprises. From the literature (e.g. Alvarez and Crespi, 2001; Nikaido, 2004; Batra and Tan, 2003; Radam, Abu and Mahir, 2008; Bigsten, Kimuyu and Lundvall, 2004) it is clear that it is still debatable on whether small firms are more efficient or less efficient than large firms. The literature also reveals that technical efficiency varies across enterprises, scales of operation and across regions. Disagreement in findings can be attributed to the difference in variable selection and the different methods of analysis. This study aims to improve the understanding of the determinants of technical efficiency and provide current estimates of technical efficiency in Kenya.

CHAPTER THREE

3.0 METHODOLOGY OF THE STUDY

In this chapter, the methods and procedures used in this analysis are presented. Both the theoretical and empirical models are presented and data issues (source of data and the measurement of the variables) are discussed.

3.1 Analytical Framework

3.1.1 Model

This study uses the stochastic frontier approach because of three reasons. One is the ability of the stochastic frontier approach to consider both factors beyond the control of the firm and firm-specific factors; two is because of the separation of the random variation of the frontier across firms, the effects of measurement error and other random shocks from the effect of inefficiency; and three is the ability of the model to accommodate analysis of the determinants for inefficiency simultaneously with the estimation of technical efficiency which helps to derive policy implications.

The model proposed by Battese and Coelli (1995) is used. The model consists of two equations, one to represent the production frontier and a second to capture inefficiency effects. For cross-sectional data the model specification is expressed as:

$$Y_i = \exp(x_i \beta + V_i - U_i) \qquad (1)$$

$$E_i = \exp(-U_i) = \exp(-Z_i \delta - W_i) \qquad (2)$$

In equation (1) Y_i is output for the *i*-th firm, X_i is a (1x k) vector of values of known functions of inputs of production associated with *i*-th firm, β is a (k x 1) vector of unknown parameters to be estimated. V_is are iid $N(0,\sigma_V^2)$ random errors, independently distributed of the $U_i s$. U_is are non-negative random variables, associated with technical inefficiency of production, which are assumed to be independently distributed, such that U_i is obtained by truncation (at zero) of the normal distribution with mean $z_i\delta$ and variance, σ_u^2;

In equation (2), z_i is a (1 x *m*) vector of explanatory variables associated with technical inefficiency of production of firms and δ is an (*m* x 1) vector of unknown coefficients. The random variable W_i is defined by the truncation of the normal distribution with zero mean and variance σ^2, such that the point of truncation is $-z_i\delta$.

The technical efficiency of production for the i-th firm is defined as $TE_i = exp\ (-U_i)$.It measures the output of the *i*-th firm relative to the output that could be produced by a fully efficient firm using the same vector. TE will take a value of between zero and one in the stochastic production frontier.

The production function is specified in Cobb-Douglas form:

$$\mathbf{Y_i} = A \prod_{J}^{k} x_{ij}^{\beta j} e^{\varepsilon i}$$

Where j denotes jth and βj are the output elasticity with respect to input j.

3.1.2 Empirical Model

The stochastic frontier production function estimated is of the Cobb-Douglas form. This has been widely used in the literature on technical efficiency (e.g. Admassie and Matambalya, 2002). The estimating equations are:

$\ln(Y_i) = \ln\beta_0 + \beta_1 \ln(K_i) + \beta_2 \ln(L_i) + V_i - U_i$ ....(4)

The dependent variable $\ln Y_i$ is the natural logarithm of value of output and $\ln K_i$ and $\ln L_i$ are independent variables; natural logarithm of physical capital and natural logarithm of labor. V_i is the two sided error associated with the stochastic production frontier of the ith firm and U_i is the one sided error associated with the inefficiency effects.

The technical inefficiency effects equation is:

$U_i = Z_i\delta + W_i$... (5)

Where $\mathbf{Z}_i$ is a vector of explanatory variables hypothesized to explain technical inefficiency effects. In this study the set of independent variables include, owner specific characteristics which are age, education, sex and training. These variables capture the theory of human capital advanced by Schultz, (1961). Schultz compares the acquisition of knowledge and skills to acquiring the "means of production." He believes that an investment to enhance workers education or skills leads to an increase in human productivity, which in turn leads to a positive rate of return. Schultz highlights Western countries, and explains their increase in national output as a result of investment in human capital. He also makes a direct link between an increase in investment in human capital, and the overall increase in workers earnings.

An investigation into levels of entrepreneurship development within Kenya which focused on the types of training entrepreneurs received outside of academic schooling for example management, technical training, marketing and business counseling showed that training in entrepreneurship is generally lacking in the Micro and Small Enterprise MSE sector. On the whole, 85% of the entrepreneurs surveyed had not received any entrepreneurial skills training. For the few that had received training, most received technical training (CBS, K-Rep, ICEG, 1999). Going by Schultz hypothesis, this lack of investment in training entrepreneurs may be the cause of low productivity in Kenyan MSEs.

