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**INNOVATION CAPABILITY AND GROWTH OF MICRO AND SMALL
ENTERPRISES IN KENYA**

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University or for any other award.

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DEDICATION

Dedicated to my loving wife Njeri and our daughters Njoki and Wangui for their patience and encouragement.

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ABBREVIATIONS AND ACRONYMS

2SLS	Two Stage Least Squares
ASEAN	Association of Southeast Asian Nations
CIS	Community Innovation Survey
FIML	Full Information Maximum Likelihood
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
ICDC	Industrial and Commercial Development Corporation
ICEG	International Centre for Economic Growth
ICT	Information and Communication Technology
ILO	International Labour Organization
IMR	Inverse Mills Ratio
ISIC	International Standard Industrial Classification
IV	Instrumental Variable
K-Rep	Kenya Rural Enterprise Programme
KIRDI	Kenya Industrial Research and Development Institute
KNBS	Kenya National Bureau of Statistics
KNFJA	Kenya National Federation of Jua Kali Association
KSh	Kenya Shilling
MLE	Maximum Likelihood Estimation
MLE	Maximum Likelihood Estimation
MSEA	Micro and Small Enterprise Authority

MSEs	Micro and Small Enterprises
NCKK	National Council of Churches of Kenya
OECD	Organization for Economic Co-operation and Development
PCA	Principal Component Analysis
RoK	Republic of Kenya
SMEs	Small and Medium Enterprises
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VIF	Variable Inflation Factor
WEF	Women Enterprise Fund
YEDF	Youth Enterprise Development Fund

OPERATIONAL DEFINITION OF TERMS

Innovation: Refers to implementation of a new or significantly new product/service, new production process, new marketing method and or a new business organizational practice that facilitates an enterprise to expand its employment and sales turnover. This definition thus include the four main types of innovation namely product innovation, process innovation, organizational innovation and market innovation.

Innovation capability: Refers to skills and knowledge that facilitates the process of conception or modification of existing technology into new solutions that are economically viable, practical and replicable to an enterprise's need.

Micro and Small Enterprise: Refers to an enterprise/firm employing 1 up to 50 workers.

Growth: Refers to expansion in the number of employees or sales per employee for a micro and small enterprise.

Survival: Refers to the ability of micro and small enterprises to operate beyond the initial year since formation.

MSE employee/worker: Refers to any person engaged in a micro and small enterprise on part time or full time basis whether paid or not.

Micro enterprise: Refers to an enterprise/firm employing up to 10 workers.

Small enterprise: Refers to an enterprise/firm employing between 11 and 50 workers.

Medium Enterprise: Refers to an enterprise/firm employing 51 to 100 workers.

Large Enterprise: Refers to an enterprise/firm employing over 100 workers.

Jua Kali: Is a Swahili word meaning 'Hot Sun' used to refer to the informal sector in Kenya.

Knowledge capital: Refers to the composite of research and development and human capital not embodied in production processes or products of the firm.

ABSTRACT

In many countries, micro and small enterprises are recognized for their contribution towards economic growth, generation of employment opportunities and enhancing competitiveness. It is estimated that there were between 410 million and 473 million informal enterprises globally in 2015. These enterprises were estimated to contribute between 60 and 70 per cent of global gross domestic product by 2015. In spite of the prevalence of these enterprises and their large employment creation potential, only one per cent of these enterprises grow and graduate to employ more than ten employees globally. The rest either stagnate or die before reaching their third anniversary. In Kenya, it is estimated that there were 7.38 million micro and small enterprises, employing 14.1 million workers in 2015. These enterprises, however, continue to experience high mortality rates with an estimated 46 per cent of the enterprises closing down within their first year of operation. Thus, the numerous micro and small enterprises are characterized by high death rates and job churning alluding to the marginal nature of the jobs that they create. One growth challenge facing micro and small enterprises in Kenya is lack of market for their products and high local competition as cited by 32 per cent of the owners/operators of these enterprises. Innovation capability studies argue that a firm's innovation capability provides it with an opportunity to introduce new products and production processes thus opening up new market opportunities. Empirical evidence on the role that innovation plays in the growth of micro and small enterprises in Kenya, however, remains nascent. This study, therefore, investigated the role played by innovative capability toward growth of micro and small enterprises in Kenya. Specifically, the study analysed factors influencing innovation decisions, intensity, capability and how successful innovation influenced growth of micro and small enterprises. It made use of innovation capability indicators collected through a national cross-sectional survey of 575 micro and small enterprises in 2013. An augmented recursive econometric model was used to estimate the link between innovation capability and the growth of micro and small enterprises. The study found that the key factors influencing micro and small enterprise' innovation decisions, intensity and outcomes include innovation expenditure per worker, physical capital intensity, skilled labour especially for production workers, affiliation status, proportion of domestic ownership and age. On the effect of innovation on micro and small enterprises' growth, a key finding of the study was that there was no sufficient empirical evidence to support the idea that innovation capability influences micro and small enterprise growth in terms of employment. The study, however, found empirical evidence that links micro and small enterprises' innovative capability and the sales growth. The study, therefore, recommended that Government should provide technical training targeted at improving micro and small enterprise production workers skills; pursue strategies aimed at broadening micro and small enterprises access to capital; provide shared physical capital infrastructure through shared work sites and improve these enterprises access to information and technology communication. Meanwhile micro and small enterprises and other larger enterprises should endeavour to collaborate, acquire intellectual property rights for their innovations and offer targeted and tailor made training for their production level workers.

CHAPTER ONE

BACKGROUND

1.1 Introduction

This chapter presents the background to the study, statement of the problem, objectives, research questions, significance, scope and the organization of the study.

1.2 Importance of Micro and Small Enterprises

The growth of micro and small enterprises (MSEs) is considered a fundamental component of economic growth and development in many countries (Ayyagari, Demirguc-Kunt & Maksimovic, 2014; International Labour Organisation [ILO], 2017). Informal enterprises, which largely account for over 70 per cent of micro and small enterprises, were estimated to have contributed on average 55 per cent of gross domestic product (GDP) between 1990 and 1999 at the global level (Ayyagari, Beck & Demirguc-Kunt, 2007). Since then, the contribution of MSEs to GDP has continued to grow. In 2015, ILO (2015) study estimated that there were between 410 and 473 million informal enterprises globally. These enterprises contributed between 60 and 70 per cent to global GDP.

According to Ayyagari, Demirguc-Kunt and Maksimovic (2014), micro and small enterprises play a major role in employment creation. Micro and small enterprise

data for 2006-2010 analysed by the authors found that these enterprises generated 45.34 per cent of new jobs across 104 developing countries. In 2017, ILO (2017) estimated that 50 per cent of the global workforce was employed in informal enterprises most of which largely fall within the definition of MSEs. Informal enterprises, however, mostly offer marginal employment that is semi-permanent (ILO, 2015). Thus inspite of widespread prevalence of the MSEs, they only account for 16 per cent of total permanent and full time employment globally (ILO, 2015; Ayyagari, *et al.*, 2014).

The low survival rate among MSEs, however, results into the death of over 50 per cent of these enterprises within the first five years of operation (Liedholm, 2002). It is the high death rate that contributes to the high job churning rates and low productivity jobs among the MSEs that is of policy concern. To create higher quality jobs that are more permanent, productive and offering higher wages, MSEs must first manage to survive and grow in the competitive environment to which they are born. As Minitti (2008) argues, a firm's ability to innovate is an important driver for survival and growth. According to World Bank (2015), one way through which MSEs can be facilitated to grow and create more and higher quality employment is by improving their innovation capabilities.

Acs (2006), Admassie and Matambalya (2002) and Ayyagari, *et al* (2014) observed that apart from being a source of employment, MSEs also play other important roles of enhancing competition, economic dynamism and innovation. In terms of innovation, Gupta, Guha and Krsihnasami (2013) argue that in the twentieth

century, about 60 per cent of innovations emanated from MSEs. The innovativeness among MSEs has happened inspite of relatively low expenditures on research and development. According to Acs and Audretsch (1990), MSEs only account for relatively small shares of total research and development expenditures in countries of the Organization for Economic Co-operation and Development (OECD). This is despite the fact that they contribute to the dynamism in these economies through introduction of new products.

In terms of productivity, ILO (2015) points out that while MSEs out-number large enterprises at a global level, large enterprises experience higher productivity growth on average. The relatively higher growth rates amongst large enterprises is attributable to the fact that unlike MSEs, large enterprise are better placed to exploit economies of scale, acquire new machinery and hire skilled human skills as well as utilize out-sourcing opportunities (ILO, 2015; Fafchamps, 1994).

In Africa, data on the role of MSEs is nascent and only static profiles are available from periodic enterprise survey data. Mel and Woodruff (2009), for example, estimate that in 1989 MSEs in Africa comprised more than 40 per cent of businesses and generally served as the largest engine of job growth. Table 1.1 presents a 1998 profile showing the role that MSEs play in terms of employment for selected African countries.

Table 1.1: Employment Contribution of MSEs in Selected African Countries (%)

	Kenya	Botswana	Lesotho	Malawi	Zimbabwe
MSEs Empl/Pop. ages 15-64 yrs	18	17	17	23	27
Share of MSEs that are one worker	70	65	79	61	69
Share of MSEs with 10-50 workers	2	3	1	1	2
MSEs employment (Urban areas)	15	24	18	12	30
MSEs employment (Rural towns)	22	52	28	16	36
MSEs employment (Rural areas)	78	48	72	84	64
Manufacturing MSEs (Urban)	18	15	35	29	64
Commerce MSEs (Urban)	74	71	41	62	30
Manufacturing MSEs (Rural)	27	34	62	36	75
Commerce MSEs (Rural)	66	64	27	60	66

Source of Data: Liedholm (2002) and Republic of Kenya (1999)

Table 1.1 shows that in 1998, MSEs employed between 17 and 27 per cent of the working age (15-64 years) population for the selected countries. The share of one-worker MSEs ranged from 47 per cent in Kenya to a high of 79 per cent in Lesotho. Equally, the share of MSEs employment levels in the rural areas ranged from 84 per cent in Malawi to 48 per cent in Botswana while in urban areas the shares ranged between 12 per cent in Malawi and 30 per cent in Zimbabwe. Thus MSEs do play a role in providing employment for the majority of Africa's working age population.

Sectoral distribution of MSEs presented in Table 1.1 shows that the share of commerce based MSEs in urban areas ranged from 30 per cent in Zimbabwe to 74

per cent in Kenya. The sectoral distribution data seems to suggest that commerce or trade based MSEs dominate in Kenya. An overview of other studies on MSEs in the continent reveals that they continue to employ low-level techniques to produce low quality products largely for the low-income groups (Gebreeyesus, 2009; McCormick & Maalu, 2011; Kiraka, Kobia & Katwalo, 2013; Kuuya, 2015; RoK, 2013a).

Overall, MSEs have the potential of absorbing surplus labour force and geographically spreading livelihood opportunities in rural areas as shown in Table 1.1. The large proportion of small sized MSEs, however, alludes to possible stagnation or high birth and death rates among these enterprises. Such stagnation or high churning rates has negative implications on employment growth. Studies by Sleuwaegen and Goedhuys (2003) and Liedholm (2002) have argued that MSEs that are innovative are able to increase their sales revenue, employ more workers and survive for more years. In Zimbabwe, for example, McPherson (1996) estimated that a one per cent increase in employment within the MSE reduced the likelihood of its death by 5 per cent.

Debate is on-going on the influence of demand and supply side policies or a combination of both on the growth of MSEs. The demand side adherents, who view the MSEs as a temporary phenomenon that mirrors the performance of the formal sector, advocate for demand led policies (Romijn, 2011). Such policies include preferential procurement for MSE products and services by government and sub-contracting schemes by large enterprises. The supply side adherents view the sector

as being constrained by supply side factors (Wuyts, 2000). The supply side adherents argue that improvement of productivity and, therefore, competitiveness is the key driver of the MSEs sector (Romijn, 2001). The latter side advocates for policies that seek to build innovative capabilities and technologies among MSEs (Kuuya, 2015).

According to Engel, Rothgang and Trettin (2004), the prevalence of MSEs in Africa implies that these enterprises can be useful vehicles for innovation. This is important because as Romijn and Caniels (2011) argue, technical change emanating from MSEs in developing countries is as important, if not more important, than the novel innovations that are often associated with developed countries' enterprises. The inherent characteristic of MSEs that encompasses flexibility and adaptability means that such firms typically possess unrealized innovation potential (McCormick, 1989; Subrahmanya, 2011; Coad & Tamvada, 2011). Such potential can be harnessed to drive economic growth and development.

The onset of intensified global competition for markets means that building innovation capability among MSEs becomes even more urgent (McCormick & Maalu, 2011; Peters, Riley, Siedschlag, Vahter & McQuinn, 2014). Globalization trends that entail liberalization of trade and greater integration into the world markets suggests that MSEs have to improve their productivity and competitiveness to survive global competition (Commission of European Union, 1997; Gebreeysus 2009; Romijn & Caniels, 2011; McCormick & Maalu, 2011).

1.3 Role of MSEs in Kenya

In Kenya, MSEs play a significant role in terms of their contribution to GDP, employment creation and generation of income earning opportunities (Mullei & Bokea, 1999). In 1998, an estimated 1.3 million MSEs accounted for 18.4 per cent of Kenya's GDP (RoK., 1999). The contribution to GDP could, however, have been about 30.2 per cent if the invisible and unpaid labour such as that of family workers among MSEs was incorporated (RoK, 1999). In 2015, RoK (2016a) estimated that the number of MSEs had risen to 7.38 million and they contributed 24.7 per cent to Kenya's GDP. Table 1.2 presents the overall growth of MSEs and their contribution to employment and gross domestic product for selected years.

Table 1.2: MSE Contribution to Employment and Gross Domestic Product, 1993-2015

	1993	1995	1999	2006	2015
No. of MSEs	910,000	708,000	1,289,012	1,900,000	7,380,000
Employees (million)	2.0	1.2	2.36	4.4	14.1
GDP (%)	n.a	n.a	18.4	n.a	24.7

Notes: n.a – not available

Source of Data: RoK (1999), RoK (2016a) and Kuuya (2015)

Another contribution of MSEs is in terms of employment generation. As shown in Table 1.2, MSEs were estimated to have employed 2 million and 1.2 million people in 1993 and 1995 respectively. In 1998, these enterprises employed 2.4 million people and this number rose to 14.1 million people in 2015 (RoK, 1999; RoK, 2016a). The deviations in number of employees by MSEs may have been due to

a variation in MSE survey approach for the different years. For instance, the 2016 survey used each single establishment as the unit of analysis (RoK, 2016a). Thus if one worker was partially engaged in three establishments registered under one business name, the worker was most likely counted three times (RoK, 2016a). The 2015 survey also counted MSE workers who are 5 years of age and above in contrast to earlier survey whose working age was defined as the population between ages 16 and 64 years.

A notable contribution about the MSEs is the ability to spread employment and income generation opportunities across the country. Table 1.3 shows the distribution of MSEs' employees across the country in 1998.

Table 1.3: Geographical Distribution and Employment Contribution of MSEs (1998)

Stratum	Number of MSEs	%	MSE Employees	%
Nairobi/Mombasa	204,280	15.8	349,838	16.9
Other Major Towns	157,533	12.2	279,133	11.8
Rural Towns	81,320	6.3	135,349	5.6
Rural Areas	845,879	66.6	1,551,930	65.7
Total	1,289,012	100	2,361,250	100

Source of Data: RoK (1999)

As Table 1.3 indicates, 66.6 per cent of MSEs were located in rural areas while 15.8 per cent were located in cities of Nairobi and Mombasa in 1998. In the rural areas, the MSEs accounted for 65.7 per cent of all MSEs employees while in the

major cities they accounted for 16.9 per cent of all MSE employees. In 1998, RoK (1999) estimated that 26 per cent of total Kenyan households were involved in some MSE activities to supplement their incomes. Though regional distribution data for subsequent years is not comparable, as it follows counties as opposed to rural/urban dichotomy, the 2015 MSE survey data presented in Figure 1.1 shows a similar geographical spread of MSEs across the country.

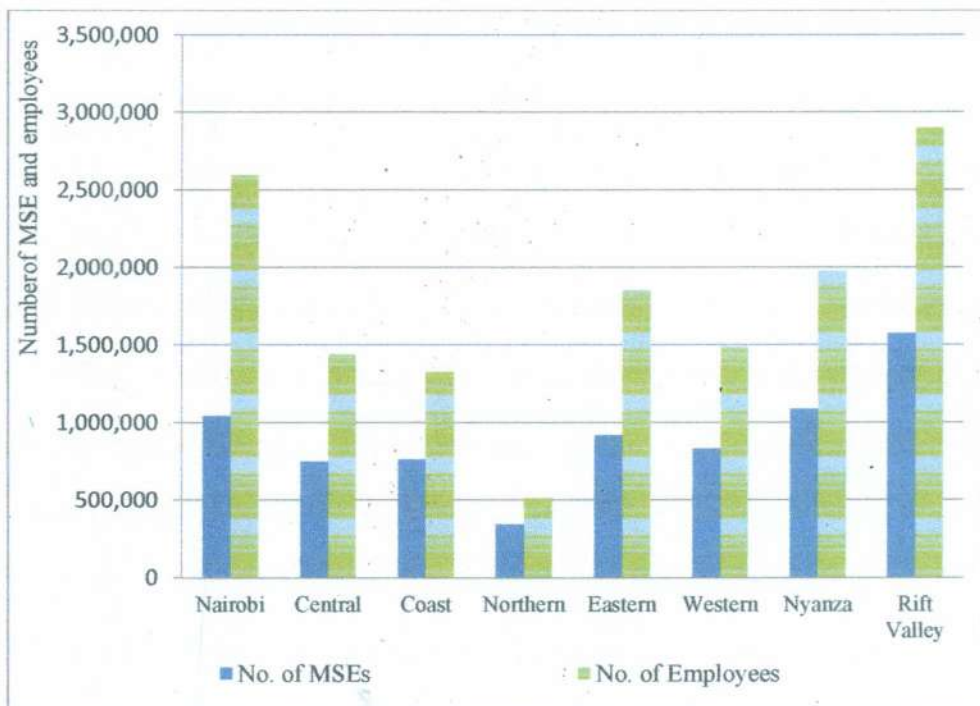


Figure 1.1: Geographical Distribution and Employment Contribution of MSEs, 2015

Source of Data: RoK (2016a)

As Figure 1.1 indicates, in 2015 MSEs were prevalent in almost all the regions in Kenya. This geographical prevalence seems to suggest that MSEs play a crucial role in providing employment and income generating opportunities across the country. The 1999 survey estimated that on average MSE generated a gross

nominal income of KSh 6,008 per month against monthly national per capita income of KSh 3,258 (RoK, 1999). In the 2015 survey, the average gross monthly nominal income generated by a MSE stood at KSh 38,092 against a monthly per capita of KSh 13,000 (RoK 2016a). Micro and small enterprises do therefore play an important role of reducing per capita income inequalities across regions.

The rapid creation of jobs in the MSE sector as shown in Table 1.2, however, masks the quality and the high churning of jobs within the sector. Liedholm (2002) and Kuuya (2015) noted that while MSEs start-up in Kenya averaged 21.6 per cent annually in 1990s, the closure rates were also above 20 per cent. This means that even as MSEs create many jobs, an almost equal number of jobs are lost among these enterprises annually (Kuuya, 2015). High mortality rate within the MSEs was also highlighted in RoK (2016a), which reported that about 2.2 million MSEs were closed between the years 2011 and 2016. About 35 per cent of the MSEs closures happened in 2015. According to the estimates, an average of 46 per cent of the 2.2 million MSEs ceased operation within the first year (RoK, 2016a). Another 33 per cent were closed after 2 to 5 years of operation. The high MSEs closure rates suggests low survival rates among MSEs.

Table 1.4 presents data on the distribution of MSEs in 1999 by the number of years that they have been operational since formation for selected African countries.

Table 1.4: MSEs Distribution by Age of Enterprise (%), 1998*

Country	Age (years)		
	< 2	2-10	> 10
Botswana	47	37	14
Eritrea	36	38	27
Kenya	36	48	17
Zimbabwe	30	44	26

Source of Data: RoK (1999)

Note: The percentages may not add up to 100 per cent due to rounding off of some figures

As shown in Table 1.4 a regional comparison on the age of MSEs shows that in 1999 the bulk (84 per cent) of Kenya MSEs were up to 10 years old while only 17 per cent were above 10 years old. This supports the idea that most Kenyan MSEs die before their tenth anniversary. Although comparative data for other countries is not available for subsequent periods, the 2015 MSE survey in Kenya showed that about 61.3 per cent of all MSEs ceased operation within the first two years of operation while 29.9 per cent closed within 10 years. Only 9.8 survived beyond 10 years (RoK, 2016a).

The average number of employees at inception, at peak and at closure for closed MSEs does not vary significantly. According to RoK (2016a), the average number of employees at inception for the closed MSEs was 1.4 employees. This number rose to 1.6 employees at peak of the MSEs growth and dropped back to 1.4 employees at closure. One of the reasons for early closure of MSEs in Kenya as

cited by 34.1 per cent for MSEs in the RoK (1999) survey and 32 per cent of MSEs in the RoK (2016a) relate to the saturation of market demand for MSE products.

1.4 Factors Constraining Growth of MSEs in Kenya

A number of factors have been identified as hindering the growth of MSEs in Kenya. According to RoK (1999) one of the most severe constraint to the growth of MSEs relates to inadequate market for MSE products. Inadequate markets is one of the reasons cited for early closure of MSEs in Kenya as identified by 34.1 per cent for MSEs in the 1999 survey and 32 per cent of MSEs in the 2015 survey. The second often-cited problem is that of lack of access to credit. McComick and Kinyanjui (1997) agree that inadequate access to credit negatively affects growth of MSEs.

Daniels, Mead and Musinga (1995) argues that high poverty levels characterising owners of MSEs implies that even with access to credit, owners of MSEs often divert the loans borrowed for business development to smoothen their consumption instead of investing it in their enterprises. A number of studies such as Kimuyu and Omiti; (2000); Atieno (2001); Kiraka, *et. al.*, (2013) and Mwangi and Wanjau (2013) investigated the influence of credit as a constraint to the growth of MSEs. The authours concluded that majority of MSEs by virtue of being owned by the poor require much more than credit to grow.

Another factor constraining growth of MSEs is the burdensome and costly regulatory envionment. Poor regulatory environment contributes to

disproportionately high transaction costs for MSEs relative to the larger enterprises (RoK, 2005). Poor infrastructure including road networks and lack of worksites that are serviced with electricity, water and sewerage systems have also been cited as other constraints afflicting MSEs growth (RoK, 1999; RoK 2005; RoK 2016a). According to RoK (1999) and RoK (2016a) inadequate market for MSEs products remains one of the severest constraint to the growth of MSEs. In spite of these growth constraints, the Kenya government estimated that between 2013 and 2017 MSEs would generate 80 per cent of the projected 1 million new jobs annually (RoK, 2013b).

1.5 Innovation Capability, Survival and Growth of MSEs

A firm's innovation capability takes into account the ability of a firm to transform knowledge capital or innovation inputs such as training, equipment, research and development into innovation outcomes (Hall, 2011). Such outcomes include issuance of new patents; introduction of new and improved products, new production processes, new organizational changes and new marketing innovations. According to OECD (2005) innovation can emerge as an original idea, a diffusion, absorption or imitation of new methods or processes developed elsewhere.

Innovation can be grouped into two major categories that encompass technological and non- technological innovation (OECD, 2005). Technological innovation includes product innovation, which entails introduction of products that are new to the firm and process innovation, which involves introduction of new production or

delivery method. Non-technological innovation on the other hand includes marketing and organisation innovation. Marketing innovation entails implementation of marketing methods that are new to the firm while organisational innovation entails introduction of new business practices, workplace organisations and external relations that are new to the firm (OECD, 2005; Mohnen & Hall, 2013).

While innovation needs to be significantly new to a firm, it need not be new to the market to have an impact on a firm's growth (Fu, Mohnen & Zanello, 2016). According to Hall (2011), firms invest in knowledge capital inputs to increase their capabilities. The innovation capabilities are then used to produce innovative outcomes. Whether a firm's investments in knowledge capital translate into innovation outcomes, however, depends on the innovation capability of the individual firm. Cohen and Levinthal (1990) argued that skilled labour plays a facilitative role in absorption and assimilation of knowledge among firms.

The ability to innovate within a firm is considered an important driver for firm survival and growth (Minitti, 2008; McCormick & Maalu, 2011; Audretsch, Coad & Segara, 2014). Indeed, Minitti (2008) and Ainin, Kamarulzaman and Farida (2010), argue that innovation is also an important ingredient for MSEs competitiveness. It can aid an enterprise to move to higher return activities and eventually facilitate a graduation from a MSE to a medium and then to a large enterprise. Minitti (2008) posit that such a graduation should lead to creation of more and higher quality employment opportunities.

Cressy (2006) in a similar line of argument posits that innovative enterprises grow faster in terms of sales turnover and employment creation. According to the author, innovative enterprises are able to adopt new technology with relative ease thereby improving their productivity. At the same time, innovation for small firms enhances their survival chances even in the presence of large firm dominated sectors (Cressy, 2006). Thus a firm's innovative capability is considered an asset for a firm to increase its profitability and growth prospects (Ainin, *et al.*, 2010; Nguyen & Jaramillio, 2014).

Micro and small enterprise's innovation capability is expected to generally have a positive influence on its survival and growth in sales turnover (Audretsch, *et al.*, 2014). The authors, however, argue that the overall impact on the MSE's employment level is ambiguous. This is because innovation is usually associated with increase in labour productivity leading to a displacement effect, especially for unskilled labour.

According to Mel and Woodruff (2009), lack of appropriate indicators to capture innovation capability among MSEs has, led to a paucity of empirical innovation studies. Hall, Lotti and Mairesse (2008) argue that MSEs innovation activities mostly lie outside the ordinary research and development activities and patent counts. This makes its empirical measurement more difficult. Yet knowledge on the link between a MSE innovation capability and its chances of survival and growth can be useful in designing policies that facilitate growth of such enterprises

(Mel & Woodruff, 2009). Such knowledge is even more critical given the heterogeneous nature of MSEs.

Crepon, Duguet and Mairesse (1998) concur in arguing that MSE innovation activities encompass some activities that are not observable. According to the researchers, the decision of firm to innovate or not is not observable. It is only the outcome of such a decision that can be observed in form of introduction of new product or process. As a result, MSE innovation measurement is problematic and there is a risk of underestimating innovation and its role towards the growth of MSEs. McCormick and Maalu (2011) and United States Agency for International Development [USAID, 1989] argue that in Africa where MSEs are often fragmented, the underestimation problem is even more pronounced.

McCormick and Maalu (2011) contend that MSEs fragmentation implies that while some MSEs are motivated by an entrepreneurial spirit others are survivalists. The latter may thus pursue measures to improve their productivity by building their innovation capability with greater zeal and persistence than the former (McCormick & Maalu, 2011). Gebreeysus (2009) adds that in Africa, MSEs innovative activities are further constrained by high transaction costs arising from poor access to finance, weak contract enforcement and infrastructural deficiencies.

In Kenya, RoK (2016a) reported that only 19.4 per cent of licensed MSEs engaged in innovation activities in 2015. An estimated 9.98 per cent of the licensed MSE engaged in product innovation, 3.78 per cent engaged in process innovation while

5.6 per cent engaged in organizational innovation. Among the small enterprises, only sectors such as manufacturing, Information and Communication Technology (ICT), finance and health, reported higher proportions of 31-44 per cent of small enterprises having engaged in innovation (RoK, 2016a). From the 2015 survey data, 17.5 per cent of licensed micro enterprises engaged in innovation activities while among the small enterprises a higher proportion of 43.7 per cent of enterprises engaged in innovation. Factors influencing the decision of a firm to engage in innovation activities, however, remain unclear.

After a firm operator/owner makes a decision to engage in innovation, a second step is to decide the intensity of innovation activities to engage in. One indicator of the intensity of innovation among firms is the share of budget or resources allocated to innovation activities as proportion of the firm's expenditures or resources. According to RoK (2016a) expenditure on all innovation activities among MSEs in 2015 accounted for 0.3 per cent of the total expenditure by the MSEs in that year. Such a low level of expenditure in relation to the MSEs' total expenditure outlay implies that innovation inputs are likely to be equally low leading to low innovation outcomes.

Data on MSEs patents in Kenya is not readily available neither is it upto date. However, Bolo, Odongo and Owino (2015) indicated that Kenya Industrial Property Institute (KIPI) had by 2014 issued only 633 patents in Kenya since its inception in 1990. This means that an average of 26 patents were issued annually during this period. Out of these, only 26 per cent of the patents were issued to

Kenyan local firms. The low level of patents issued among all enterprises in Kenya suggests that enterprises in Kenya, including MSEs, are either not innovating or do not bother to patent their innovations.

1.6 MSE and Innovation Capability Policies in Kenya

Since attaining political independence in 1963, the Government of Kenya has pursued varied policies on MSEs with an aim of facilitating faster growth of the sector. The sector being largely an informal one, the policy thrust has sought to ensure its formalization and growth. The emergence of the MSE sector can be traced to the *Africanization* policies espoused in Sessional Paper No. 1 of 1965 on *African Socialism and its Application to Planning in Kenya* (RoK, 1965).

Some specific policies pursued then involved training Africans for entrepreneurial functions, assisting African traders and business persons through Industrial and Commercial Development Corporation (ICDC), and allowing civil servants to operate businesses (RoK, 1965). The policies gave rise to a growing pool of African entrepreneurs and as King (1996) indicates, by 1967 there were about 90 small businesses supported by ICDC. King (1996), however, argues that by 1967 the total number of small African businesses in Kenya bigger than a craftsman's workshop or a country shop could hardly exceed 200.

In 1965, the National Council of Churches of Kenya (NCCCK) launched a programme of training school drop outs. The aim of the programme was to equip youths with self-employment skills. The training programmes included

entrepreneurship and know how in book-keeping. In 1969, the NCCK programme was taken over by government resulting into setting up of vocational training institutes all over the country.

It is the graduates of these programme that gave birth to the mushrooming of MSEs in both rural and urban areas (Kuuya, 2015). The ILO noticed the contribution of MSEs to Kenya's GDP and sent a team to study the problem of unemployment in Kenya resulting into the ILO report of unemployment in Kenya (ILO, 1972). The establishment of Kenya Industrial Research Development Institute (KIRDI) was one of the ILO recommendation on technology improvement. It was established to develop and produce appropriate technology for use by the informal sector with a view to improving productivity and quality of products.

According to King (1996), the MSE sector exhibited notable technological capabilities. King (1996) indicates that the MSEs had capability to use adapted technologies using skills acquired outside the formal education system. To harness such capabilities and to spur growth in the sector, the ILO Mission of 1972 advocated for various strategies. These included the need for simplification of informal sector business licensing, promotion of sub-contracting between formal and informal sector, provision of security of tenure and provision of site and service schemes (King, 1996). As a result of implementation of some of the strategies like sub-contracting, MSEs improved their products and production processes (King, 1996).

business among the MSEs (RoK, 1986). The 4K strategy, it was argued, would enable MSEs products to compete locally with the anticipated influx of imported goods as the economy became relatively more liberalized (RoK, 1986).

In a bid to expand market access for MSE products, the policy paper also intended to pursue a preferential public procurement strategy for MSE products. It advocated for revision of the building code to accommodate use of MSE products in the construction industry (RoK, 1986). These policies focused on enhancing market access for MSE products by preserving markets for their products. Most of the strategies including the preferential procurement for MSEs were, however, not fully implemented until much later. It was not until 2013, for instance, when the public procurement laws and regulation reserving 30 per cent of government purchases for MSE owned by youth women and persons with disabilities was enacted.

In Sessional Paper No. 2 of 1992 on *Small Enterprises and Jua Kali Development in Kenya*, the government policy on MSE technological innovativeness emphasized the need to encourage research and development (RoK, 1992). The policy paper espoused strategies aimed at building linkages between small and larger firms through sub-contracting (RoK, 1992). The policy sought to encourage collaboration amongst KIRDI, universities and Ministries dealing with MSE development in a bid to identify technology needs for the MSE sector. In particular, KIRDI was mandated with additional responsibilities of modifying and adapting foreign technologies thus enhancing their usage by MSEs (RoK, 1992).

A shortcoming of this policy stance was that MSEs rarely get involved in formal research and development. The linkages between research institutions, universities and the fragmented MSEs has also remained weak at best. As Karingithi (1999) argues, in spite of the concerted effort by government to create a policy framework aimed at fostering growth of MSEs through this Sessional paper, implementation was greatly hampered by lack of both technical and financial capacity.

The MSE policy stance adopted by government in the *Economic Recovery Strategy for Wealth and Employment Creation* centered on expanding markets for MSE products (RoK, 2003). The strategy was largely informed by the RoK (1999) MSE National Survey Report that indicated that 34 per cent of MSEs viewed lack of market as the single biggest hindrance to MSEs growth (RoK, 2003). To remedy the situation, the policy paper sought to create an environment suitable to facilitate MSEs to produce high quality products (RoK, 2003). Provision of MSE incubation infrastructure that would also act as nodal points for linking MSEs with large enterprises was thus proposed (RoK, 2003). The idea was to enhance sub-contracting among these groups of enterprises thereby enabling MSEs to upgrade their technologies and products.

In the 2005 Sessional Paper on *Development of Micro and Small Enterprises for Wealth and Employment Creation for Poverty Reduction*, government began to focus on developing internal technological capabilities of MSEs (RoK, 2005). The policy encouraged sub-contracting, preferential public procurement for MSEs and

improvement in access to information on available technology and provision of technological skills. According to RoK (2005), the government policy centred on developing technological skills of MSEs by building capacities and linkages among technology support institutions. Such institutions included universities, KIRDI, institutes of technology, youth polytechnic, rural technology development centres and national youth service. The government also sought to facilitate importation and adaptation of relevant technologies as well as starting an award scheme for innovators (RoK, 2005).

The *Kenya Vision 2030* identified science, technology and innovation (STI) as a key driver in the country's comparative and competitive advantage (RoK, 2007). The main focus with regard to technology and innovation aims at ensuring access to necessary technology by all sectors of the economy. No special attention was, however, devoted in the *Kenya Vision 2030* to MSEs' innovation capability. In *The First Medium Term Plan (2008-2012)*, government acknowledges that for Kenya to benefit from globalization, it needs to enhance its global competitiveness through STI. The policy paper thus advocated for strategies aimed at strengthening technical capacities and capabilities by focusing on better production technologies, technological learning, create awareness on the importance of science, technology and innovation and developing capacities of science, technology institutions.

In the *Kenya Vision 2030* paper, government also targeted to increase funding for research and development to KSh 37 billion by 2012 (RoK, 2007). This allocation, however, translated to only 0.02 per cent of the government budget in 2012. In *The*

Second Medium Term Plan (2013-2017), government focus with regard to MSEs was on the technology transfers to MSEs aimed at improving product innovations and product designs. Technology transfer for MSEs has been pursued through establishment of MSE parks, industrial clusters and establishment of MSEs centres of excellence at local levels (RoK, 2013b).

In the 2016/2017 budget statement, government announced its intention of using industrial and technology parks to stimulate innovation (RoK, 2016b). The strategy aptly recognised that rapid changes in technologies constitute a significant hindrance to MSE growth (RoK, 2016b). It thus advocated for preferential public procurement using the 40 per cent local content for government projects, enhanced support for research and development, boosting of STI and development of industrial parks.

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An overview of the aforementioned MSE innovation capability policy interventions indicates that the policies are skewed towards demand-pull strategies that aim at increasing technological innovativeness capacity among MSEs. Policy intervention aimed at improving innovativeness among MSEs seems to presume demand-pull strategies such as reservation of markets for MSEs products will automatically facilitate MSEs to develop their innovative capabilities. Whenever the MSE innovation policies have adopted supply side strategies such as improving access to technology, the policy framework has tended to assume existence of an underlying homogenous MSE sector, which is in sharp contrast to reality.