Mlambo, (2001) found that although the number of females who participate in the MSEs as entrepreneurs are slightly larger than their male counterparts, they have much greater difficulties in securing start-up as well as operating capital than their male counterparts in Botswana. This may lead to female headed firms being more technically inefficient than male headed firms.

The vector also includes firm specific characteristics which are sources of capital and type of ownership. Inadequate capital, both start-up and operating capital hampers the performance of an enterprise (Mukras, 2003).

Also included are environmental characteristics and these are the type and availability of infrastructural facilities like water, electricity and roads. The poor state of Kenyan roads, unreliable electricity and water supply are some of the reasons that were found to hamper informal African firms thus hampering efficiency in this sector (Bigsten, Kimuyu and Lundvall, 2004)

3.2 Data Issues

3.2.1 Source of data

This study uses data from The National Micro and Small Enterprise baseline survey 1999. The survey was carried out by the Central Bureau of Statistics (CBS) in conjunction with International Center for Economic Growth (ICEG) and K-Rep Holdings Ltd. To date this Survey remains the most authoritative and basic source of information on the MSE sector in Kenya. It has a broad range of variables that might explain variation in technical efficiency across firms. Details of the survey are reported in survey report, (CBS, K-Rep, ICEG, 1999).

The survey was stratified to ensure that different demographic and economic characteristics of enterprises were represented based on the overall distribution of households in Kenya. The country was divided into four main strata. The first stratum was Nairobi and Mombasa whose characteristics were considered to be similar, the second stratum included towns with population exceeding 10,000 persons in the 1989 census, the third stratum was formed of small (rural) towns with population between

2,000 and 10,000 persons while the fourth stratum was made up of rural areas. In this survey the enterprise was the unit of analysis. For the precision criteria however, the survey used household samples as a basis for determining and identifying those economic units that were interviewed. A total number of 12,227 households were interviewed in the survey. The survey covered all economic activities performed by household members, whether main or secondary and whether as independent or on own-account workers.

3.2.2 Measurement of Variables

The data on variables used in this study was acquired through an administered questionnaire.

The variable $\ln Y_i$ (output) is value added output of the firm which was measured by subtracting the total intermediate costs from the total sales revenue, the variable $\ln K_i$ is measured as the natural logarithm of the sum of initial capital and additional capital. The variable $\ln L_i$ is measured as the natural logarithm of the total labour force. The total labour force is the sum of paid workers, unpaid family members, apprentices and the owner.

Age of respondent (age_resp) is measured in years and age of respondent squared (age_respsq) is also included. Dummies for *education* indicate the highest education level attained by the owner are, no education(enone=1; 0 otherwise) for those who have never gone to school, primary education (eprim=1; 0 otherwise) secondary education (esec=1; 0 otherwise) graduate and post graduate (edegr=1 ; 0 otherwise). Dummies associated with *sex* include; a firm owned by either a male only (m_only=1; 0 otherwise), female only (f_only=1; 0 otherwise), male only or female only partnership (mmp_ffp=1; 0 otherwise) or male female partnership (mf_p=1; 0 otherwise). Dummies for *training* which represents the highest vocational or professional qualification of the owner of the *i*-th firm are; no training (tnone=1; 0 otherwise) for owners with who had not undergone any training, trade test (tr_test=1; 0 otherwise), ordinary diploma and higher diploma (t_dip=1; 0 otherwise) and certified public accountant certificates and other certificates (t_cert=1; 0 otherwise). Dummies for *source of initial capital* are represented by funds from owner's family and own savings (f_own=1; 0 otherwise), funds from family and friends' loan which is not free (f_loan=1; 0 otherwise) and funding from financial institution either banks or credit facilities (fin_inst=1; 0 otherwise).

Dummies for type of ownership are represented by family business (family=1; 0 otherwise), sole proprietorship (sol_prop=1; 0 otherwise) and partnership (partnership=1; 0 otherwise). The variables for infrastructure are represented by dummies for access to water, access to electricity and access to electricity. The dummies for access to water are measured by the distance to the nearest water source. Is the water in the premises (in_prem=1; 0 otherwise), is it within the compound (w_compd=1; 0 otherwise), equal or less than 500metres (eq_less500m=1; 0 otherwise) and more than 500metres (m_500m=1; 0 otherwise). Access to electricity is represented by a dummy; either the owner has no electricity (no_elec=1; 0 otherwise). The dummies for access to roads are created by the type of road accessible to the MSE. The type of road can either be a foot path (f_path=1; 0 otherwise), an earth(earth=1; 0 otherwise), a murram (murram=1; 0 otherwise) or a tarmac road(tarmac=1; 0 otherwise).