As a result, innovation capabilities in Kenya remain under developed, a factor that Romijn (2001) argues contributes to the low survival and growth of MSEs. As early as 1999, Aduda and Kaane (1999) posited that, over 90 per cent of MSEs in Kenya harboured a desire to improve their technologies through innovation. Most of their innovations, however, often failed to attain any commercial value, a fact that the authors attributed to a clogged innovation process in the country. Aduda and Kaane (1999) thus called for measures aimed at enhancing success rates of MSEs innovations capabilities.

The number of patent issued is one of the outcomes of a successful innovation outcome that indicates the level of innovation in a country. Data on innovation activities in Kenya is scarce and not up to date. As Bolo, Odongo and Owino (2015) shows an average of 26 patents were issued annually between 1990 and 2014. About 73.6 per cent of the patents issued within this 24-year period were, however, issued to foreign owned firms in spite of the fact that 48.6 per cent of patent applicants were by locally owned firms. This implies that either Kenyan enterprises do not bother to patent their innovations or their innovations are imitations.

According to RoK (2016a), the first national survey to empirically measure innovation activities among MSEs, indicates that significantly low proportions of microenterprises embrace innovation. The RoK (2016a) survey captured innovative activities using various indicators. These included introduction of new or improved products; new or improved products designs; intra-mural activities;

new or improved logistics; and new or improved manufacturing methods by MSEs for the period 2008 to 2011.

The proportion of micro-entreprises reporting any innovation ranged between 0.5 to 20 per cent in 2015. However, among small enterprises some sectors such as manufacturing, ICT, finance and health, high proportions of enterprises ranging between 31 and 44.4 per cent reported engaging in innovation. Given the low levels of recorded innovation activities among MSEs, identification of the drivers of MSEs innovation capability and its linkage to the growth of these enterprises is an important policy agenda.

1.7 Statement of the Problem

In Kenya, MSEs play an important economic development role in the context of employment creation, contribution to GDP and provision of income generating opportunities. In 1993 and 1995 it was estimated that MSEs employed about 2 million and 1.2 million, respectively (RoK, 1999). These numbers rose to 2.3 million people in 1998 and accounted for over 50 per cent of the working age population (RoK, 1999). By 2015, RoK (2016a) estimated that the sector employed 14 million people. In terms of contribution to GDP, the sector was estimated to have contributed 18.4 per cent and 24.7 per cent to Kenya's GDP in 1998 and 2015, respectively (RoK, 1999; RoK, 2016a).

In spite of the role MSEs continue to play, the survival rate among Kenyan MSEs remains low with only 46 per cent of MSEs surviving beyond the first year of operation (RoK, 2016a). The situation is dire with about 2.2 million MSEs reportedly closed between the years 2011 and 2016. The mortality rate of MSEs in 2015 was estimated at 35 per cent. According to (RoK, 2016a), 32 per cent of MSEs owners and operators cite inadequate market and stiff local competition for their products as one of the major constraints facing them.

Innovation capability studies (Astrid, 2010; Hall, 2011; Subrahmanya, 2011; Audretsch, *et al.*, 2014) have argued that a firm's innovation capability provides one pathway for a firm to increase its growth and competitiveness. According to the authors, innovation enables a firm to introduce innovative products thus opening up new market opportunities. In this manner, a firm is able to survive competition and grow. In Kenya, RoK (2016a) reports that in 2015 less than 20 per cent of micro-enterprises engaged in innovation activities.

The debate on role of innovation capability in firm growth lacks a clear consensus (Hall, *et al.*, 2008). Some researchers argue that innovation capability positively influences firm survival and growth (Roper, *et.al.*, 1996; Engel, *et al.*, 2004; Audretsch, *et al.*, 2014). Another set of researchers have found the relationship to be weak or negative (Coad & Guenther, 2014; Hervas-Oliver, Sempere-Ripoll & Boronat-Moll, 2014). This is especially true where process innovation, which often aims at labour cost rationalisation, dominates product innovation (Hervas-Oliver,

et al., 2014). Most of these studies have, however, been in the context of developed countries.

Within Africa, Fu, Mohnen and Zanella (2016) found that for informal firms in Ghana, technological innovation has a negative impact on informal firms productivity. In Tanzania, Mahemba and Bruijn (2003) and Goedhuys (2007) found a weak linkage between a firm's investment in innovation capability activities such as increased research and development, licensed technology or employees training and firm performance. Instead, Goedhuys (2007) found business environment more important predictor of growth of MSEs than innovation. In Ethiopia, Greeyesus (2009) found a positive and statistically significant relationship between MSEs growth and innovation. Thus as Fu, *et al.*, (2016) argued, the link between innovation and firm growth is only partially understood.

In Kenya, only a handful of studies have focused on innovation capability and MSE growth. Studies by Kiraka, *et al.*, (2013); Walobwa, Ngugi and Chepkulei (2013) and Martin and Namusonge (2014), however, focused on sub-categories of MSEs involved in manufacturing and garments making. The studies were based on relatively small regional survey data. The analysis also failed to take account of possible selectivity bias and endogeneity problems that bedevil cross sectional data analysis. The findings provided in the three studies too indicate a mixed relationship between innovation capabilities and firm growth. The findings provided in the three studies do not provide conclusive knowledge on the role that

innovation capability plays in the growth of Kenyan MSEs. This study sought to bridge the gap by analysing the role played by innovation capability in the growth of Kenyan MSEs.

1.8 Research Questions

The study seeks to answer the following questions;

- (i) Which factors influence MSEs' decision to engage in innovation activities in Kenya?
- (ii) Which factors affect the intensity of MSEs' innovation activities in Kenya?
- (iii) What are the factors that determine innovation capability among MSEs in Kenya?
- (iv) How does innovation capability affect the growth of MSEs in Kenya?

1.9 Objectives of the Study

The main objective of this study was to investigate the role played by innovation capability in the growth of MSEs in Kenya. The specific objectives were to:-

- (i) Analyse factors that influence MSEs' decision to engage in innovation activities in Kenya.
- (ii) Establish factors that affect the intensity of MSEs' innovation activities in Kenya.
- (iii) Ascertain the determinants of innovation capability among MSEs in Kenya.
- (iv) Establish the effect of innovation capability on growth of MSEs in Kenya.

1.10 Significance of the Study

This study contributes to the existing literature on role of innovation capability on MSEs growth in Kenya. Such knowledge is of interest to policy makers within national government institutions charged with responsibility of developing the MSEs sector such as the Micro and Small Enterprise Authority (MSEA), the Women Enterprise Fund (WEF), the Youth Enterprise Development Fund (YEDF) and County Governments. By establishing the relationship between MSEs innovation capability and firm growth, the study findings enables policy makers to identify cohorts of MSEs with better innovation capability prospects. This promotes better-targeted policies that facilitate MSEs to develop their innovation capability and thereby enabling them to grow and contribute to economic development.

The study findings are useful to development partners in Kenya who have been extending assistance aimed at facilitating the growth of MSEs. By revealing a positive and statistically significant relationship between of innovation capability and MSEs growth, the study provides a justification for such institutions to continue offering assistance aimed at building MSEs innovation capabilities.

To academicians in universities, research institutions and other institutions of higher learning, the study provides an empirical test case for the endogenous growth theory and its relevance in the Kenyan context.

1.11 Scope of the Study

This study used cross sectional data from the World Bank Enterprise Survey on innovation among the main categories of Kenyan MSE covering the period 2010 to 2012 (World Bank, 2013). The data was collected using random sampling techniques and covers manufacturing, retail and services MSEs located in Nairobi, Mombasa, Nyanza, Central and Nakuru regions of Kenya. The unit of analysis used in the survey was the enterprise and the total numbers of enterprises used for this study was 575.

1.12 Organization of the Study

This thesis is organized in five chapters. Chapter one presents the background for the study, the statement of the problem, the research questions and objectives, the significance of the study, the scope of the study and organization of the study. In Chapter two a review of the theoretical and empirical literature on MSEs and innovation capability is presented and discussed while Chapter three presents the research design, theoretical framework, empirical models, data collection and estimation procedures. Chapter four covers the descriptive statistics and empirical findings. Lastly Chapter five presents the study summary, conclusion, policy implications and areas of further study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature reviewed. Sections 2.2 and 2.3 present theoretical and empirical literature respectively. An overview of literature is presented in section 2.4.

2.2 Theoretical Literature Review

The theoretical review section examines firm growth theories starting with the neo-classical firm growth theory advanced by Solow (1956). The second theory is the resource base theory by Penrose (1959). The literature review also discusses the endogenous growth theories starting with the augmented capital model by Romer (1990), the creative-destruction growth theory by Aghion and Howitt (1992) and an innovation and profit maximisation theory by (Klette and Kortum, 2004).

2.2.1 Neo-Classical Growth Theory

The neo-classical growth theory is an economic theory that explains the growth process in an economy. The theory was first advanced by Solow (1956) and can be used to explain growth of a firm. It states that a steady economic growth can be achieved by increasing appropriate mix of labour and capital in the production function. The neo-classical growth theory argues that without technological

change, economic growth would eventually fizzle out. This is because capital and unskilled labour exhibit diminishing returns. Technology thus plays a role of augmenting unskilled labour.

According to Solow's (1956) neo-classical growth model, a firm's growth can be explained through use of the Cobb Douglas production function. The firm is assumed to use both labour and capital to produce an output as specified in a production function:

$$Y_t = A_t F(K_t, L_t) \dots \dots \dots (2.1)$$

Where Y_t is the firm's output at time, t ; A_t is the level of technology at time t ; K_t is capital at time t and L_t is labour at time t . The theory assumes that A_t is exogenously determined and it grows at a rate of g_A such that,

$$A_{t+1} = (1 + g_A)A_t \dots \dots \dots (2.2)$$

The model's first assumption is that the production function is homogenous of degree one. Multiplying the factor inputs labour, L , and capital, K , by a constant, C , then for a given level of technology A , and $Ac \geq 0$ then $F(cK, cL) = cF(K, L)$ implying that the model exhibits constant returns to scale. Thus for a given level of technology, increasing factor inputs by a constant increases output by the same constant. The second assumption is that both factors of production, labour L and capital K are necessary in the production of the output Y_t such that $\frac{\partial F(K,L)}{\partial K} > 0$ and

$$\frac{\partial F(K,L)}{\partial L} > 0.$$

Thirdly the model assumes that the firm faces a diminishing marginal returns in each of the inputs so that $\frac{\partial^2 F(K,L)}{\partial K^2} < 0$ and $\frac{\partial^2 F(K,L)}{\partial L^2} < 0$. Thus continuing to increase the factors of production, means output will increase at an increasing rate but after some point it will increase at a decreasing rate when diminishing returns set in. Fourthly, that $\lim_{K \rightarrow 0} \frac{\partial F(K,L)}{\partial K} = \infty$ and $\lim_{K \rightarrow \infty} \frac{\partial F(K,L)}{\partial K} = 0$. The assumptions hold because the level of technology is fixed at any one particular time. Thus though these conditions highlight the importance of labour and capital accumulation as a prerequisite for a firm's sustained growth, the level of technology which is exogenously determined must also grow.

The Solow (1956) theory is, however, critiqued on its assumption that technology, a major contributor to growth, is exogenously determined. Aghion and Howitt (1992) and Romer (1990) have shown that a firm's technology level is the outcome of the purposive actions of firm owners and operators. The authors have also questioned the assumption of constant returns to scale implied in the neo-classical model.

The theory was, however, useful for the current study, in regard to its prediction that capital accumulation is important in as far as technology adoption and diffusion among firms is concerned. It illuminates the fact that capital and labour are some of the key factors of production that explain a firm's growth (Solow 1956). Capital stock and labour employed by the MSEs are thus important

variables in explaining MSEs growth. These variables are thus used in this study as some of the explanatory variables.

2.2.2 Resource Base Theory

The resource base theory is a management economic theory that explains the growth of firm and was developed by Penrose (Penrose, 1959). It states that a firm's growth is an internal process through which the productive opportunities and capabilities of a firm are used to expand the size of the firm. According to Penrose (1959), each firm possesses repositories of firm specific resources and capabilities that enable it to have a competitive advantage. The competitive advantages enable such a firm to have superior performance (Penrose, 1959; Hervas-Oliver *et al.*, 2014). The firm specific resources include assets such as its knowledge capabilities some of which are tacit in nature, firm attributes, organizational structure and external source of knowledge.

The theory views a firm as a bundle of unique tangible and intangible resources and capability that are acquired, developed and expanded over time (Estene-Perez & Marez-Castillejo, 2008). It therefore emphasizes the aspect of firm learning as an important ingredient for firm growth. Estene-Perez and Marez-Castillejo (2008) argue that generation of firm specific capability need not be directly related to the firm's investments in research and development activities. The knowledge outputs from research and development inputs may, however, enable the firm to develop unique innovation capabilities that are not easily imitable by competitors. Such

knowledge exhibit spill-over effects over the firm's other activities. Hervas-Oliver *et al.*,(2014) argue that the decision to innovate in a firm is to some extent be influenced by the firm's unique organizational capabilities, its capability and dynamism in reconfiguring and sustaining its resource base.

The relevance of the resource base theory in the current study comes from its assertion that certain unique firm capabilities and attributes such as firm's traditions, organisation capability, manager's personal attributes and skills contribute to influence a firm's innovation capability and thus growth. The current study thus borrowed from the resource base theory by using organisational capability variables. The resource base theory also emphasizes the role of research and development and the knowledge inputs in a firm's growth. These are among the variables used in the current study.

According to Kraaijenbrink, Spender and Groen (2009) one key shortcoming of the theory is its treatment of value as being exogenously determined from the firm. The resource base theory fails to take account of the demand side characteristic that are important in influencing final price of a product. According to Akio (2005) the resource base theory was also criticized on its failure to meet the empirical criterion for an economic theory. It is for instance difficult to test the theory empirically.

2.2.3 Endogenous Growth Theory

Endogenous growth theory constitutes a number of theories all of which states that in general economic growth is an internal outcome generated within an economic system as a result of internal processes (Romer, 1994). The theories were advanced by Romer (1990) and Aghion and Howitt (1992). In the context of a firm growth, the theory argues that investments in capital, innovation and knowledge possess spillover effects that reduces the diminishing returns to capital and thus contributing to the firm's growth. According to Acs, Audretsch, Braunerhjelm and Carlsson (2003) introduction of new technologies and processes should lead to a firm's growth. The authors argue that at the micro-level, profit-maximizing firms engage in production of knowledge through such activities as research and development and other innovation activities. In this manner, they endogenize knowledge production.

One strand of endogenous growth theory is Romer's augmented (A) capital (K) model, commonly referred to as the AK model (Romer, 1994). It relaxes the assumption of diminishing returns for the reproducible capital, a key assumption in the neo-classical growth theory (Romer, 1994). The model lumps together capital accumulation and technology thus acknowledges that accumulation of capital is key to firm growth. The AK model, however, assumes existence of competitive markets. It thus argues that with competitive markets and well-functioning policy institutions, capital should move freely across regions thereby facilitating firms to accumulate capital. Technology adoption and diffusion

movements that started in 1970s focusing on ensuring MSEs adopt new technologies were founded on this line of thought. Like the neo-classical theory, the AK model thus emphasizes capital accumulation and, therefore, the need for technology diffusion.

The AK model's main shortcoming is with regard to the assumption of competitive markets and well-functioning institutions and policies (Aghion & Howitt, 1992). The theory becomes less useful in light of the imperfect market that exists in many developing countries like Kenya. Imperfect innovation markets and inadequate innovation policy frameworks imply that free movement of technology across firms and regions may not a tenable route to MSEs acquiring technology.

The creative-destruction model is another strand of endogenous firm growth theory developed by Aghion and Howitt (1992). It has its roots in the Schumpeterian creative-destruction arguments. The theory states that innovative enterprises are constantly engaged in a cycle of discovering new production combinations in the form of new products, new production techniques, new markets and sources of raw materials. The aim of the enterprises is to be at the frontier of knowledge. According to this model, firms that lag behind the frontier of knowledge lose out, stagnate and eventually die through obsolescence.

The theory views success of a firm as being gauged on its ability to weed out unsuccessful enterprises through competition. Enterprises at the frontier of knowledge exploit such knowledge and are able to destroy their competitors

through introduction of new innovative products or new and more efficient production processes (Kangasharju & Moisio, 1998; Klette & Kortum, 2004). The theory emphasizes the complex incessant product and process innovation mechanism that are amenable to the managerial skills and institutions within which firms operate.

2.3.4 Firm Innovation and Profit Maximisation Theory

According to Klette and Kortum (2004), firm's growth emanates from the firm's innovations in products new to them. Using the endogenous growth theory, the authors developed a theory that shows that the decision of a firm to innovate or not is a purposive profit maximisation firm behaviour. In the model Klette and Kortum (2004) assume a firm that start at size $k \geq 1$, where k represents the number or products. At size, k the firm earns profit according to the function: $\bar{\pi}k$; where $\bar{\pi}$ is optimal profit. Klette and Kortum (2004) argued that such a firm faces a prospect of Poisson hazard, μk , of being forced out by other innovative firms that introduce new competitive products. If the firm does not innovate, it will become $k - 1$ size firm. However if the firm innovates it faces a Poisson hazard I of becoming $k + 1$ firm.

Klette and Kortum (2004) posit that if the firm choose an innovation policy, $I(k)$, then this implies that it invests in research and development according to the function $R(k)$ and an associated cost function $C = [I(k), k]$. The model further assumes that the objective of the firm is to maximise its expected value, $V(k)$ at

some fixed interest rates, Klette and Kortum (2004) showed that in such a case the firm's optimisation problem then becomes:

$$rV(k) = \max_I (\bar{\pi}k - C(I, k) + I[V(k+1) - V(k)] - \mu k[V(k) - V(k-1)]) \dots\dots(2.3)$$

The optimisation problem solves to:

$$V(k) = vk \dots\dots\dots(2.4)$$

$$I(k) = \lambda k \dots\dots\dots(2.5)$$

And v and λ solves for;

$$C'(\lambda) = v \text{ or } C'(\lambda) = 0 \text{ and } \lambda = 0 \dots\dots\dots(2.6)$$

$$(r + \mu - \lambda)v = \bar{\pi} - c(\lambda) \dots\dots\dots(2.7)$$

Where $\lambda - \frac{I(k)}{k}$ is the firm's innovation intensity and the firm's associated innovation policy is given as:

$$R(k) = C(I(k), k) = kc(\lambda) \dots\dots\dots(2.8)$$

Thus according to Klette and Kortum (2004), a firm would be expected to scale up its innovation expenditure in proportion to its knowledge capital. From this theory, therefore, a firm will make the decision to innovate or not and the intensity of that innovation with a view to profit maximisation as well as to ensure its survival from competing firms (Klette & Kortum, 2004).

These strands of the endogenous growth theories relate well with the observed high birth and death rates among Kenyan MSEs (RoK, 2016a). The endogenous growth theories' inclusion of an assumption that each firm possesses some market power may seem not to apply given the numerous MSEs that almost mirror a perfectly competitive market. Each MSEs does, however, experience temporary market power inform of a downward sloping demand curve at the time it introduces an

innovative product or process (Hall, 2011). Data on innovation inputs and outputs such as count of the MSEs innovative products and sales revenue from innovative products is available from the innovation survey carried out among Kenya MSEs. The model thus enables an empirical testing of the role of innovation capability in firm growth.

2.3 Empirical Literature

Roper, Du and Love (2006) analysed the drivers of innovation, productivity and firm growth among manufacturing firms in Ireland and Northern Ireland for the period 1991 to 2002. The study used a production function approach to estimate bivariate probit models. According to the authors, the bivariate probit estimation was preferred over a multivariate probit due to its simplicity in interpreting marginal effects, it allows observation of each individual probit relationship and is more suitable for survey data with cases of missing data. The bivariate probit models from knowledge inputs to innovation outputs and firm growth were estimated as a recursive model. Econometric problems of heterogeneity especially with regard to variability of business growth was handled by estimating the models using robust standard errors. Roper, Du and Love (2006) used predicted innovation outputs as instrumental variables to minimise endogeneity between variables.

Among the key independent variables in the estimation included predicted product and process innovation outputs, firm size, affiliation, human skills levels, physical location and capital intensity. The findings of the study showed that all coefficients

of these variables were positive and statistically significant in predicting business growth. Of interest, however, was the finding that the coefficient for the variable innovation capability were negative and statistically significant with regard to productivity growth of the firms. Thus while firms undertaking product and process innovation grew faster in terms of sales than the rest, their productivity in terms of sales per employee was found to be statistically insignificant. One limitation of the study was its failure to empirically test for the presence of self-selection. The study sample was also limited to a only manufacturing sector firms. However, the current study borrowed heavily on the study methodology.

Esslaar, Stork, Ndiwala and Swarray (2008) investigated the impact of usage of ICT on small enterprise performance in 14 African countries. The study used survey data of 3691 SMEs to estimate a turnover function where the share of a firm's turnover over its fixed assets was regressed against cost of shares of inputs costs to fixed assets. The inputs included utilities such as phone costs, electricity, internet costs, wage costs and other raw materials cost. The study found that informal SMEs using ICT tend to have higher profitability than formal ones. This finding indicates that ICT is productive input factor that increases labour productivity for SMEs in Africa. An even more interesting finding of the study was on the growing importance of mobile technology. The study found that mobile phones have overtaken computers as tools that support the running of SMEs. This was attributed to their prevalence and accessibility. Esselaar, *et al.*, (2008) found that the capability to adopt to both current and new technologies and the nature of business the firm is engaged influences business performance. It was thus

imperative for the current study to probe the role of access to ICT especially mobile telephony in influencing MSEs innovation capability. Thus among the key control variables included in the analysis was access to ICT for MSEs in Kenya.

Ayyagari, Demircug-Kunt and Maksimaic (2007) investigated the determinants of firm innovation among 19,000 small, medium and large enterprises across 47 emerging market countries. The study used an ordinary Least Square (OLS) estimation technique. Among the key findings was that large exporting firms that are privately owned and have access to external finance and highly educated and experienced managers are better innovators. Thus access to external financing, managerial skills, foreign competition and firm organizational structures are important determinants of innovation across firms.

Ayyagari, *et al.*, (2007) use of cross-sectional data means caution is important in attaching strong causal relationships as some fixed effects that can only be captured through use of panel data can only be speculated. The current study emulated Ayyagari, *et al.*, (2007) and incorporated access to export markets and external financing as some of the control variables that influence MSEs' innovation capability and thus growth prospects.

Goedhuys (2007) investigated the importance of firm learning, investments and linkages to a firm's product innovation in Tanzania. Goedhuys (2007) sample constituted 252 large and small firms from a World Bank Investments Climate Survey data for Tanzania collected in 2003. The author used descriptive analysis

combined with a Probit model to analyse the probability of innovating given particular learning, linkages and firm characteristics such as firm size, sector and ownership structure. Instrumental variables were introduced to handle endogeneity and establish causality. The study found a weak linkage between foreign firm learning spillover as it relates to product innovation. Linkages among local firms, in-house research and development were, however, found to be important determinants of product innovation among the small enterprise.

According to the author, local industrial structure influences product innovations among small enterprises. A major limitation of the study was that the surveyed firms were those that had carried out some innovation. It thus suffered from a selectivity bias. The use of instrumental variables to handle endogeneity by Goedhuys (2007), however, provided some insights for the current study. The role of local linkages and networks, internal research and development was also incorporated in the current study based on their relevance in the Kenya's MSEs local dynamics.

Hall, *et al.*, (2008) used a variant of the knowledge production function approach pioneered by Crepon, *et al.*, (1998) to study the linkage between innovation and firm growth. The authors extended production function into a structural model to incorporate additional indicators that are more relevant to capturing SMEs innovation decisions, outcomes and impact on SME productivity in Italy. The study used data derived from a number of Italian manufacturing surveys to construct a large unbalanced panel. Panel data was used to investigate role of

research and development and ICT access on innovation MSE Innovation. The analysis made use of a step-wise and instrumental variable procedure.

The study found that SME innovation activity had a positive impact on SMEs productivity. Process innovation impact, measured through investments expenditures, was found to have a larger productivity impact than product innovation. The study attributed the finding to the fact that dummies used to represent process innovation failed to capture process innovation when compared to investment or capital stock measures. The study also found that firm size is negatively related to innovation intensity but positively related to product and process innovation. The use of step-wise and instrumental variable procedure, however, resulted in underestimation of the productivity impact. To remedy the underestimation, the study adopted a Full Information Maximum Likelihood (FIML) estimation, which they found to improve the estimation. The current study used Maximum Likelihood Estimation (MLE) technique as suggested by Hall, *et al.*, (2008) to improve the robustness of the estimations.

Mel, McKenzie and Woodruff (2009) investigated the role of firm owner characteristics in SME innovation. They used cross-section survey data of about 700 SMEs in Sri Lanka in 2008. The study used a Poisson process based innovation model whereby innovation arrival rate is specified as a function of current research and development, and knowledge generated by past research and development. The model incorporated SMEs owner's characteristics including the socio-economic background, personal traits, and performance abilities. The study found that all the

owner characteristics are a significant predictor of innovation. Firm size was found to play a bigger role for process and organization innovation than it does for product and marketing innovation. The study attributed this finding to the fact that while organization and process innovation spreads the cost savings across all the products, product and market innovations are confined to a single product. The current study made use of owner-manager characteristics among the control variables.

Gebreeysus (2009) investigated the determinants of innovation capability and the effect of innovation on the growth of micro-enterprises in Ethiopia for the period 2001-2003. The study used cross-sectional data for 1,000 micro-enterprises from 5 main regional locations in Ethiopia. The study used logistic regression analysis to analyse the determinants of innovation while Two Stage Least Squares (2SLS) and Generalised Methods of Moments (GMM) to analyse the micro-enterprise growth estimation. Instrumental variables were used to handle endogeneity problems. The dependent variable for the determinants of innovation model was a dummy variable taking on value of one for innovative enterprises and zero otherwise. Independent variables included MSE's size, age, physical location and owner attributes. In the growth equation, the dependent variable was the cumulative growth of number of workers between 2001 and 2003.

The main findings of the study were that size, age and vocational training were positive and statistically significant determinants of micro-enterprise innovation activities. With regard to the impact of innovation on growth, the study found that

innovation output had a positive and statistically significant impact on the growth of the micro-enterprises while age, size and credit access were negative and statistically significant. Human capital and vocational training had no statistically significant impact. Some of the shortcomings of the study by Gebreeysus (2009) were that it did not consider selection bias and it also amalgamated the types of innovation capability into one indicator. In the analysis, the study did not clearly distinguish innovation input and innovation outputs. The study scope in Gebreeysus (2009) was also limited to micro-enterprises. The current study used several variables that were used by Gebreeysus (2009).

Robson, Haugh and Obeng (2009) investigated the inter relationships between entrepreneurship, innovation and MSEs growth in Ghana' in 2005. The study sought to analyse how entrepreneurship characteristics of a MSE influenced its innovativeness. The study used cross section data that was gathered from 496 MSEs within manufacturing and service sectors. The study methodology comprised descriptive analysis using such test as Mann-Whitney test of association and test of significance as well as logistic regression analysis. Among the key variables were firm growth, entrepreneur's human capital skill levels, firm size, firm ownership status and external firm linkages. One finding of the study included the dominance of incremental product innovations. Robson, *et al.*, (2009) argued that this type of incremental innovation which, is common among African MSEs, demonstrates the risk averseness of entrepreneurs.

Robson, *et al.*, (2009) argued that MSEs in Africa operate in resource-poor environments and mostly innovate to survive competition. They thus result to imitating other firms products, practices or technologies. The authors found positive and statistically significant influence of firm size and external linkages on MSEs innovation activities. Robson, *et al.*, (2009), however, found no statistically significant influence of innovation on the MSE's growth. The dominance of family ownership of MSEs in Ghana was also found to have acted as a constraint to MSEs innovativeness. The study methodology adopted by Robson, *et al.*, (2009) failed to convincingly handle the econometric problems of endogeneity and self selection that are common in this type of study. The current study, however, used some of the variables used in by Robson, *et al.*, (2009).

Corsino and Gabriele (2010) used the knowledge production function framework to investigate whether or not the significance of the relationship between innovation and sales is invariant to industrial level classification. The study used a panel data for the period 1998 to 2004 for 95 global companies producing Integrated Circuits (IC) and comprised 18 clusters of 7 digit International Standard Industrial Classification (ISIC). The analysis was carried out using the GMM and OLS estimation techniques. The study found that, at firm level, incremental product innovations introduced in the most recent past significantly affect the growth performance of IC producers.

The authors attributed the finding to the fact that the loci of learning, innovation, competition and changes in market shares can only be found at a disaggregated

level. The level of analysis (product SIC classification) thus seems to be important. The study was, however, limited to investigating product innovation. While the current study data does not attain the disaggregated industrial level proposed by Corsino and Gabriele (2010), it made use of different MSEs sector categories using sectoral dummies to attain some level of MSEs disaggregation.

A study by Subrahmanya, Mathirajan and Krishnaswamy (2010) probed the likely impact of innovation on SMEs' growth in Bangalore, India in 2007. The study used both quantitative and qualitative approaches that included frequency, correlation, regression analysis and analysis of variance. Growth of SMEs in the study was viewed in terms of sales turnover, investments and employment. The authors sought to shed light on the drivers, dimensions, achievements and outcomes of technological innovation among 214 small manufacturing enterprises engaged in auto components, electronics and machine tool in Bangalore, India in 2007. In the regression analysis, some of the variables used included the SMEs gross value added as the dependent variable while independent variables included growth rate of capital and labour, percentage of innovative sales to total sales and firm size dummies.

The study found that SMEs that are innovative perform better in terms of sales turnover and employment generation relative to firms that are non-innovative. The firms that experienced the highest growth are the same enterprises that accounted for the higher share of innovated products in their total sales when compared to those that experienced lower sales growth. The study methodology, however,

failed to account for endogeneity problems where the high growth firms are lumped with the rest of the firms yet innovative capability of an SME may be endogenously influenced by its previous growth performance. Following Subrahmanya, *et al.*, (2010), the current study will borrowed the use of sales turnover and employment as dependent variables that measure growth of MSEs.

Dutz and O'Connell (2013) analyzed the impact of key business environment indicators on productivity, innovation, and firm growth in Sri Lanka. The study used a cluster level productivity analysis and firm level total factor productivity analysis approaches. Dutz and O'Connell (2013) used OLS and Probit estimation techniques to estimate firm-level total factor productivity analysis and a firm-level innovation analysis, respectively. Among the key variables included in the analysis were global knowledge accessed through internet, export and import trade openness and access to skills among SMEs in Sri Lanka. All these variables were found to be significant determinants of SMEs innovation activities.

Other inclusions in the model included the market power variable captured by reported number of competitor firms as well as the business environment component that captures such aspects as spillover from other firms. The study found a positive relationship between firm level total factor productivity and technological innovations. A shortcoming of the study, however, was that the total factor productivity measure was limited to manufacturing sector firms. Thus the findings by Dutz and O'Connell (2013) may not be applicable across other sectors.

Manez, Rochina-Barrachina, Sanchis and Sanches (2013) studied the effect of process innovation on firm productivity in Spain. Apart from investigating the impact of process innovation on SMEs total factor productivity, the authors sought to establish the direction of the causality of this relationship. The study methodology included stochastic dominance and matching estimation techniques. It used panel data for 10,302 Spanish manufacturing SMEs for the period 1991-2002.

Through use of the stochastic dominance technique, the study established the presence of non-random selection into the production process. Thus SMEs that eventually introduced process innovation exhibited high previous growth. In the matching estimation technique a logistic regression was estimated with previous year SME productivity as a dependent variable. Independent variables included firm research and development performance, skilled labour, cash flow, export participation, number of competitors, market share, firm age, firm size, firm legal status, industry dummy and time dummies.

The study found that introduction of process innovation among these SMEs yielded productivity growth that was non-contemporaneous. The lifespan of productivity was also found to be for one period. One limitation of the study by Manez, *et al.*, (2013) was that existence of an unobservable factor that initially induce a firm to introduce process innovation could also have been correlated with the firm's productivity growth. The current study was unable to use the approach used by Manez, *et al.*, (2013) due to lack of a complete panel data. The current study,

however, used some variables similar to those used by Manez, *et al.*, (2013) to analyse factors that influence SMEs decision to engage in innovation.

Walobwa, *et al.*, (2013) studied the growth effects of different types of innovation on small enterprises involved in garments in Nairobi in 2013. The study used cross sectional survey data collected from 31 garments processing SMEs in Jericho residential estate of Nairobi, Kenya. Using a descriptive methodology combined with an OLS estimation analysis, the study tested for significant relationship between the SMEs sales turnover with technological innovation, administrative innovation, strategic innovation and marketing innovation.

The study found that apart from technological innovations other forms of innovations were also important for small enterprise growth in Jericho. Marketing innovation was found to be the relatively more statistically significant among the small enterprises engaged in garments making in Jericho. A unit increase in marketing innovation contributed to 0.71 increase in business growth while strategic innovation, administrative innovation and technological innovation accounted for 0.123, 0.4, and 0.52 of business growth, respectively.

The data analysis approach, however, failed to take account of endogeneity bias even after having established that there existed a positive correlation between technological innovation and the other three types innovation. The study did not include other enterprise factors such as size, age and owner/operator attributes that contribute to enterprise growth. Following Walobwa, *et al.*, (2013), the current

study extended MSE innovation analysis beyond technological innovation to include other forms of innovation such as marketing and organization innovations, which were found to positively impact on SMEs performance in Jericho.

The study by Kiraka, *et al.*, (2013) investigated the determinants of firm growth among women-owned micro, small and medium enterprises in Kenya. The main objective of the study was to evaluate how women owned enterprises that accessed loans from the Women Enterprise Fund (WEF) between 2007 and 2012 had performed in terms of turnover, gross profits and employment. The study also investigated how access to loans had impacted on innovative activities among the enterprises. The study used cross sectional data collected from 855 women-owned enterprises that were randomly selected across Kenya. In the case of innovativeness, the study specified a logistic regression equation where a dichotomous dummy variable was used as a dependent variable to represent status of a firm's innovativeness. The dependent variable was regressed against firm characteristics and firm owner characteristics. The estimation used maximum likelihood method.

Kiraka, *et al.*, (2013) found that innovative activities for micro, small and medium enterprises were largely confined to an additional new product immediately after the loan period. The study concluded that women-owned micro, small and medium enterprises have not benefited from the advantage of urban location, which commonly assumed to propel enterprises into new market and technological advantages. Instead, the study found that locating an enterprise in an urban location

increased the likelihood that the business would either stagnate or decline in its number of employees and gross profit. The current study borrowed from the study by Kiraka, *et al.*, (2013) and used a dummy variable for regional location of and MSEs to explore the influence of location on MSE's growth.

The study by Coad and Guenther (2014) analysed how a firm's product diversification, a form of innovation, influenced firm growth among machine tool industry in Germany between 2000 and 2010. The authors examined how introduction of new products, among 821 machine tool industry firms, impacted on the firm's sales turnover, number of employee and assets held by the firms. The study used cross sectional data from 821 machine tool firms and matched this firm level data with other secondary data for the same firms. Secondary data firm characteristics included firm size, age, regional location and number of patents issued during study period. A correlational and probit analysis was carried to establish the relationship between a firm's new product introduction and sales, employment and asset growth. The probit analysis was carried with the dependent variable being introduction of new product while control variable included firm age, firm size, number of universities per region where firm was located, and dummies representing years.

Coad and Guenther (2014) found that growth in sales and employment was negatively associated with introduction of new products with reference to the previous year. Asset growth was, however, found to be positively related to introduction of new products with reference to the previous period. This type of

analysis, however, did not establish the casual relationships between the dependent and the independent variable. The authors use of a machine tool industry as the only sector also limits the applicability of the study findings to the other sectors. The current study used both sales and employment as indicators of firm performance following Coad and Guenther (2014). The current study, however, went beyond the relational analysis. Through the use of a structural model, the study investigated the casual relationships between the dependent and independent variables.