3.3 Estimation Procedure

Both the stochastic frontier model and the inefficiency effects model were estimated simultaneously by the maximum likelihood method following Battese and Coelli, (1995) one- stage estimation procedure. This gave consistent estimates of the parameters of the production frontier and the inefficiency effects model. The likelihood function is expressed in terms of the variance parameters of the frontier function:

$\sigma^2 = \sigma_v^2 + \sigma_u^2$ and $\gamma = \sigma_u^2 / \sigma^2$ where σ_v^2 is variance of noise and σ_u^2 is variance of inefficiency effects, γ has a value between one and zero. If γ has a value of zero, the deviations from the frontier are attributed to random error but if it has a value of one, the deviations are due to technical inefficiency.

CHAPTER FOUR

4.0 STUDY RESULTS

In this chapter, we present the descriptive statistics and the stochastic production frontier results. We begin by presenting the descriptive statistics, followed by the empirical results.

4.1 Descriptive Statistics

Many statistical tests and intervals depend on normality assumptions. An analysis of the descriptive statistics can enable us determine the variables that are close to a normal distribution. We use the number of observations, mean, median and standard deviation to describe the data which are summarized in Table 3. The total number of observations is denoted by (N). If a variable is normally distributed, the mean which is the average value of a variable and median should be equal. For the continuous variables in this study, there is none for which the mean and the median are equal indicating that the data are not normally distributed. The standard deviation is the most common measure of statistical dispersion, measuring how spread out the distribution of a variable is. If many data points are close to the mean, the standard deviation will be small; if many data points for a variable are far from the mean, then the standard deviation is large. If all the data values for a variable are equal then the standard deviation is zero. From table 3, apart from the variable age_resp (age of respondent) all the other variables have minimal standard deviation. This shows that values fall fairly close to the central tendency measure. The minimum and the maximum values determine the range of the data.

Table 4.1: Characteristics of the data

Variable	N	Mean	Median	Std.dev	min	max
lnYi	1846	9.0597	9.0572	1.5205	2.7081	18.1674
lnKi	1899	7.9690	8.0064	2.1407	1.6094	18.2582
lnLi	50694	0.0066	0	0.0836	0	2.7726
age_resp	50483	21.9189	19	16.6595	0	99
age_respsq	50483	757.9709	361	1083.47	0	9801
m_only	1976	0.4013	0	0.4903	0	1
f_only	1976	0.4909	0	0.5000	0	1
ffp_mmp	1976	0.0339	0	0.1810	0	1
mf_p	1976	0.0739	0	0.2617	0	1
enone	1981	0.0828	0	0.2786	0	1
eprim	1981	0.4866	0	0.4999	0	1
esec	1981	0.4038	0	0.4908	0	1
edegr	1981	0.0268	0	0.1614	0	1
tnone	1904	0.7421	1	0.4376	0	1
tr_test	1904	0.0730	0	0.2602	0	1
t_dip	1904	0.0357	0	0.1856	0	1
t_cert	1904	0.1492	0	0.3563	0	1
f_own	1853	0.8975	1	0.3034	0	1
f_loan	1853	0.0702	0	0.2555	0	1
fin_inst	1853	0.0324	0	0.1771	0	1
family	1941	0.2257	0	0.4181	0	1
sol_prop	1941	0.7202	1	0.4490	0	1
partnership	1941	0.0541	0	0.2263	0	1
in_prem	1896	0.2242	0	0.4171	0	1
w_compd	1896	0.2263	0	0.4185	0	1
eq_less500m	1896	0.3223	0	0.4675	0	1
m_500m	1896	0.2273	0	0.4192	0	1
elec	1302	0.4931	0	0.5001	0	1
no_elec	1302	0.5069	1	0.5001	0	1
tarmac	1937	0.4202	0	0.4937	0	1
murram	1937	0.2602	0	0.4389	0	1
earth	1937	0.2272	0	0.4191	0	1
fpath	1937	0.0924	0	0.2897	0	1

Source: own computation

Table 4.1 shows that the average age of a respondent (age_resp) is 21 years, suggesting that MSE workers are very young. The table also indicates that there are more female headed (f_only) MSEs than male (m_only) headed MSEs. Female headed MSEs have the greatest percentage at 49%. The highest number of MSEs is headed by primary (eprim) school leavers. Only 2% of the MSEs are headed by university graduates (edegr) suggesting that most graduates shy away from this sector in search of formal employment. It is also clear that a large percentage of MSEs are headed by none trained individuals (tnone) at 74%. Most MSE owners prefer to use their own funds (f_own) for start-up capital than borrow from financial institutions (fin_inst). Only 3% of the MSEs in the sample borrowed from financial institutions where as almost 90% of the MSE owners used their own funds and funds from family members. 72% percent of the firms are sole proprietorships (sol_prep) suggesting that most owners prefer to run their firms alone. The number of firms with electricity (elec) is almost equal to the number of firms without electricity (no_elec) at 49% and 51% respectively. This shows that there are very many firms running without electricity. Only 9% of the MSEs run their firms near a footpath this suggests that there have been great efforts in improving the road networks in Kenya.

Correlation analysis was used to check collinearity between independent variables. According to Gujarati (2003), multicollinearity becomes a serious problem if the parwise or zero-order correlation coefficient between two regressors is in excess of 0.8. The correlation results for the variables used in the analysis are in the appendix. The results showed no strong correlation between the variables indicating no problem with multicollinearity.

4.2 Empirical results

4.2.1 Stochastic frontier

The statistical analysis was carried out using STATA 10 statistical software. The estimates of the parameters of the stochastic frontier model are presented in table 4.2.

Table 4.2: Stochastic frontier estimation results

	OLS Regression Results		Stochastic frontier results	
$\ln Y_i$	Coef.	Std. Err.	Coef	Std.Err
$\ln K_i$	.2749443***	.0246879	.3380014***	.0148215
$\ln L_i$	.3482551***	.1114275	.4696371***	.0844413
cons	5.109971***	.4680084	7.355254***	.1433194
$\ln \sigma_v^2$			.1171245	.0868714
$\ln \sigma_u^2$			.5263003	.164306
σ_v			1.060311	.0460554
σ_u			1.301022	.1068829
σ^2			2.816918	.2058446
λ			1.227019	.1470108
N=1004				
R-squared = 0.3417			Log L-R test of σ_u =0	
Prob > F = 0.0000			$x^2 = 19.73$	
			Prob>=chibar2 = 0.000	
F(24,979)=21.17			$\gamma = \sigma_u^2 / \sigma^2 = .600890$	

Source: own computation

Levels of significance of 1, 5 and 10 percent are indicated by ***, ** and * respectively

The OLS estimates are presented in table 4.2 for the purposes of comparison and completeness. From the OLS results the basic inputs of the production function have the expected positive signs consistent with economic theory of production and high levels of significance.

Maximum likelihood estimates for the parameters of the inputs in table 4.2 are statistically significant and have the expected signs. The coefficients of log input variables represent percentage change in the dependent variable as a result of percentage change in the independent variable.

The estimate for the parameter γ shows the relative magnitude of the variance associated with the frontier model. It lies between 0 and 1; with a value equal to zero implying that technical efficiency is absent. OLS would then be suitable. A value equal to 1 implies the frontier model is suitable. From our analysis this estimate is quite large at 0.6. This means that the inefficiency effects are highly significant in the analysis of the technical efficiency of the MSEs in Kenya. This result implies that more than 50% of the difference between the actual and the potential output levels are primarily due to inefficiency effects. The test statistic chi-square (χ^2) is 19.73 and the p-value is 0. Since the p-value is less than at all conventional levels of significance (1%, 5% and 10%), we can reject the null hypothesis that there are no inefficiency effects in the production frontier. Based on these results, we estimate a stochastic frontier model with the inefficiency effects for better and more realistic results. The results for the stochastic frontier model are presented in table 4.3, with the results of the inefficiency effects being displayed in table 4.4.

Table 4.3 Stochastic frontier with inefficiency effects results

lnYi	Coefficient.	Standard Error
lnKi	.3086415***	.0206561
lnLi	.3491259***	.1072153
cons	7.089599***	.1987402

N=1004

Log likelihood = -1672.3257

Prob > chi2 = 0.0000

Source: Own Computation

Levels of significance of 1, 5 and 10 percent are indicated by ***, ** and * respectively

Maximum likelihood estimates for the parameters of the inputs are statistically significant and have the expected signs. The coefficients of log input variables represent percentage change in the dependent variable as a result of percentage change in the independent variable. The elasticity of output with respect to capital is 0.31. This means that a one percent increase in capital will increase output by 0.31 percent. The elasticity of output with respect to labour is 0.35percent, therefore a one percent increase in labour increases output by 0.35 percent. The coefficients of the input variables suggest that MSEs experienced decreasing returns to scale. The sum of the coefficients of the inputs is less than unity.

4.2.2 Inefficiency Model

The estimates of the parameters of the inefficiency model are presented in table 4.4

Table 4.4 Inefficiency Model results

Variable	Coef	Std. Err
cons	1.28617	1.344522
age_resp (age of respondent)	-.2122564***	.0611238
age_respsq(age of resp sq)	.0027113***	.0007209
ffp_mmp(female-female/male-male partnership)	-.8323006	4.081537
f_only(female only)	1.248592***	.4516471
mf_p(male-female partnership)	2.232**	1.103807
Eprim (primary education)	-.4129751	.4580674
Esec(secondary education)	-1.14449*	.5985893
Edegr(Degree holders)	-30.39683	8129.048
tr_test(trade tests)	.9403565*	.5009252
t_dip(Diploma holders)	-.428625	1.840454
t_cert(certificate/CPA)	-.3678344	.5279783
f_loan (Family/friends' loan)	-.4666785	.6777494
fin_inst(financial institution loan)	2.058445**	.8114927
Partnership	-6.564603	29.33939
sol_prop(Sole proprietorship)	1.796231**	.7262306
in_prem(water in premise)	-1.632742**	.8276491
w_compd (water within the compound)	-.4300112	.4343462
eq_less500m(water equal or less than 500m)	-.4194026	.3646828
no_elec(no electricity)	.6475994*	.3524926
fpath (foot path)	-2.659937**	1.33644
Murram	-.0766518	.406691
earth	-.2652493	.3963192
N=1004		