Love, Roper and Vahter (2014) analysed the effect of firm external linkage on innovation capability for Irish manufacturing firms in Ireland for the period 1994-2008. The authors used data from Irish Innovation data to construct an unbalanced panel. They used a fixed effect model with proportion of innovative sales as well as total sales revenues as the dependent variables. Key independent variables included number of current and previous plant linkages, product innovation dummy, size, internal research and development expenditures, human capital skills levels and physical location. The use of panel data in the OLS model allowed the authors to investigate the impact of prior linkages and control for unobserved heterogeneity among the firms. A key finding of the study was that a firm linkage such as a firm being part of larger group has a positive and statistically significant effect on a firm's innovation capability. The study, however, failed to tackle the problem of self-selection, as the firms in the study sample were the innovative manufacturing firm. The current study thus attempted to test for self-selection problem, which usually leads to biased estimated coefficients.

Oum, Narjoko and Harvie (2014) in their study, investigated potential constraints and determinants to SMEs capability to innovate in Thailand, Indonesia, Malaysia, Philippines, Vietnam, Cambodia, Lao Peoples Democratic Republic (PDR) and China in 2014. The study used SMEs cross-sectional survey data for the Association of Southeast Asian Nations (ASEAN). The study adopted a maximum likelihood estimation technique to estimate the significance of the various constraints that affect SME capability to innovate. The authors also examined how government support in these countries helped SMEs to overcome the potential constraints. The authors carried out an empirical assessment of constraints and determinants of SME innovation capability in ASEA countries using a Probit regression analysis.

The study found size of the firm, higher skill levels, human resource availability and ease of access to external resources as common facilitators to SME innovation capability. The study also found younger firms to be more successful in business process innovations. On effectiveness of government support, the study found that on its own, government support does not in general help SMEs to innovate. The findings of the study were in line with the resource base theory and knowledge spillover, which supports the importance of networking, access to financial resources and market access support as determinants of MSEs innovative activities.

Hervas-Oliver, *et al.*, (2014) studied process innovation strategies used by Spanish manufacturing SME to achieve growth. The study analysed the implications of process innovation strategies among the SME firms. It also explored the

contribution of the complimentary relationships between technological process innovation and organisational innovation. Hervas-Oliver, *et al.*, (2014) made use of Community Innovation Survey (CIS) data collected for the year 2004 to 2006 for 13,638 Spanish manufacturing SMEs. Principal Component Analysis (PCA) that comprised labour cost reduction, flexibility and capacity utilisation was used to construct the dependent variable.

The PCA score was used to represent process innovation performance for each of the SMEs. The independent variables included research and development expenditure, source of knowledge, an organisational innovation dummy, expenditure on technology, industrial classification, firm size and export linkage. The regression model was then estimated using the OLS estimation technique. During the analysis, however, the Heckman test was carried out to tackle potential selection bias that could have arisen when only process innovators firms were selected.

The study found that the coefficient on expenditures on research and development were negative and statistically insignificant in explaining process innovation performance among SMEs. Instead, coefficients on acquisition of embodied technology, internal and external sources of knowledge and co-adoption of organisational innovation were found to be statistically significant and positively related to process innovation. The model estimated by Hervas-Oliver, *et al.*, (2014) failed to take account of possible endogeneity problems among some of the independent variables such as expenditure on research and development, firm size

and the dependent variable. Following Hervas-Oliver, *et al.*, (2014) the current study incorporated organisational innovation as one of the variables in the innovation and production link analysis.

Fu, *et al.*, (2016) investigated the role of innovation on firm's performance in Ghana. The study used the knowledge production function methodology whereby a firm's productivity per worker was estimated as a function of technological and non-technological innovations, level of firm informality and other firm characteristics such as firm owner's entrepreneurial acumen. The study used cross sectional survey data for 501 formal and informal manufacturing firms in Ghana. The estimation technique used in the analysis was probit analysis. To take account of endogeneity, a two Stage Least Square was used. Firm's access to credit was used as the instrumental variable.

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During the estimation, an interaction between the degree of formality and technological and non-technological innovation was included. The study found out that while in general innovation positively impacted on labour productivity, non-technological based innovation had significantly larger impact on productivity for the informal firms than for formal firms. For the formal firms none of the coefficient for technological innovation was negative and statistically significant. The usefulness of the study is, however, limited in that it is a sectoral study only analysed innovation among the manufacturing sector. Fu, *et al.*, (2016) findings may, therefore, not be applicable for other sectors where MSEs operate. The authors also lumped non-technological innovations into one sub-category thus

obscuring such innovation activities as organisational and marketing innovation. The current study borrowed the methodological approach used in the study including the choice of instrumental variable to take care of endogeneity.

2.4 Overview of Literature

The theoretical literature reviewed in this study includes the neo-classical growth theory, the resource base theory and the endogenous growth theory. A review of endogenous growth theory in particular suggests that growth of a firm is influenced by innovation capability or knowledge inputs. There is, however, no consensus on the link between firm growth and innovation. The current study thus used the endogenous growth theory to investigate the link between innovation capability and MSEs growth in Kenya. This was based on the premise that in Kenya the numerous MSEs that are characterized by high birth and death rate, which mirrors the creative and destructive, forces inherent in the endogenous growth theory.

The empirical literature reviewed indicates that most studies used cross-sectional data while a few used panel data in analysing the linkage between innovation capability and growth of MSEs. The estimation techniques and models ranged from OLS, MLE, FIML, GMM, logistic regressions, Probit regression, Poisson regression and 2SLS. Some of the studies, however, combined the quantitative approaches with qualitative approaches using descriptive analysis such as correlation analysis and analysis of variance. The empirical literature reviewed was thus useful in pointing out the various approaches used to study small enterprise's innovation and firm growth.

The literature reveals the different ways in which MSE growth can be measured through sales turnover, profitability, return on equity, and employment numbers. The empirical literature reviewed also provides insight that was instrumental in the development of the current study. Firstly, the influence of the owner manager in the MSE innovativeness seems to play an important role. A notable influence on firm innovative and growth process is the participation in export-import trade, which is thought to go beyond ordinary market transactions to influencing external relations that provide crucial knowledge spillover. The time dependent learning process, firm survival and growth are other aspects highlighted by the literature reviewed. Firm age is thus important in innovation capability analysis.

The reviewed literature also asserts that firms that have unique superior human skills and capabilities, some of which assume a tacit nature, enable certain MSEs to learn faster and outwit their competitors. Skilled labour thus gives a firm the capacity to absorb, assimilate and develop new knowledge. Most of the empirical literature reviewed was, however, in reference to developed countries where the environment and even motivations for micro and small enterprises may differ significantly with that of Kenya.

The empirical literature reviewed in reference to Kenya, focused on MSEs from a specific region Jericho in Nairobi in the case of Walobwa, *et al.*, (2013), or focused on a sub-set of MSEs such as women-owned enterprises in the case of Kiraka, *et al.*, (2013) while Walobwa, *et al.*, (2013) focus was garment making MSEs.

Generalisations of findings of such regional or sectoral studies may be inappropriate for informing national innovation policies for MSEs. The estimation techniques used in Walobwa, *et al.*, (2013) and Kiraka, *et al.*, (2013) also failed to take account of possible selectivity bias and endogeneity problems that bedevil cross sectional data analysis. The robustness of such findings may thus be in doubt.

The current study differed from the studies reviewed in the empirical literature in four ways. Firstly, the study was carried out with reference to a developing country. It, therefore, adds to the few studies that are in the context of a developing country. Secondly, the study sought to establish empirically the linkage between innovation capability and firm growth at a national level as opposed to the reviewed Kenyan studies that had either sectoral or regional level focus. Thirdly, the current study by using a structural econometric model, tackled potential selection bias and endogeneity problems thereby improving the robustness of the results.

Furthermore, the study by using a structural model enabled the tracing of the transformation of knowledge inputs into innovation outputs. The innovation outputs were thereafter used to analyse the effect of innovation on the growth of the MSE. The structural model was novel for Kenyan MSEs as it mimics a firm's decision-making logic. To the knowledge of the author, the method had not been used before to analyse the contribution of knowledge capital to the growth of the MSEs in Kenya. Finally, the study made use of the latest and most comprehensive data on innovation by MSEs in Kenya.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was used to carry out the study. It includes the research design, theoretical framework on which the study was based on, the empirical model, data type and sources and data analysis.

3.2 Research Design

The main objective of this study was to investigate the role played by innovation capability in the growth of MSEs in Kenya. To fulfil this objective, the study adopted a non-experimental cross-sectional research design. This research design enables the researcher to make inferences about their innovation process and its effect among different MSEs who differ in size and in the resources they control but share other characteristics such as their age, physical location, ownership structures and market structures. The research design was justified on the premise that it was not possible or ethical to manipulate some of the variables of interest in the study.

3.3 Theoretical Framework

The current study was anchored on the endogenous growth theory, which argues that firm growth is an internal outcome generated within the firm as a result of

internal processes. Moreover, MSEs in Kenya are characterized by a high birth and death rate that mirror the creative and destructive forces inherent in the endogenous theory. As suggested by (Hall, 2011) the theoretical framework used to express the relationship between firm growth and innovation starts with the Cobb Douglas production function.

3.3.1 Firm Production Function

The description of endogenous growth of a firm can be captured by the relationship between output levels and inputs in a firm's production function (Hall, 2011). The common expression for this relationship emanates from the neo-classical firm growth theory. This relationship is stated as a production function as follows:

$$Q = AC^{\alpha}L^{\beta} \dots \dots \dots (3.1)$$

Where Q stands for output; C represents capital input ; L represents labour input; A stands for the overall productivity or technology and varies across firms; α and β are unknown coefficients to be estimated. These coefficients represent elasticities of output to changes in capital and labour respectively. According to Hall (2011), differences in organizational structures, firm individual constraints or frictions means that even firms with the identical levels of capital and labour are unlikely to achieve the same level of output. In modelling the contribution of innovation to firm growth, the traditional practice is to use the production function approach that focuses on total factor productivity as a function of research and development (Loof & Heshmati, 2002). According to Hall (2011), a variable that captures the

intangible capital, K created out of an innovative capability should then added to the production function 3.1 as follows:

$$Q = AC^\alpha L^\beta K^\gamma \dots \dots \dots (3.2)$$

Where, K represents the firm's innovative capability aspects obtained from the firm's investments in research and development; γ is a coefficient representing the elasticity of output to changes in K . The other variables and parameters in equation (3.2) are as explained in equation (3.1). Hall (2011) adds that the variable, K also captures the firm's competency or capability at transforming research results into economically useful products and processes. The view by Hall (2011) is also shared by Acs, *et al.*, (2003) who argue that, K , the knowledge capital, constitutes a composite of research and development and human capital which are not embodied in processes or products. Introducing the knowledge capital takes cognizance of the fact that this intangible asset is compatible with possibility of increasing returns (Hall, 2011; Acs, *et al.*, 2003). According to Acs, *et al.*, (2003) the properties of non-excludability and non-rivalry that characterise knowledge capital connotes that its marginal productivity need not diminish even as it becomes available to more users.

Thus it is possible for a firm's growth to go on indefinitely as a result of positive knowledge spillover. Knowledge capital, K , is treated as a stock variable and has traditionally been measured through the enterprises expenditures on research and development. With regard to measurement of output, the potential for market

power across firms and how innovation influences such market power has to be considered (Hall, 2011). Taking logarithmic version of equation (3.2) yields;

$$q_{it} = a_{it} + \alpha c_{it} + \beta l_{it} + \gamma k_{it} \dots \dots \dots (3.3)$$

Where q_{it} represents output produced by a firm i at time t expressed in log form, a_{it} is an intercept to be estimated, α and β are parameters representing the elasticity of output with respect to capital and labour respectively, c_{it} and l_{it} represent stock of physical capital and number of labourers for firm i at time t expressed in log form. The variable k_{it} , is the innovation input or knowledge capital while γ is the elasticity of output with respect to knowledge capital.

From this theoretical framework, innovation inputs in form of research and development and other innovation activities of a firm should lead to increase in a firms innovation capability captured as K in equation (3.2). Over time, increase in innovation capability should lead to a shift in demand curve facing the firm as it extends its market through introduction of new innovative products and processes (Hall, 2011).

To estimate the Total Factor Productivity (TPF) a_{it} in equation (3.3), the equation is rewritten as:

$$TPF \equiv a_{it} = q_{it} - \alpha c_{it} - \beta l_{it} - \gamma k_{it} \dots \dots \dots (3.4)$$

According to Hall (2011), the measurement of TPF calls for real measures of output Q , real capital stock input K , real labour inputs Q , other relevant inputs as well as α , β and γ . While α , β and γ are estimated using regression, measuring the

output Q and inputs can be problematic. Hall (2011) argues that depending on the approach used to measure inputs, the interpretation of the TPF should be in the light of the deflation and the adjustment method adopted. This is because of the difficulties of holding the unit of measurement constant as the input is measured. Hall (2011) thus suggested a rewriting of the TPF equation in terms of revenue rather than in terms of real output.

Towards this end, the author makes use of an iso-elastic demand equation based on the premise that each firm produces a differentiated product and is assumed to face a downward sloping demand curve for its product. Each firm thus faces idiosyncratic output prices for its outputs so that deflation of revenue by an overall deflator yields real and observable revenue rather than the actual output measure. Since revenue, $(R_{it}) = P_{it} \cdot Q_{it}$, log-linearising and denoting log of real revenue as r_{it} and the log of firm's output price as p_{it} , then $r_{it} = p_{it} + q_{it}$. The iso-elastic demand equation facing the firm is thus given as:

$$q_{it} = \eta p_{it} \dots \dots \dots (3.5)$$

Where η represents the demand elasticity and η is assumed to be negative for most goods. Combining equation (3.3) and (3.5) yields an expression for revenue, which is observable, as a function of inputs and TPF as follows:

$$r_{it} = \left\{ \frac{\eta+1}{\eta} \right\} (a_{it} + \alpha c_{it} + \beta l_{it}) \dots \dots \dots (3.6)$$

Hall (2011) posits that since most innovative activities are directed towards new products and product improvement, it is useful to introduce a new demand equation

(3.7) to allow for the innovation variable to shift the demand curve facing the enterprise such that;

$$q_{it} = \eta\rho_{it} + \phi k_{it} \text{ where } \phi > 0 \dots \dots \dots (3.7)$$

Where ρ_{it} is the log of firm's output price and η is the demand elasticity which is negative in this case denoting the downward sloping demand curve facing the firm. Assuming the innovation capability variable k_{it} has a positive coefficient ϕ , would imply that increased innovative activity shifts the enterprise demand curve outwards as it makes the enterprise product more attractive to its customers at any given price level or reduces the cost of producing the product.

Since $r_{it} = \rho_{it} + q_{it}$ and $\rho_{it} = \phi k_{it} - \eta q_{it}$ from equation (3.7), combining equation (3.6) and (3.7) yields an equation for revenue as follows;

$$r_{it} = \left\{ \frac{\eta+1}{\eta} \right\} (a_{it} + \alpha c_{it} + \beta l_{it}) + \left\{ \frac{\gamma(\eta+1) - \phi}{\eta} \right\} k_{it} \dots \dots \dots (3.8)$$

Equation (3.8) implies that innovation capability of firm is likely to contribute to the firm's sales revenues and, therefore, growth of the firm through two channels (Hall, 2011; Subrahmanya, 2011). The first channel is through improved efficiency in the firm's production technique due to innovation output. The second channel is through a shift in demand curve for the firm's products outward thus enlarging its market. The latter happens if η is negative, implying an inelastic demand to the firm's products. An outward shift of the demand curve also implies a higher willingness to pay more for the same good or for a higher quality good. This is clear from equation (3.8) where the term $\left(\frac{-\phi}{\eta} \right)$ will be positive.

An important observation depicted in equation (3.8) is that one can predict *a priori* that with innovation inputs directed towards product innovation, the effects on revenue productivity and labour demand is most likely to be positive (Hall, 2011). However, for process directed innovation inputs, the effect on revenue productivity is likely to depend on the relative elasticities of demand for the firms products and therefore ambiguous since the sign for $\gamma \left(\frac{\eta+1}{1} \right) / \eta$ is indeterminate *a priori*.

From this theoretical framework therefore, innovation inputs in form of research and development and other innovation activities of firms should lead to increase in a firm's innovation capability captured as K in equation (3.2). Over time, increase in innovation capability should lead to a shift in demand curve facing the firm as it extends its market through introduction of new innovative products and processes.

To estimate equation (3.3), Loof and Heshmati (2002), re-specified the production function as follows;

$$q = \alpha_0 + \sum_j \beta_j x_j + \gamma_k k + \varepsilon \dots \dots \dots (3.9)$$

Where q represents output produced by a firm expressed in log form, α_0 represents an intercept to be estimated, β_j represents the elasticity of output with respect to a vector of inputs, x represents a J vector of standard input variable like physical capital, labour, other material inputs and human capital. The variable k , is the innovation output or knowledge capital while γ_k represents the elasticity of output with respect to knowledge capital and ε represents a residual term. Loof and

Heshmati, (2002), however, argued that equation (3.9) fails to show the structural relationships through which a firm's investment in innovation activities is transformed into knowledge capital. The firm's production framework can be extended into a structural model based on a knowledge production framework initially developed by Pakes and Griliches (1984) and later by Crepon *et al.*, (1998).

3.3.2 Knowledge Production Framework

The approach pioneered by Pakes and Griliches (1984) to capture the relationship between innovation and firm growth uses a Knowledge Production Function (KPF). The KPF extends the neo-classical firm growth theory by augmenting the Cobb Douglas production function with knowledge capital. Pakes and Griliches (1984) established that patents can be modelled as a function of time trend t , current and five lagged values of logarithm of research and development expenditures r , and a set of firm specific dummy variables. Pakes and Griliches (1984) developed the KPF where research and development r is transformed into knowledge capital K .

In developing the KPF, Pakes and Griliches (1984) distinguished innovation inputs that consists of research and development, other related investments and the output of innovation investments including proportionate increase in sales due to innovative products. The KPF thus describes a causal relationship between

resources invested in innovative activities and a firm's productivity growth (Legros & Galia, 2012).