Source: own computation

Levels of significance of 1, 5 and 10 percent are indicated by ***, ** and * respectively

The inefficiency model results showed the coefficient of age variable to be negatively related to technical inefficiency. This implies that older entrepreneurs are less technically inefficient. This is contrary to some of the literature, (Ajibefun, 2007) who found the age of the owner to be positively related to technical inefficiency. This could be explained by the fact that older owners may have accumulated resources, experience and networks. However, the coefficient of age of respondent squared (age_respsq) is positive showing it reaches a point beyond 39 years when this relationship becomes positive implying that at that age older workers start becoming inefficient.

The results also showed that firms that were owned by either two male partners or 2 female partners were more technically efficient than male only, female only or male female partnerships. Female only owned firms were found to be positively related with technical inefficiency and statistically significant at 1% level of significance. This implies that female only owned firms are more technically inefficient than male only headed firms. This may be attributed to the fact that women find it harder to acquire financial credit due to the inability to own property which usually serves as collateral for bank loans. Till recently men in Kenya were mainly the property owners.

Education and training were found to be negatively related to technical inefficiency Owners who had attained secondary(esec) and higher education were found to be less technically inefficient than their counterparts who only reached nursery or never went to school (tnone). This is so because educated owners are able to learn and adjust to new technology easily. Firms whose owners had diplomas (t_dip) or certificates (t_cert) were found to be less technically inefficient than firms whose owners had no training.

This analysis found that partnerships are less technically inefficient than sole proprietorships. The results show that sole proprietorships (sol_prep) are positively related to technical inefficiency. This may be attributed to sharing of management ideas and pooling of financial resources. The data showed that most MSEs got their start up capital from their own savings or borrowing from friends and family. This therefore means that if a firm is a partnership there will be more capital pooled from both partners.

Financial institutions (fin_inst) as a source of credit were found to have a positive relationship with technical inefficiency. This implies that MSEs that borrow from financial institution are more technically inefficient than those that use their own savings (f_own) or loan from family members (f_loan). This relationship can be attributed to the costs associated with financial loans. The interest rates that are charged by these financial institutions may be too high that the MSEs are not able to service these loans.

Having water inside an MSEs premises makes a firm to be less technically efficient compared to fetching the water from more than 500meters away. This implies that the nearer the water source, the less technically efficient the MSE will be. This can be attributed to the time value of money. A lot of time is usually wasted by going to fetch water.

Having no electricity makes a firm to be more technically inefficient compared to having electricity. This is because all firms need electricity to carry out their activities. Even the small kiosks in the village have a need for electricity since having electricity will increase the number of hours spent transacting. Most shops forced to close as soon as it gets dark which makes them suffer losses compared to shops with electricity.

Results show that access to roads is negatively related to technical inefficiency. This implies that being near a road network reduces inefficiency. This is because roads open up an MSE to a larger market that it's immediate surroundings. It is easier to acquire raw materials and to sell the product.

4.2.3 Technical efficiency levels

The technical efficiency levels are presented in table 4.3.

Table: 4.5 Technical Efficiency Levels

Variable	N	mean	median	sd	min	max
Tech.efficiency	1004	.7160348	.7402658	.1861337	.003539	1

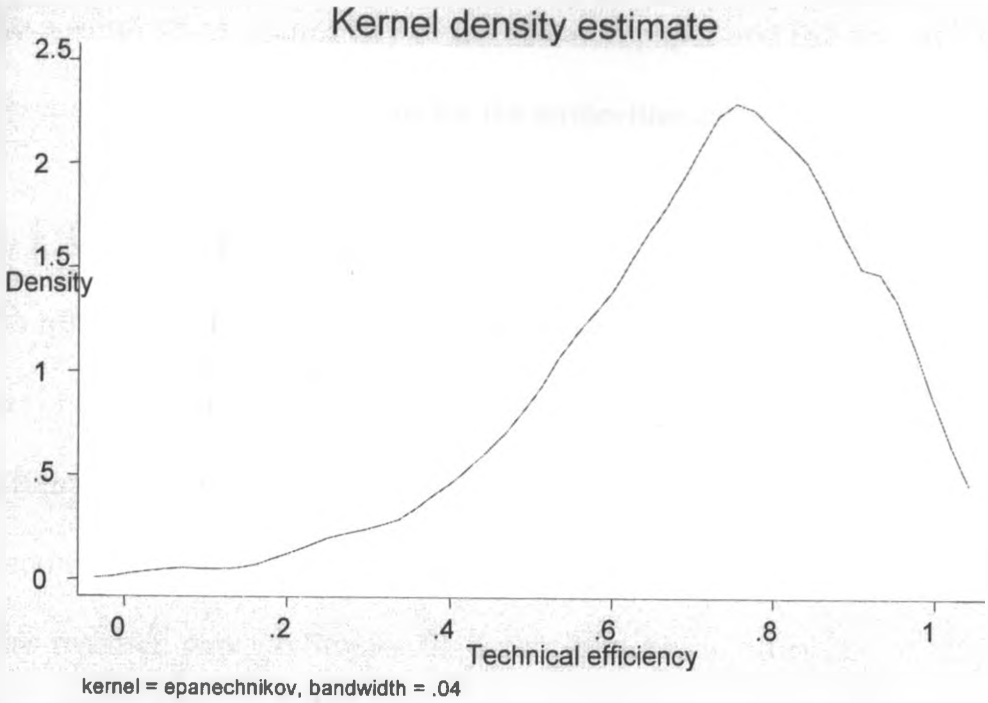
Source: Own computation

The mean technical efficiency for the Kenyan MSE is about 72 percent which means, on the average, about 72 percent of the technically potential output level could not be realized due to factors that are specific to the firms.

Table 4.3 shows the estimates for the median to be 74 percent which is different from the mean showing that technical efficiency is not normally distributed. This can also be seen by the standard deviation (sd) of almost 19%. Technical efficiency of Kenyan MSEs ranges between 0.003 and 1 meaning that even though the mean technical efficiency is high at 72%, there are some firms that have extremely high levels of inefficiency.

This distribution can be well illustrated by figure 4.1.

Figure 4.1: A histogram showing the distribution of technical efficiency of MSEs in Kenya



Source: Own Computation

This graph shows that the distribution of technical efficiency is heavily skewed to the left. The median lies about the 0.74 mark but the heavy skewedness to left tells us that there are MSEs Producing at technical efficiency levels of below 0.3.

CHAPTER FIVE

5.0 Conclusion and policy implications

This section gives a summary of the research paper and the drawn conclusions. It also presents the policy implications for the authorities and stake holders in the MSEs sector.

5.1 Conclusions

The Micro and Small enterprises (MSEs) sector has become an increasingly important part of the Kenyan economy. It generates many jobs each year and earnings for millions of Kenyans. However, in order for MSEs to create decent jobs and become a force for economic growth and poverty reduction, they need to be highly productive.

This research paper estimates the levels of technical efficiency of MSEs in Kenya, and investigates factors that are likely to influence technical efficiency levels in the MSE sector. The research questions addressed were: to what extent are MSEs in Kenya technically efficient and what factors are likely to influence technical efficiency levels among MSEs in Kenya?

The study used cross-section data from a nationally representative survey in Kenya to examine technical efficiency of MSEs. A Cobb-Douglas stochastic frontier production function was estimated jointly with a model of technical inefficiency. The traditional inputs of capital and labour were used. The results show that MSEs produce under decreasing returns to scale. The mean level of technical efficiency of Kenyan MSEs is

72%. Although the level of efficiency is high, the range which is shown by the minimum and the maximum show that some firms have an extremely high level of inefficiency.

The inefficiency among MSEs was found to be attributed to firm specific factors namely age of the owner, the sex of the owner, the owner's level of education and training and business environment namely, access to water, electricity and roads.

The findings show that most MSEs are female headed and they are technically inefficient. This could be attributed to the difficulty of female MSE owners to acquire financial loans from financial institutions. There is need for more research on other factors that could explain why female headed MSEs are technically inefficient.

Education and training are positively related to technical efficiency. It is also clear from the results that almost 75% of the MSEs are headed by individuals who have undergone no training at all.

5.2 Policy Implications

Measures to improve education and training must be put in place in order to improve efficiency. The study found education and training to be significant in improving efficiency but most graduates only start MSEs when they cannot find formal employment this leaves most MSEs to be run by uneducated and untrained individuals. Entrepreneurship must be introduced into the curriculum as early as possible and be given the importance science and mathematics is given. This will cultivate the culture of entrepreneurship in Kenya and not be viewed as an afterthought when formal employment cannot be found.

According to the research findings, MSEs who borrowed start-up capital from financial institutions are more technically inefficient. This result may be attributed to high costs of borrowing and servicing loans. There is need for the Government and other stakeholders like Non Governmental Organizations (NGOS) to avail financial credit to the MSEs in order to help them improve efficiency.