According to Griliches (1992) endogenous growth theory emphasize that technical change in a firm is as a result of explicit firm decisions. The presence of a firm's spillover resulting from its past innovation efforts contributes to a build-up of knowledge capital that is a public good which is non-rival and partially excludable. The knowledge capital, K , is defined as the economically valuable technological knowledge existing at a particular time. Change in this technological knowledge capital, $\dot{k} = \frac{dK}{dt}$ thus represent the technological knowledge increments due to a firm's decision to invest in research and development and takes the functional form:

$$\dot{k}_{i,t} = \alpha_i + b_t + \sum_{\tau=0}^5 \theta_{\tau} r_{i,t-\tau} + \mu_{i,t} \dots \dots \dots (3.10)$$

Where;

- \dot{k} represent change in technological knowledge capital over time
- α_i represent firm specific differences in productivity of private research efforts.
- b_t represent time trend
- $r_{i,t-\tau}$ represent research and development expenditure for firm i at time $t-\tau$
- θ_{τ} represent a coefficient
- $\mu_{i,t}$ represent the error term
- i is a subscript representing the i^{th} firm
- t is a subscript representing time

As noted, α_i , represents firm specific differences in research productivity. According to Pakes and Griliches (1984) the differences may arise from varying appropriability environments, opportunities or managerial abilities among firms. This implies that α_i influences \dot{k} and is correlated to $r_{i,t-\tau}$.

The authors, however, argued that for the firms in the sample, α_i is constant over time and thus it is only correlated with the means of the research variables. It therefore follows that:-

$$\alpha_i = \sum_{\tau=0}^5 \psi_{\tau} r_{i,t-\tau} + \mu_i \dots \dots \dots (3.11)$$

Where

$$r_{i,0} = T^{-1} \sum_{t=1}^T r_{i,t}, r_{i,-1} = T^{-1} \sum_{t=0}^{T-1} r_{i,t-1} \dots \dots \dots (3.12)$$

In this model μ_i is assumed to be uncorrelated for the in sample research variables and knowledge increments is, however, directly observable. Pakes and Griliches (1984) argued that the number of patents, p , can be a useful proxy for \dot{k} . Allowing for a time trend, the authors thus formulated the functional relationship between patents and technological knowledge increment as follows:

$$p_{i,t} = d_t + \beta \dot{k}_{i,t} + v_{i,t}^* \dots \dots \dots (3.13)$$

Where p represents the log of patent counts

d_t represents a constant that captures the time trend

β represents a coefficient of estimation

$v_{i,t}^*$ represents the error term and is uncorrelated with \dot{k} and t

$$q_{i,t} = \sum r_{i,t} + u_{i,t} \dots \dots \dots (3.14)$$

Where $q_{i,t}$ denotes the firm growth that results from innovative outputs and $u_{i,t}$ denotes the error term and is assumed to be independent in all the three equations.

Through the KPF, innovation inputs such as research and development are transformed into commercially viable knowledge or innovation outputs. The model by Pakes and Griliches (1984) thus managed to disentangle the relationships between inputs and productivity by introducing an intermediate step, the patent equation $p = k + u_2$. The patent equation thus captures the firm's innovative output. As proposed by Pakes and Griliches (1984) the relationship can be demonstrated through a three step structural model as follows:

$$y_1 = \alpha_0^1 + \sum_m \beta_m^1 x_m^1 + \varepsilon^1 \dots \dots \dots (3.15)$$

$$y_2 = \alpha_0^2 + \beta_k k + \sum_l \beta_l^2 x_l^2 + \varepsilon^2 \dots \dots \dots (3.16)$$

$$y_3 = \alpha_0^3 + \beta_t t + \sum_j \beta_j^3 x_j^3 + \varepsilon^3 \dots \dots \dots (3.17)$$

Where in equations (3.15), (3.16) and (3.17), α_0^1, α_0^2 and α_0^3 are intercepts, β_m^1, β_l^2 and β_j^3 are elasticities with respect to a vector of firm inputs β_k and β_t are elasticities with respect to knowledge inputs and patents or other knowledge outcome respectively. In the same equations y_1 represents the innovation inputs, y_2 represents patents or other knowledge outcomes and y_3 represents firm output. Notations x_m^1, x_l^2 and x_j^3 are m, l, j vectors of variables explaining innovation input, innovation output and growth of a firm respectively. Finally $\varepsilon^1, \varepsilon^2$ and ε^3 are error terms.

The Pakes and Griliches (1984) structural model, being limited to innovative firms only, was faced with undesirable effects of selectivity and simultaneity bias. Crepon, *et al.*, (1998) thus developed an improved model, referred to as CDM model. The CDM model established the relationship between innovation and firm's performance while tackling selection and simultaneity. The model was specified as follows;

$$y_{0i} = \begin{cases} 1 & \text{if } y_{0i}^* = X_{0i}\beta_0 + \varepsilon_{0i} > 0 \\ 0 & \text{if } y_{0i}^* = X_{0i}\beta_0 + \varepsilon_{0i} \leq 0 \end{cases} \dots \dots \dots (3.18)$$

$$y_{1i} = y_{1i}^* = X_{1i}\beta_1 + \varepsilon_{1i} \text{ if } y_{0i} = 1 \dots \dots \dots (3.19)$$

$$y_{2i} = \alpha_{2i}y_{1i} + X_{2i}\beta_2 + \varepsilon_{2i} \text{ if } y_{0i} = 1 \dots \dots \dots (3.20)$$

$$y_{3i} = \alpha_{3i}y_{2i} + X_{3i}\beta_3 + \varepsilon_{3i} \text{ if } y_{0i} = 1 \dots \dots \dots (3.21)$$

Where y_{0i}^* is the latent innovation decision variable that captures the decision of a firm to innovate or not. The variable y_{0i} is the observable binary variable that takes value of 1 for innovative firms and 0 otherwise and α_{2i} and α_{3i} are elasticity coefficients to be estimated. Variables y_{1i} , y_{2i} and y_{3i} represents the innovation input, innovation output and firm growth respectively. The variables X_{0i} , X_{1i} and X_{3i} represented vectors of factor inputs and firm characteristics that influence firm growth. The β_0 and β_1 are vectors of coefficients to be estimated representing the impact of certain factors on the propensity and intensity of a firm's innovation respectively. On the other hand β_2 is a coefficient of a parameter associated with level of innovation and β_3 is a coefficient of a parameter associated with firm's growth. Finally ε_{0i} , ε_{1i} , ε_{2i} and ε_{3i} are errors terms that are assumed to be independent.

The CDM framework starts with a selection equation (3.18) where the firm makes a decision on whether to engage in innovation activities or not. The second decision involves an innovation intensity equation (3.19) whereby for a firm that decides to engage in innovation simultaneously decides how much resources to devote to the innovation activities. In the third part of the model equation (3.20), the innovation output equation, a firm's inputs into the innovation process are transformed into innovation outputs.

In the fourth part of the model the firm growth equation (3.21), a firm's innovation outputs impacts on its growth. Thus under the CDM framework firms invest in knowledge inputs which are transformed into innovation outputs. The transformation process depends on capabilities of firms to transform innovation outputs into new or improved products or processes (Jienwatcharamongkhon & Tavassoli, 2014). It is the innovation output that contributes to higher enterprise growth (Classen, Carree, Gils & Peters, 2013).

3.4 Model Specification

3.4.1 Factors influencing MSE's decision to innovate

To respond to the first objective of analysing factors that influence the decision of a MSE to engage in innovation activities, equation (3.18) was estimated. The decision of MSEs on whether to innovate or not is unobservable. The result of that decision, y_{0i}^* , is, however, observable and it takes a value of one if the MSE

reported that it introduced a product, process, organisational or marketing innovation new to the MSE between the years 2010 and 2012 the study period for which data was available. If no new product, process, organisational or marketing innovation was reported, y_{0i}^* , took a value zero. The variable, y_{0i}^* , thus represents the latent unobserved endogenous variable that captures the firm's decision to innovate or not. This decision is determined by a vector of observable independent variables summarized in, x_{0i} , and other unobservable variables summarized in the idiosyncronatic error term, ϵ_{0i} .

The vector of independent variables, x_{1i} include MSE specific characteristics such as age, size, physical capital, human capital, training intensity, export participation, access to finance, MSE legal ownership structure and regional location. The estimation equation for (3.18) was specified as:

$$\begin{aligned}
 \text{Dummy for innovative/non-innovative MSEs} = & f(\text{physical capital, human capital} \\
 & \text{skills, training intensity, external trade participation, market competition, access} \\
 & \text{to finance, foreign ownership, size, age} \dots \dots \dots (3.22)
 \end{aligned}$$

3.4.2 Factors influencing MSE's innovation intensity

To respond to objective two on factors that influence the intensity of innovation by the MSE, equation (3.19) was estimated. Once the MSE decides to innovate in equation (3.18), then the intensity of innovation was denoted as y_{1i}^* in equation

(3.19), X_{1i} represent the vector of MSEs characteristics influencing innovation intensity and ϵ_{1i} is the error term. The estimation equation was specified given as:
Innovation expenditure per employee = f(predicted innovation propensity, access to finance, physical capital intensity, physical location, human capital, training intensity, market share, affiliation, size, age, export intensity)..... (3.23)

3.4.3 Factors influencing MSE’s innovation capability

In response to the third objective on the factors influencing the ability of MSEs to transform innovative inputs into innovative outcomes, the study estimated equation (3.20) for product, process, organizational and marketing innovation. For MSEs that have decided to innovate in equation (3.18) and (3.19), y_{2i} in equation (3.20) represents the transformation process from innovation input into product, process, organisation and marketing innovation. The estimation equations for (3.20) were specified as:

Product innovation = f(predicted innovation intensity, physical capital, human capital skills, affiliation, ownership structure, source of innovation financing, market share, size, age)..... (3.24)

Process innovation= f(predicted innovation intensity, physical capital, human capital skills, cost of labour, external trade proportion, affiliation, legal ownership status, access to finance, source of innovation financing, age, use of mobile money transactions)..... (3.25)

Organisation innovation = $f(\text{predicted innovation intensity, physical capital intensity, human capital skills, cost of labour, affiliation, market share, access to finance, use of mobile money transactions, size, age}) \dots \dots \dots (3.26)$

Marketing innovation = $f(\text{predicted innovation intensity, physical capital intensity, human capital skills, cost of labour, affiliation, source of innovation financing, age, size}) \dots \dots \dots (3.27)$

3.4.4 Effect of innovation capability on MSE's growth

In response to objective four that examined the effect of innovation capability on growth of MSEs, the study estimated equation (3.21). Equation (3.21) represent an augmented Cobb-Douglas production function where sales, y_{3i} is a function of physical capital inputs, labour inputs and innovation outputs. The MSE growth performance variable, y_{3i} , was proxied by either the log of total sales per employee and/or the employment growth. Given the possibility of simultaneity between innovation outputs and MSE's growth performance, predicted values for product innovation, process innovation, organisation innovation and marketing innovation were used as instruments. A vector of other explanatory variables, X_{3i} that includes firm characterises such as age, size, affiliation, sales per employee, physical location and export sales proportion were also included. The equations estimated were;

MSE employment growth = $f(\text{predicted innovation intensity, predicted product innovation, predicted process innovation, predicted organisation innovation,$

predicted marketing innovation, physical capital intensity, labour, affiliation, sales per employee, age, size)..... (3.28)

MSE log sales per employee = f(predicted innovation intensity, predicted product innovation, predicted process innovation, predicted organisation innovation, predicted marketing innovation, physical capital intensity, physical region location, export sales proportion, age, size)..... (3.29)

3.5 Definition and Measurement of Variables

The operational definitions and measurement of the variables used in the analysis were defined as follows:-

Variable	Definition	Measurement
Innovation decision	The choice to introduce new product, new process, new organisational change or new marketing method or not between the period 2010 to 2012	Dummy=1 if MSE innovated, 0 Otherwise
Innovation intensity	Total expenditures on innovation related activities (R&D, equip., machinery, training) per employee 2010-2012	$\frac{\sum \text{Annual innov. related expenditures 2010 - 2012}}{\text{No. of fulltime employees 2012}}$

MSE growth variables

Employment growth	Percentage change in number fulltime employee between 2010 and 2012	$\left(\frac{\text{No. fulltime employee 2012} - \text{No. fulltime employees 2010}}{\text{No. of fulltime employees 2010}} \right) \times 100$
Sales per employee	Refers to the MSEs sales in Ksh for main product per worker in 2012	$\text{Log} \left(\frac{\text{sales from main product in Kshs for 2012}}{\text{No. of fulltime employees 2012}} \right)$

Variable	Definition	Measurement
MSE's innovation capability (knowledge capital) variables		
Product innovation	Introduction of a new product to the market between 2010 and 2012	Dummy=1 if MSE reported a new product, 0=Otherwise
Process innovation	Introduction of a new process (e.g. automation of manual systems) between 2010 and 2012	Dummy=1 if MSE reported a new process, 0=Otherwise
Organization innovation	Introduction of a new organisational change (e.g. out sourcing) between 2010 and 2012	Dummy=1 if MSE reported a new organisational change, 0=Otherwise
Marketing innovation	Introduction of a new marketing procedure (e.g. branding) between 2010 and 2012	Dummy=1 if MSE reported a new marketing procedure, 0=Otherwise

MSE characteristics variables (X_i)

Physical capital (K)	Tangible assets used for production	$\sum \text{land} + \text{buildings} + \text{machinery} + \text{inventory 2012}$
Phy. capital intensity	Tangible assets used for production per employee	$\frac{\sum \text{land} + \text{buildings} + \text{machinery} + \text{inventory 2012}}{\text{No. fulltime employees 2012}}$
Size MSE	No. of fulltime employees in 2010	Count of number of fulltime employees in 2010 or Dummy=1 if No. of fulltime employees was 1-10, 0 Otherwise in 2010
Age of MSE	No. of yrs. MSE has been operation up to end of 2012	Year 2012 – Year MSE established
Access to internet	No. of yrs. that MSE had internet connection up the year 2012	Year 2012 – Year MSE connected to internet
Prop. employees using	Proportion of fulltime employees to total employees using	$\frac{\text{No. fulltime employees using computers}}{\text{Total employees 2012}}$

Variable	Definition	Measurement
computer skills	computers in their daily operations in 2012	
Prop. skilled fulltime employees production	Proportion of skilled fulltime employees to total number of employees that engaged in the actual production activity in 2012	$\frac{\text{No. skilled fulltime employees in production 2012}}{\text{Total employees 2012}}$
Av. no. of yrs educ. for the production worker	The average number of years of formal education possessed by the production worker	Count of number of years
Managers yrs of experience	Cumulative number of years that the MSE manager has worked in the current sector	Count of number of years
No. of competitors	The number of firms selling MSE's main product	Count of number of competitors
Unregistered firms competition	Response by MSE on existence of other unregistered firms selling the MSE's main product	Dummy=1 if informal competing firms existed, 0 Otherwise
Market share (2010) %	The proportion of the MSEs sales to total sales by all MSEs	$\frac{\text{MSE's sales in 2010}}{\text{Total sales by all MSEs in 2010}}$
Local market size	No. of people with the area MSE operates	Count of the population
Physical location	The either of the 5 regions of Central, Nyanza, Mombasa, Nairobi, Nakuru in Kenya where the MSE operates in.	Dummy =1 if MSE located in Central region, 0=otherwise; Dummy 1= if MSE located in Nyanza region, 0=otherwise; Dummy=1 if MSE located in Mombasa region, 0=otherwise; Dummy =1 if MSE located in Nairobi region, 0=otherwise; Dummy =1if MSE located in Nakuru region, 0=otherwise
External trade participation	Proportion of MSE's annual sales that was exported in 2012	Reported percentages for 2012

Variable	Definition	Measurement
Access to finance	MSE ease of access to finance	Dummy =1 if access is not an obstacle, 0 otherwise; Dummy =1 if access is minor obstacle, 0 otherwise; Dummy =1 if access is a moderate obstacle, 0 otherwise; Dummy =1 if access is major obstacle, 0 otherwise; Dummy =1 if access is a severe obstacle, 0 otherwise
Total labour costs	Total annual expenditure on MSE's employees compensation in 2012	Count of total labour expenditure for 2012
Own-source innovation financing	Internally generated funds used to finance innovation activities	Dummy= 1 if Yes, 0 otherwise
Comm. Bank source	Comm. bank sourced innovation financing	Dummy = 1 if Yes, 0 Otherwise
Prop.of foreign ownership	Percentage of the MSE firm owned by foreign residents	Reported percentages for 2012
Prop.of domestic ownership	Percentage of the MSE firm owned by domestic residents	Reported percentages for 2012
Legal ownership structure	Various categories of MSE ownership structure	Dummy =1 if listed company, 0 otherwise; Dummy =1 if non-listed company, 0 otherwise; Dummy = 1 if partnership, 0 otherwise; Dummy =1 if sole proprietor, 0 otherwise
Mobile money use	Practice of using mobile money transactions in the operations of the MSE	Dummy =1 if Yes, 0 otherwise
Affiliation	Whether the MSE was part of a larger group of firms	Dummy =1 if Yes, 0 Otherwise
Av. length of employment temporary employees	The average length of employment for temporary employees by the MSE in 2012	Reported average for 2012

3.6 Diagnostic Tests

Heteroskedasticity is a common problem with cross sectional survey. For this reason, tests for heteroskedasticity were carried out using the Breusch-Pagan-

Cook-Wisenberg test for heteroskedasticity as well as the Cameron and Trivedi's decomposition of IM-test. Whenever heteroskedasticity was detected, this study made use of robust standard errors to tackle it following Jones (2007).

The study also carried out goodness of fit tests using the Hosmer and Lemeshow (H-L) tests. The H-L test is useful in ascertaining that the expected outcomes from the regression reflect the observations from the data. For the predictors to fit data, it is required that the probability value associated with the H-L test statistic be statistically insignificant (Hosmer & Lemeshow, 2000). When H-L probability is greater than 0.05, then the model fits data well. This implies that the model prediction is not significantly different from the observed values.

To avoid specification errors and ensure models were correctly specified, link tests were also used. The link test requires that the linear predicted value of the model (\hat{y}) is statistically significant whereby p value is less than 0.10 while the square of the linear predicted value of the model (\hat{y}^2) should be statistically insignificant whereby p is greater than 0.10 (Pregibon, 1980). If the model is correctly specified the squared predicted value should not have any explanatory power in the model.