The study showed that access to water, electricity and roads increases the level of technical efficiency. Good infrastructure is vital to improving the performance of the MSEs. Improving the road networks will make MSEs accessible to their various markets. It will also make it easier for the firms to access new technology and market information easily. There is also need for the government to subsidize the cost of these services, some firms have access to water and electricity but may refuse to apply due to the high costs.

5.3 Limitations of the study

One of the limitations of this study was finding panel data on MSEs therefore we had to use cross sectional data which leaves out the time element. This forced the study to assume a time invariant technical efficiency which may be unrealistic. Data limitations also made it difficult to control for unobserved firm specific factors. There is therefore need for the Central Bureau of Statistics to improve data collection and to make data readily available to researchers.

5.4 Suggestions for future Research

This study found high technical inefficiency in female only headed MSEs. There is room for more research to examine the factors related to this high inefficiency.

If data allows there is room for future research on time variant technical efficiency

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Appendix

CORRELATION MATRIX

	lnYi	lnKi	lnLi	age_resp	age_re~q	m_only	f_only	ffp_mmp	mf_p	enone	eprim	esec	edegr
lnYi	1.0000												
lnKi	0.5066	1.0000											
lnLi	0.2263	0.2398	1.0000										
age_resp	0.0910	0.1711	0.0955	1.0000									
age_respsq	0.0528	0.1526	0.0841	0.9818	1.0000								
m_only	0.1776	0.2306	0.1227	0.0901	0.0871	1.0000							
f_only	-0.2695	-0.3649	-0.2014	-0.0962	-0.0888	-0.8184	1.0000						
ffp_mmp	0.1082	0.1215	0.1206	-0.0039	-0.0037	-0.1635	-0.1808	1.0000					
mf_p	0.1094	0.1867	0.0723	0.0172	0.0080	-0.2263	-0.2503	-0.0500	1.0000				
enone	-0.1484	-0.1311	-0.0369	0.2354	0.2579	-0.0702	0.1177	-0.0532	-0.0581	1.0000			
eprim	-0.2075	-0.3086	-0.0477	-0.0337	-0.0247	-0.0674	0.1135	-0.0511	-0.0568	-0.2675	1.0000		
esec	0.2164	0.2928	0.0181	-0.1336	-0.1513	0.0971	-0.1469	0.0236	0.0853	-0.2404	-0.8200	1.0000	
edegr	0.2220	0.2736	0.1539	0.1369	0.1267	0.0246	-0.0923	0.1741	0.0081	-0.0457	-0.1557	-0.1400	1.0000
tnone	-0.1805	-0.3164	-0.1211	-0.0313	-0.0131	-0.0397	0.0843	-0.1169	-0.0042	0.1271	0.1945	-0.2225	-0.1269
tr_test	0.0016	0.0615	0.0287	-0.0615	-0.0711	0.0473	-0.0343	0.0268	-0.0454	-0.0663	0.0245	0.0252	-0.0470
t_dip	0.1888	0.2365	0.1135	0.1006	0.0906	0.0722	-0.0946	0.0761	-0.0098	-0.0153	-0.1894	0.1149	0.2634
t_cert	0.1205	0.2180	0.0675	0.0306	0.0206	-0.0242	-0.0282	0.0834	0.0436	-0.0989	-0.1565	0.1936	0.0512
f_own	-0.0371	-0.1742	-0.0671	-0.0404	-0.0383	0.0210	0.0136	-0.0100	-0.0623	0.0154	0.1086	-0.1014	-0.0512
f_loan	0.0044	0.0359	0.0359	-0.0536	-0.0511	-0.0250	0.0213	0.0372	-0.0208	-0.0278	-0.0442	0.0569	0.0074
fin_inst	0.0559	0.2413	0.0622	0.1420	0.1351	-0.0004	-0.0523	-0.0350	0.1331	0.0129	-0.1202	0.0904	0.0755
family	0.0991	0.0577	0.0361	0.0414	0.0443	-0.0192	-0.0890	-0.0301	0.2417	-0.0310	-0.0678	0.0764	0.0262
sol_prop	-0.1577	-0.1241	-0.0885	-0.0344	-0.0347	0.1073	0.1796	-0.2694	-0.3793	0.0386	0.1035	-0.0882	-0.1142
partnership	0.1285	0.1384	0.1081	-0.0084	-0.0133	-0.1762	-0.1903	0.5869	0.3028	-0.0190	-0.0792	0.0332	0.1768
in_prem	0.2297	0.2567	0.0963	0.1091	0.1011	0.1071	-0.1046	0.0365	-0.0302	-0.0183	-0.1681	0.1226	0.1771
w_compd	-0.0044	0.0050	-0.0066	-0.0343	-0.0383	-0.0126	-0.0072	-0.0124	0.0491	-0.1032	0.0361	0.0255	-0.0241
eq_less500m	-0.1098	-0.1883	-0.0612	-0.0373	-0.0390	-0.0812	0.1033	-0.0350	-0.0204	0.0714	0.0962	-0.1010	-0.1050
m_500m	-0.1158	-0.0572	-0.0235	-0.0362	-0.0201	-0.0033	-0.0047	0.0177	0.0028	0.0509	0.0258	-0.0403	-0.0388
elec	0.2655	0.3458	0.0864	0.1170	0.1025	0.0128	-0.0809	0.0530	0.0989	0.0100	-0.2005	0.1519	0.1416