Another common econometric problem is that of multicollinearity. To test for the presence of multicollinearity the study made use of the Variance Inflation Factor (VIF) test. The VIF test statistics provide estimates of the factor by which the variance of the regression coefficient of a variable is inflated compared to the

scenario where there is no correlation between the variable and other explanatory variables (Verbeek, 2012; Green, 2012). Using the VIF test, presence of multicollinearity becomes problematic when VIF is greater than 10. According to Green (2012) the lower the VIF indicates a better overall fit for the model. Murray, Nguyen, Lee, Remwenga and Smith (2012), however, argues that large VIF is not a reason enough to remove predictors from the model especially where dummy variables are involved.

3.7 Data Type and Sources

This study used the World Bank Enterprise firm level survey data collected through stratified sampling techniques. The survey data was nationally representative as the survey used the Kenya National Bureau of Statistics (KNBS) 2012 Census of Business Enterprises (World Bank, 2013). The KNBS Census had 6,147 firms that had more than five employees and another 3,717 firms with five or less employees. Out of the total firms in the Census, the survey interviewed 720 firms with more than five employees and another 360 firms with five or less employees. The survey's unit of study was the physical establishment where the enterprise owners and operators were interviewed.

The MSE data used in this study was extracted from the World Bank Enterprise Survey (ES) and the Kenya Innovation Follow-up Survey (World Bank, 2013). The two surveys contained data collected from enterprises in Kenya for the years 2010, 2011 and 2012. The Kenya Innovation Follow up survey specifically collected enterprise innovation activities. For purposes of this study, the two surveys were

merged using the common variable referred to as "idstd". The data on MSEs was extracted by specifying for enterprises that had 1 up to 50 employees in 2010 in line with the definition of a MSE in RoK (2005). Variables of interest were checked, recoded and transformed where necessary.

The survey captured product, process, organizational and marketing innovation activities that MSEs engaged in during the years 2010, 2011 and 2012. Indicators for MSE growth captured in the survey included changes in number of employees and sales of main product in 2012. Data for MSEs was collected through random stratified sampling technique, where the strata included MSE size, business sector and geographical location. The survey covered five regions of the country including the Central region, Nyanza region, Mombasa region, Nairobi region and Nakuru region. Firm sizes ranged from owner-employee for the micro enterprise to 10 workers/employees while small enterprises were those employing between 11 and 50 employees/workers. The data set was selected on the basis that it was the most comprehensive and up to date recent data on MSEs' innovation in Kenya by the time of the study.

3.8 Data Analysis

To achieve the study objectives one and two that sought to analyse factors that influence choice and intensity of a MSE engaging in innovation activities, equations (3.18) and (3.19) were estimated using the Heckman selection estimation model following Hall, *et al.*, (2008). The choice of Heckman selection model was based on the intuition that factors that explain the MSE's decision to

innovate is usually correlated with the intensity of innovation activities of the MSE. Thus the intensity of innovation is normally embodied in the decision to innovate which is the selection criterion.

The choice of Heckman selection estimation technique was further informed by an expectation that in the survey data, there were many MSEs which did not carry out or did not report any innovation activity during the period of survey. Results of the descriptive analysis reported in Table 4.2 confirmed that 80 out of 573 MSEs had reported zero values. Under such circumstances, self-selection bias in the estimation could not be ruled out. Selection bias leads to biased estimated coefficients and also influences level of significance of the variables (Heckman, 1979; Hanas & Leatherman, 2011). According to Jienwatcharamongkhon and Tavassoli (2014), the Heckman selection model is designed to deal with such selection bias problem.

Equation (3.18) and (3.19) were estimated jointly using the Heckman MLE which is considered relatively more efficient and consistent (Hall, *et al.*, 2008). Furthermore, the Heckman MLE estimator is useful with structural equation models due to the expectation that a number of MSEs chose not to innovate and, therefore, cases of zero values were expected to be many (Hall, *et al.*, 2008). During the estimation, it was assumed that the error term, ε_{1i} and ε_{2i} , are bivariate normal distributions with a mean of zero, variances of $\sigma_1^2 = 1$ and $\sigma_2^2 = 1$ and a correlation coefficient, ρ . Based on the estimation results presented in Table

A2, the Heckman MLE model was unstable with a *rho* value converging to a value of one. Wooldridge (2010) argued that such convergence of *rho* to a value of one implies an unstable model. Thus the estimation results could not be relied upon to confirm the presence or absence of self-selection.

To verify the presence of self-selection the study sought an alternative approach. The alternative estimation approach used was a variation of the Heckman Two Step estimation technique that made use of Sequential Instrumental Variables (IVs). Following Hall, *et al.*, (2008) equation (3.18) was estimated using Probit estimation technique. The predicted probabilities of a MSE having positive innovation effort in estimation results of equation (3.18) and their corresponding Inverse Mills Ratio (IMR) were calculated and stored. Equation (3.19) was then estimated with the control variable X_{2i} . The estimated predicted probabilities and IMR values in equation (3.18) and their squares were included as independent variables. The use of the predicted probabilities and IMR values acted as IVs, helped to resolve potential endogeneity and served to link to the two models into a structural model (Loof & Heshmati, 2006).

In the sequential IV estimation method, the presence of selection bias was tested by checking for the significance of the coefficient of the IMR variable. The coefficient for the IMR variable reported in Table A3 was found to be statistically insignificant. Thus as argued by Hall *et al.*, (2008) equation (3.19) was estimated using an OLS estimation technique. According to Loof and Heshmati (2006) such

a structural model is desirable as it is consistent with the firm innovation decision making.

To achieve the third study objective, four estimation equations under (3.20) representing product, process, marketing and organisational innovation outcomes were estimated using the Probit models. From estimation (3.19), the predicted value of innovation intensity input γ_{2i} was used as one of the independent variables.

To achieve the fourth study objective, the estimation equation (3.21) was estimated using the OLS estimation technique. The choice of OLS as an estimator was because the knowledge production function does not assume any interaction between innovation output and firm growth (Hall, *et al.*, 2008; Hall, 2011; Roper & Love, 2006). From estimation (3.19) the predicted value of innovation intensity input, γ_{2i} , was used as one of the independent variables. In addition product innovation inputs, process innovation input, organisation innovation input and marketing innovation input (the knowledge capital inputs) from (3.20) are also used as independent variables. The use of this instrumental variables helped to reduce the potential endogeneity problem whereby innovation expenditure per employee and innovation outputs were expected to be simultaneously determined. It also links the different models into a structural model.

CHAPTER FOUR

EMPIRICAL FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter presents the results, discussions and findings of the study. The chapter starts with a discussion of the descriptive statistics of the variables used in the analysis. The chapter thereafter presents and discusses the empirical results for each of the four study objectives. Diagnostic test results of various models used in the study have also been presented where applicable.

4.2 Descriptive Statistics

The data used in this study was extracted from the World Bank Enterprise Survey (ES) and the Kenya Innovation Follow-up Survey (World Bank, 2013). Table 4.1 present descriptive summary statistics for the continuous and count variable that were used in the study. The summary statistics presented include the number of observations, mean, standard deviations and the range.

The total sample size for the study was 575 but due to missing observations, the maximum number of MSEs with complete data was 573. As shown in Table 4.1, the size of individual MSEs ranged between 1 and 50 employees in 2010. Due to the growth of some of the MSEs during the three-year period, however, some MSEs had up to 210 employees by the end of 2012. While the average size of a MSE in 2010 was 16.1 employees, it rose to 18.1 employees by the end of 2012.

The descriptive statistics measuring the growth of MSEs through changes in employment and changes in sales show that the mean growth rate in terms of employment was 0.15 per cent while growth in terms of sales averaged 4.22 per cent.

Table 4.1 Descriptive statistics for Continuous and Count Variables

Variable	Obs	Mean	Std. Dev.	Range	
				Min.	Max
Employ. growth (%)	547	0.15	(0.48)	-0.714	3.33
Sales growth (%)	449	4.22	(41.62)	-0.991	749.00
Physical capital (Ksh)	447	37,400,000	(163,000,000)	0	2,600,000,000
Cost of R&D (Ksh)	16	823,617	(1,518,750)	0	5,500,000.00
Innov. expend. per employee (Ksh)	520	191,648	(825,861.70)	0	9,000,000.00
Prop. skilled fulltime employees (%)	235	0.0015	(0.0022)	0	0.02
Prop. employees using computers (%)	406	26.83	(30.87)	0	100
No. of yrs. internet connection (yr)	299	6.48	(4.69)	0	23
Total cost formal training (Ksh)	84	4,995,619	(43,600,0000)	70000	400,000,000
Av. education years for production worker (yr)	233	11.48	(3.68)	1	20
No. of fulltime employees (2010)	547	16.14	(12.89)	1	50
No. of fulltime employees (2012)	567	18.40	(19.55)	1	210

Variable	Obs	Mean	Std. Dev.	Range	
				Min.	Max
MSE Age (yr)	552	19.73	(15.76)	1	85
No. of market competitors	138	13.94928	(45.96132)	1	500
Manager's experience (yr)	560	17.15714	(10.78163)	1	57
Prop. of domestic ownership (%)	567	89.52028	(27.66417)	0	100
Prop. of foreign ownership (%)	566	5.90106	(20.88699)	0	100

Source of Data: World Bank Database (2013)

The mean value of physical capital, which includes the value of land, buildings and equipment owned by the MSE was estimated at KSh 37,400,000 in 2012. This relatively high mean, however, masks the huge disparity in the ownership of physical capital by MSEs. Whereas some MSE were estimated to own zero physical capital, others owned physical capital valued at KSh 2,600,000,000. Such disparities illustrate the heterogeneous nature of the MSE sector in Kenya.

Expenditures on research, development and innovation related activities among the MSEs were found to be either relatively uncommon or under reported. Results in Table 4.1 show that only 16 or 2.8 per cent of the 573 MSEs reported having spent money on research and development. The mean annual expenditures on research and development was estimated to be KSh 823,617.10

The finding on the small number of MSEs reporting research and development echoes the findings in the MSE survey report for 2015. The survey established that MSEs' expenditures on all innovation related research and development activities

accounted for only 0.3 per cent of MSE's total annual expenditures in 2015 (RoK 2016a). The annual mean expenditures on innovation per employee or innovation intensity was estimated KSh 191,648.60. This variable includes expenditures on research and development, innovation related expenditures such as training of employees on innovation, purchases of innovation related equipment and purchases of patents and copyrights.

The results presented in Table 4.1 show that the proportion of skilled employees to total employees among MSEs was 0.15 per cent. The highest proportion of skilled employees by MSEs was estimated at 2 per cent. An average of 27 per cent of MSEs' employees reported to use computers regularly in their daily operations. On average, MSEs indicated that they had been connected to the internet for a duration of 6 years. These findings imply that MSE in Kenya mostly used unskilled labourers who rarely use information technology in their operations. This, therefore, limits the capability of MSEs to benefit from information technology knowledge flows that could be useful in spurring innovations within the sector.

The mean annual expenditure on formal training was estimated at KSh 4,995,619. Disparities of expenditures on formal training by MSEs were, however, relatively big with the lowest spending of KSh 7,000 while the highest spent KSh 400,000,000. With such skewed expenditures in a sector characterized by shortage of skilled workers, the sector is thus likely to continue being quite heterogeneous in terms of human skills development and distribution.

Managerial experience was found to vary considerably. Some MSE managers were reported to have only one year's experience while other managers were reported to have an accumulated experience of 57 years in the particular sector. Table 4.1 shows that the mean number of years of experience by the managers was 17.1 years. Ownership of the MSEs was found to be mostly domestic with a mean of 89 per cent of the MSEs reporting to have full domestic ownership while about 5.9 per cent of MSE indicated some level of foreign ownership. An estimated 41 per cent of the MSE were found to be owned by females.

With reference to the competition within the MSE sector, the mean number of competitors in the market for the main product/service was found to be 13.9 firms. Some MSEs, however, reported to have as many as 500 competitors. This could be interpreted as indication of the high competition that characterizes the MSE sector in Kenya. But this could also be an a pointer to the low levels of innovations whereby MSEs tend to crowd in on similar activities. The finding also conforms to the high number of MSEs reported at 7.38 million in 2015 (RoK, 2061a). In spite of the competition, the average age of the MSE was found to be 19 years with the highest reporting an age of 84 years. A cumulative frequency analysis of the data by age showed that 32 per cent of the MSEs were, however, less than 10 years old. Table 4.2 presents the descriptive statistics of the discrete and categorical variables used in this study.

Table 4.2 Descriptive Statistics for Discrete Variables

Variable	Measurement	Freq.	Percent
Decision to innovate	No	80	13.96
	Yes	493	86.04
	Total	573	100
Product innovation	No	202	35.5
	Yes	367	64.5
	Total	569	100
Process innovation	No	143	25
	Yes	429	75
	Total	572	100
Organization innovation	No	266	46.75
	Yes	303	53.25
	Total	569	100
Marketing innovation	No	219	38.49
	Yes	350	61.51
	Total	569	100
Physical location	Central	83	14.49
	Nyanza	78	13.61
	Mombasa	100	17.45
	Nairobi	241	42.06
	Nakuru	71	12.39
	Total	573	100
Legal ownership status	Shareholding listed	4	0.7
	Shareholding non-listed	77	13.9
	Sole proprietor	204	36.8
	Partnership	270	48.6
	Total	555	100
Access to Finance	Not obstacle	167	29.72
	Minor obstacle	168	29.89
	Moderate Obstacle	120	21.35
	Major Obstacle	66	11.74
	Severe Obstacle	41	7.3
	Total	562	100
Size category	Micro	262	47.9
	Small	285	52.10

Variable	Measurement	Freq.	Percent
	Total	547	100
Informal competition	No	206	37.66
	Yes	341	62.34
	Total	547	100
Affiliated	No	476	83.07
	Yes	97	16.93
	Total	573	100
Use Mobile Money	No	274	47.9
	Yes	298	52.1
	Total	572	100
Own source innov. Funds	Yes	309	80.89
	No	73	19.11
	Total	382	100
Commercial source innov. Funds	Yes	125	32.81
	No	256	67.19
	Total	381	100

Source of Data: World Bank Database (2013)

The descriptive statistics presented in Table 4.2 show that out of the 573 MSEs, 86 per cent reported to have carried out innovation activities during the period 2010-2012. This is a relatively high percentage when compared to the 30 per cent average for overall innovation incidence for Africa, 51 per cent for Europe and 40 per cent for Emerging economies (ILO, 2017). With regard to the various categories of innovation reported by the MSEs during this period, 64.5 per cent of the MSEs reported to have carried out product innovation, 75 per cent reported to have carried out process innovations, 53 per cent reported organisation innovations while 61.5 per cent reported to have carried out marketing innovations. Overall, this implies that MSEs carried out relatively high levels of all types of innovation.

As shown in Table 4.2, the regional distribution of the sampled MSEs for this study indicates that Nairobi region had the largest proportion of MSEs with 42 per cent, followed by Mombasa region with 17.5 per cent. The Central region had 14.5 per cent, Nyanza region had 13.6 per cent while Nakuru region had 12.4 per cent. Analysis of the legal ownership structures of the MSEs indicated that 48.6 per cent were partnerships and 36.8 per cent were sole proprietorship. Approximately 13.9 per cent were shareholding companies that were not publicly listed while 0.7 per cent were shareholding companies that were publicly listed. Thus more than 85 per cent of MSEs fall within the partnership companies and sole proprietorship businesses. Less than one per cent were listed at the securities exchange.

The analysis on MSEs' access to finance presented in Table 4.2 show that 7.3 per cent of the MSE considered access to finance a very severe obstacle, while 11.74 per cent perceived access to finance a major obstacle to their operations. Overall, only 30 per cent of the MSEs perceived access to finance not as an obstacle. Table 4.2 show that 80.9 per cent of the MSEs surveyed use internal or own funds to finance their innovation activities while 19.1 per cent use externally sourced finances to fund their innovative activities.

On MSEs' external linkages, 16.93 per cent of the MSE indicated that they belonged to a larger group of firms while 83.07 per cent were not affiliated. Table 4.2 also show that 52.1 per cent of the MSEs used mobile money to carry out various transactions, while 47.9 per cent did not use mobile money to carry out

transactions. Competition from informal or unregistered firms for their main products/services was reported by 62.3 per cent of the MSEs while 37.7 per cent did not report the presence of informal firms competition for their main product/service.

4.3 Empirical Results

This section presents the empirical findings and discussions for each of the four study objectives. The analysis start with the test for self-selection econometric problem whose results are reported in the Appendix. In all cases, diagnostic test results of various models used in the study have also been presented.

4.3.1 Factors influencing MSEs' decision to engage in innovation activities

The first objective of the study was to analyse factors that influence MSE's decision to engage in innovation activities in Kenya. According to RoK (2016a) significantly fewer micro-enterprises were found to have embraced innovation relative to small enterprises. The analysis was thus carried out with the expectation of the existence of a self-selection econometric problem. As indicated in Table 4.2, 80 out of 573 MSEs reported not to have innovated and thus had zero values. Such zero values were expected to be non-random, especially where MSEs from a specific sub-sector might have chosen not to report innovation output. Such an occurrence could, therefore, constitute a self-selection econometric problem that would make the estimation results biased (Jienwatcharamongkhon & Tavassoli,

2014). Following Hall (2011), to verify the existence or non-existence of self-selection, a Heckman Probit regression model was estimated using both the Maximum Likelihood Estimation (MLE) approach and the Heckman Two Step approach. The regression results output are presented in Table A2 and Table A3.

As shown in Table A2, the results from the Heckman MLE regression model were found to be unstable as the coefficient of ρ converged to a value of one. According to Wooldridge (2010) such convergence of ρ to value of one was an indication of an unstable model. Secondly, the use of Heckman MLE also resulted to the reduction of the sample size to 61 uncensored observations with only eight censored observations. In spite of the model being unstable, the coefficient of IMR was found to be statistically insignificant, an indication that self-selection was not present. However, due to the small number of observations that were censored and the convergence of the value of ρ to one, the study concluded that given the data, the presence of self-selection could not be conclusively confirmed. Such a conclusion, however, does not mean self-selection was not a possibility (Hall, 2011).