no_elec	-0.2655	-0.3458	-0.0864	-0.1170	-0.1025	-0.0128	0.0809	-0.0530	-0.0989	-0.0100	0.2005	-0.1519	-0.1416
tarmac	0.1742	0.2052	0.1140	0.0982	0.0773	0.0231	-0.0422	0.0244	0.0209	-0.0763	-0.1344	0.1310	0.1399
murram	-0.0458	-0.0580	-0.0136	-0.0691	-0.0722	0.0125	-0.0325	0.0130	0.0312	-0.0236	0.0795	-0.0418	-0.0813
earth	-0.1321	-0.0736	-0.0884	-0.0651	-0.0399	-0.0091	0.0374	-0.0563	-0.0158	0.0664	0.0492	-0.0645	-0.0626
fpath	-0.0350	-0.1636	-0.0462	0.0348	0.0381	-0.0477	0.0697	0.0235	-0.0631	0.0720	0.0392	-0.0693	-0.0253

	tnone	tr_test	t_dip	t_cert	f_own	f_loan	fin_inst	family	sol_prop	partne~p	in_prem	w_compd	eq_~500m
tnone	1.0000												
tr_test	-0.4740	1.0000											
t_dip	-0.3262	-0.0572	1.0000										
t_cert	-0.7054	-0.1236	-0.0851	1.0000									
f_own	0.0623	0.0200	-0.0044	-0.0887	1.0000								
f_loan	-0.0198	-0.0009	-0.0315	0.0415	-0.8020	1.0000							
fin_inst	-0.0767	-0.0321	0.0513	0.0906	-0.5574	-0.0489	1.0000						
family	0.0567	-0.0474	-0.0010	-0.0341	0.0679	-0.0827	0.0015	1.0000					
sol_prop	-0.0106	0.0392	-0.0201	-0.0051	-0.0241	0.0486	-0.0274	-0.8647	1.0000				
partnership	-0.0835	0.0102	0.0416	0.0730	-0.0777	0.0565	0.0513	-0.1375	-0.3785	1.0000			
in_prem	-0.1637	0.0005	0.1993	0.0952	-0.0073	-0.0322	0.0569	0.0169	-0.0143	-0.0029	1.0000		
w_compd	0.0187	0.0447	-0.0450	-0.0320	-0.0119	0.0004	0.0194	-0.0945	0.0665	0.0429	-0.3242	1.0000	
eq_less500m	0.1104	-0.0515	-0.0779	-0.0565	0.0219	0.0106	-0.0514	0.0899	-0.0673	-0.0330	-0.3997	-0.4264	1.0000
m_500m	0.0230	0.0128	-0.0742	0.0015	-0.0057	0.0226	-0.0219	-0.0231	0.0241	-0.0049	-0.2454	-0.2617	-0.3227
elec	-0.1143	-0.0349	0.1192	0.1029	-0.0240	-0.0263	0.0767	-0.0064	-0.0426	0.0958	0.3420	0.0995	-0.2440
no_elec	0.1143	0.0349	-0.1192	-0.1029	0.0240	0.0263	-0.0767	0.0064	0.0426	-0.0958	-0.3420	-0.0995	0.2440
tarmac	-0.0707	-0.0039	0.1369	0.0174	-0.0148	-0.0071	0.0347	-0.0679	0.0372	0.0517	0.2250	0.0464	-0.1320
murram	0.0225	0.0025	-0.0685	0.0067	-0.0280	0.0562	-0.0313	0.0351	-0.0199	-0.0256	-0.1236	-0.0107	0.0741
earth	0.0594	0.0126	-0.0996	-0.0296	0.0458	-0.0367	-0.0255	0.0117	0.0030	-0.0276	-0.0738	-0.0383	0.0078
fpath	-0.0011	-0.0167	0.0179	0.0042	-0.0002	-0.0195	0.0274	0.0483	-0.0404	-0.0095	-0.0941	-0.0068	0.1084

	m_500m	elec	no_elec	tarmac	murram	earth	fpath
m_500m	1.0000						
elec	-0.1941	1.0000					
no_elec	0.1941	-1.0000	1.0000				
tarmac	-0.1417	0.3576	-0.3576	1.0000			
murram	0.0584	-0.1401	0.1401	-0.5015	1.0000		
earth	0.1190	-0.1600	0.1600	-0.4818	-0.3305	1.0000	
fpath	-0.0236	-0.1728	0.1728	-0.2533	-0.1738	-0.1669	1.0000