Since self-selection could not be ascertained using the Heckman MLE, the study then used the Heckman Two Step method to establish existence or not of self-selection. The results of the estimation are presented in Table A3. Using this approach, the coefficient of error term or λ was found to be statistically insignificant. According to Heckman (1979), this finding confirms that selection

bias was not present in the model. This result thus imply that the error terms ε_{0i} and ε_{1i} for equations 3.18 and 3.19, respectively were, therefore, uncorrelated. Since selection bias was not present, equation 3.18 for analysing factors influencing MSE decision to engage in innovation was, therefore, estimated as a Probit model.

To handle the econometric problem of endogeneity, the study followed Loof and Heshmati (2006) and adopted a sequential IVs approach in carrying out the estimations. This method allows the use of IVs to handle endogeneity and to link the model into a structural model. The sequential IV approach starts with the estimation of a Probit model, equation 3.18, for the factors that influence the MSEs' decision to innovate or not.

The estimation results of the Probit model for the factors influencing MSE's decision to engage in innovation or not are presented in Table 4.3. The specific Probit model estimated was equation 3.22. The dependent variable was a dummy variable, which was equal to one if the MSE reported any category of innovation and zero if no innovation was reported. The explanatory variables were log of physical capital intensity, proportion of fulltime employees in production, average number of education years for the production worker, MSE size, age of MSE, dummy for unregistered firms' competition, dummy for mobile money use, export sales proportion, proportion of foreign ownership, manager's experience and dummies for various levels of access to finance. The results from the Probit output and the marginal effects of the model are presented in Table 4.3.

Diagnostic tests carried out to test the robustness of the model and reported in Table 4.3 show that Wald χ^2 test was 40.38 with a p-value of 0.0004. The Wald χ^2 was statistically significant at one per cent significance level suggesting a statistically significant relationship between the dependent and explanatory variables in the model. The pseudo R^2 for the model was 0.4591 indicating that the explanatory variables explained about 46 per cent of the changes in the dependent variable. As shown in Table 4.3, the p-values for *hat* and *hat squared* were 0.000 and 0.122, respectively. This means that the squared predicted value had no prediction power in the model and that the model was correctly specified (Pregibon, 1980). The test for the null-hypothesis of goodness of fit using Hosmer-Lemeshow (H-L) test shows a chi-square value of 2.5 and a p-value of 0.467. Thus the null hypothesis was not rejected implying that the data fit the Probit model well (Hosmer & Lemeshow, 2000). The mean Variable Inflation Factor was 4.31 indicating that the level of multi-collinearity was below the tolerable levels of 10 (Verbeek, 2012).

The results presented in Table 4.3 show that the estimated coefficient for average number of years of education for the MSE's production employees variable was positive with a marginal effect of 0.002. It was also found to be statistically significant at one per cent significance level. Thus other factors being held constant, an increase in the average number of years of education for the production employees by one year increases the probability of the MSE innovating by 0.2 per cent.

Table 4.3: Probit regression results for factors influencing MSE decision to innovate

Dependant variable = 1 if a MSE reported any (product , process, organization or marketing) innovation between 2010 and 2012 and 0 otherwise					
Independent variables	Coefficient	Robust Std. Error	Z Value	P Value	Marginal effect
Prop.of skilled fulltime employees	0.014504	0.008873	1.63	0.102	0.0001663
Av. no. education years production employee	0.174294***	0.046809	3.72	0.000	0.0019984
Manager experience	-0.0438**	0.0210649	-2.08	0.038	-0.0005022
Log physical capital intensity	0.14483	0.124019	1.17	0.243	0.0016606
MSE Size (2010)	0.510995**	0.248382	2.06	0.04	0.0058591
MSE Age	-0.09324*	0.056209	-1.66	0.097	-0.0010691
MSE Age squared	0.002007**	0.001065	1.88	0.06	0.000023
Prop. foreign ownership	-0.02466**	0.009015	-2.74	0.006	-0.0002828
Prop. exports in total sales	0.007249	0.007118	1.02	0.308	0.0000831
Unregistered firms competition: No (Reference)					
: Yes	-0.15245	0.433538	-0.35	0.725	-0.0017267
Access to finance: Severe obstacle (Reference)					
:Not an obstacle	2.037606**	0.813385	2.51	0.012	0.0102590
:Minor obstacle	1.038806*	0.559494	1.86	0.063	0.0084041
:Moderate obstacle	1.587372**	0.667165	2.38	0.017	0.0184764
:Major obstacle	1.726158**	0.823446	2.1	0.036	0.008230
Mobile money use: Yes (Reference)					
:No	-0.65865	0.665576	-0.99	0.322	-0.0085674
Constant	-3.07652	2.138982	-1.44	0.15	-
Wald $\chi^2(15)$	40.38***	-	-	0.0004	-
H-L $\chi^2(3)$	2.5	-	-	0.467	-
Pseudo R ²	0.4591	-	-	-	-
Link Test : hat	1.2374	0.3452	3.58	0.0000	-
:hat square	-0.10834	0.07008	-1.55	0.122	-
Mean VIF	4.31	-	-	-	-
No.of observations	123	-	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; **denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own computation

Similar studies such as Gebreeysus (2009); Dutz and O'Connell (2013) and Manez, *et al.*, (2013) found access to human skills to be a positive determinant of MSEs' decisions to innovate. Cohen and Levinthal (1990) also found that skilled labour plays a facilitative role in absorption and assimilation of knowledge among firms. This finding gives an indication that higher human capital skills among production employees positively influence MSE decision to innovate. The finding could thus be interpreted in the context that, the higher the level of education for the MSE production employee, the higher the employee's ability to initiate innovative activities.

The estimated coefficient for the proportion of skilled fulltime employees was found to be positive but statistically insignificant. The finding negates the result by Oum, *et al.*, (2014) that access to skills plays a positive role in stimulating MSEs' innovation in Thailand. Overall, the findings on the importance of human capital in firm's innovation are in line with Romer's (1990) endogenous growth theory, which emphasises human capital role in technological innovations. The finding, however, seems to give an indication that it is advanced human capital skills levels for the production employees that is more important in stimulating MSE innovation activities rather than the absolute numbers of skilled employees. Thus employment of more skilled employees without matching their skills levels to the varying MSEs' requirements is unlikely to stimulate innovative activities amongst MSEs.

The estimated coefficient for MSE manager's years of experience in a sector was found to be negative with marginal effect of 0.0005 and statistically significant at 5 per cent level. Thus holding other factors constant, an increase in the MSE's manager years of experience in a particular sector by one year decreases the probability that the MSE will innovate by 0.05 per cent. This means that the higher the number of years of experience the MSE's manager has in a particular sector, the less likely that the MSE will innovate.

The finding was in agreement with the study findings by Gebreeysus (2009) that found managers with less experience more proactive risk takers compared to more experienced managers. This may be an indication that more experienced managers tend to adopt a relatively more risk averse approach towards the uncertainties that characterize the innovation process. The more experienced managers may also tend to be complacent and do not put a premium on innovation. Experienced managers are, therefore, less likely to lead MSEs to engage in innovative activities.

Based on the results presented in Table 4.3, the estimated coefficient for log of physical capital intensity was found to be positive but statistically insignificant. This finding contradicts the arguments contained in the neo-classical and AK model firm growth theories. In these theories, Solow (1956) and AK model by Romer (1994) emphasise capital accumulation and role of embodied technology in enhancing firm innovativeness. The finding, therefore, seems to suggest that the type of MSE's innovative activities during the study period did not require high levels of complimentary physical capital per employee. As a result, physical capital

intensity did not have a statistically significant influence on MSEs innovation activities.

Size of the MSE as measured by number of fulltime employees at the beginning of the study period in 2010, was one of the factors that was found to have influenced innovation activities. Results in Table 4.3 show that the estimated coefficient for size of the MSE was positive with a marginal effect of 0.006 and statistically significant at 5 per cent level of significance. This finding implies that an additional employee by the MSE, other factors remaining constant, increased the likelihood that MSE will innovate by 0.6 per cent. This finding conforms to the Resource Base theory (Penrose, 1959) where the author argues that MSEs that are relatively bigger tend to have accumulated resources that facilitate them to become innovators.

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Cohen and Klepper (1996), Gebreeysus (2009), and Robson, *et al.*, (2009) also found size of the MSE to have positive and statistically significant relationship with a firm's decision to innovate. The authors argue that relatively larger firms enjoy better access to finance and economies of scale. It is also possible that the relatively bigger MSEs may be producing more than one product or service and therefore tend to report introduction of relatively higher number of new innovative products compared to smaller sized one-product MSEs.

With respect to the age of the MSE, the estimation results presented in Table 4.3 show that the estimated coefficient for age of MSE variable was negative with a

marginal effect of 0.001067. The coefficient was statistically significant at 10 per cent level of significance. The coefficient for age squared variable was, however, found to be positive with a marginal effect of 0.000023. The coefficient for age squared variable was also statistically significant at 5 per cent level of significance. The estimation results on MSE's age variable thus confirms that the MSE's decision to innovate and its age exhibits a non-linear relationship. The finding was in line with the creative destructive theories by Aghion and Howitt (1992), which argue that innovation is part of a process of creative-destruction where innovators are expected to be newly established firms. As age increases, MSE are likely to reduce their innovation activities until much later when they have accumulated more experience through a learning process (Gebreeysus, 2009).

According to the results presented in Table 4.3, the estimated coefficient for proportion of foreign ownership variable was found to be negative with a marginal effect of 0.00028. It was also found to be statistically significant at one per cent level of significance. This means that one per cent increase in the proportion of foreign ownership of the MSE decreased the probability of the MSE innovating by 0.03 per cent. The finding further implies that MSEs that have a higher proportion of foreign ownership are less likely to innovate. The finding contradicts the results by other studies such as Roper, *et al.*, (2006), Love, *et al.*, (2014) and Dutz and O'Connell (2013) who found a firm's foreign ownership to be positively related to firm innovation decisions. Robson, *et al.*, (2009) and Dachs, Edersberger and Loof (2007) also found MSEs' external linkages to have a positive and statistically significant influence on a firm's decision to innovate.

In Kenya, the finding that MSEs with higher proportion of foreign ownership are less likely to innovate may be partly explained by the fact that MSEs with high proportion of foreign ownership tend to be affiliates of parent firms that are incorporated abroad. Most of the innovation decisions in these firms are done centrally and tend to emanate from the foreign based parent enterprise. The local enterprise is, therefore, unlikely to initiate its own innovative activities.

Export participation measured by the proportion of export sales to total sales did not have a statistically significant influence on the MSE's innovativeness. As shown in Table 4.3, the estimated coefficient for the proportion of MSE's export sales variable was positive but statistically insignificant. Similar studies by Ayyagari, *et al.*, (2007), Robson, *et al.*, (2009) and Dutz and O'Connell (2013) found export linkage has a positive and a statistically significant relationship with a firm's innovation decision. A study by Hervás-Oliver, *et al.*, (2004) also found the relationship between firms' exports participation and innovativeness to be statistically insignificant.

It is, therefore, likely that MSEs in Kenya producing for export markets do not benefit from knowledge spillover associated with exporting firms. This could be due to the low human capital skills within MSEs that limits their knowledge absorption and assimilation capacity. Thus the largely unskilled labour force that characterise the MSE sector in Kenya could be a limiting factor in the ability to take full advantage of the export/import related knowledge spillover to enhance MSE's innovativeness.

The results presented in Table 4.3 show that the estimated coefficient for the unregistered firm's competition variable was negative and statistically insignificant. The negative sign of the coefficient indicates that competition from unregistered firms had the potential to stifle innovative activities by other MSEs. In Kenya, the large number of unregistered firms make it even more difficult for authorities to enforce intellectual property rights. As a consequence, innovative MSEs are unable to appropriate benefits of innovation. It is likely that the unfair practices such as imitation of innovative firm's products by unregistered firms is responsible for stifling the decisions to innovate by other firms.

A study finding by Robson, *et al.*, (2009) confirms that in Africa, MSEs' innovation tend to be largely confined to imitations with relatively minimal commercial value. According to Aduda and Kaane (1999), the common practice of imitating each others innovation activities among MSE is promoted by lack of fully functional intellectual property rights regulations and a clogged innovation process in Kenya.

Access to finance in the model was specified as categorical variable where "very severe obstacle" category was used as the reference. As shown in Table 4.3, the estimated coefficients for access to finance dummy variables were found to be positive and statistically significant at 5 per cent level when the access to finance was "not an obstacle", "moderate obstacle" and "major obstacle". The marginal effects were found to be 0.01, 0.018 and 0.008, respectively and were all found to be statistically significant at 5 per cent level. With the dummy variable "minor

obstacle”, the coefficient was found, to be positive with marginal effect of 0.008 but statistically significant at 10 per cent level of significance. The overall implication of the finding on access to finance was that, holding other factors constant, MSE decision to innovate was constrained by the MSEs’ varying levels of access to finance.

Thus based on the estimation results presented in Table 4.3, reducing the severity of access to finance from “very severe obstacle” level to “not an obstacle” level increases the probability that the MSE would innovate by 0.0102590. This finding resonates with the study findings by Ayyagari, *et al.*, (2007) who found access to external finance has a significant and positive relationship with a firm’s decision to innovate. Gebreeysus (2009) also found credit constraint to have a negative and statistically significant influence on micro-enterprises innovation capability in Ethiopia. In Kenya, Kiraka, *et al.*, (2013) also found access to finance has a statistically significant relationship with the decision by the MSE to engage in innovation.

Use of mobile money transaction is a technological innovation in Kenya that has been applauded for its contribution in financial deepening and improving access to finance (Islam, Muzi & Meza, 2016). Thus one of the independent variables used in this model was use of mobile money in the MSE’s transactions. Use of mobile money transaction was specified as a categorical variable with “Yes” as the reference category. The estimation results in Table 4.3 show that the estimated coefficient for the “No” category was negative and statistically insignificant. The

finding thus failed to confirm whether use of mobile money technology by MSEs had a statistically significant influence on their decision to engage in innovation activities.

Given that mobile money is an innovation meant to enhance access to finance using information technology, this finding thus negates findings by Ayyagari, *et al.*, (2007) and Kiraka, *et al.*, (2013) who found access to finance to be a statistically significant and positive determinant of a firm's decision to innovate. One possible explanation for this finding could be that MSEs were yet to fully embrace the credit facility availed through mobile money transactions to finance their innovative activities.

To sum up, average number of years of education for the MSEs' production worker, age of MSE, access to finance and size of the MSE are important factors influencing MSEs innovation decisions. Higher foreign ownership and length of manager's experience were found to act as hindrances towards MSEs' decision to innovate. On the other hand, MSE's physical capital intensity, unregistered firms competition, proportion of exports, the proportion of fulltime production workers and the usage of mobile money in MSE's operations were found not to influence MSE's innovation decisions as their estimated coefficients were found to be statistically insignificant.

4.3.2 Determinants of MSE's innovation intensity

The second objective of the study was to establish factors that affect the intensity of MSEs' innovation activities in Kenya. Innovation intensity was measured as the total annual expenditures on innovation related activities per employee in 2012. To achieve this objective, the study estimated equation 3.23 using an Ordinary Least Square (OLS) estimation method. Based on Loof and Heshmati (2006) and the results in Table A2 and A3 where proof of the existence of self-selection could not be verified conclusively, the estimation adopted a sequential Instrumental Variables (IV) approach.

The dependent variable was the log of innovation intensity. The dependent variable was log linearized to reduce the gap between the extreme values of innovation intensity among MSEs (Manning & Mullahy, 2001). Following Hall (2011), the predicted probabilities and Inverse Mills Ratio (IMR) of the MSEs' decision to innovate from the Probit estimation model in equation 3.22, were calculated and saved for use as independent variables in equation 3.23. The two predicted variables acted as Instrumental Variables (IVs) in the innovation intensity estimation equation 3.23. The inclusion of predicted innovation decision probabilities and IMR from equation 3.22 was meant to resolve potential endogeneity problems (Hall, 2011).

Independent variables in equation 3.23 included log of physical intensity, total cost of formal training, the manager's years of experience, access to finance dummies,

physical location dummies, market share, affiliation dummy, proportion of export sales, predicted probability for decision to innovate and Inverse Mills Ratio. Table 4.4 presents estimation results for the factors affecting intensity of MSEs innovation activities in Kenya.

Estimation results presented in Table 4.4 showed the R-squared was 96.28 indicating that the independent variables accounted for about 96 per cent of the variation in the dependent variable. The F-test for overall model fitness was found to be 40.36 with a p-value of 0.0000, an indication that the independent variables included in the model jointly determined the changes in the dependant variable.

The test for multicollinearity using VIF test, found that the mean VIF was 3.16. According to Verbeek (2012), the mean VIF was within the tolerable levels of multicollinearity. As shown in Table 4.4, the p-values for *hat* and *hat* squared were 0.000 and 0.121, respectively. According to Pregibon (1980), this implies that the model specification was correct. Breusch-Pagan and Cook-Weisberg test for heteroskedasticity showed that heteroskedasticity could not be ruled out as the Chi square was 13.61 and it was statistically significant at one per cent level. Thus the model was estimated using robust standard errors.

Table 4.4: OLS regression results factors influencing MSE's innovation intensity

Dependant Variable: Log Innovation Intensity				
Independent variables	Coefficient	Robust Std. Err.	t values	P values
Log physical capital intensity	0.321172***	0.032357	9.93	0.000
Annual cost of formal training	0.014528	0.023559	0.62	0.544
Access to Finance: Severe obstacle (reference)				
:Not obstacle	0.484465**	0.204933	2.36	0.027
:Minor obstacle	0.153791	0.163357	0.94	0.356
:Moderate obstacle	0.115704	0.152144	0.76	0.455
:Major obstacle	0.305195	0.213223	1.43	0.166
Manager's experience	-0.00572	0.005639	-1.01	0.321
Market share (2010)	-0.06702***	0.021954	-3.05	0.006
Prop. of export to total sales	0.002941**	0.001211	2.43	0.023
Affiliated :No (Reference)				
:Yes	0.42369***	0.140523	3.02	0.006
Physical location : Nairobi region (Reference)				
:Central Region	-0.27341**	0.117105	-2.33	0.029
:Nyanza Region	-0.25181	0.179573	-1.4	0.174
:Mombasa Region	-0.16001	0.111928	-1.43	0.166
:Nakuru Region	0.188058	0.246892	0.76	0.454
Innovation decision predicted values (p1)	-0.00334	0.005068	-0.66	0.516
Inverse Mills Ratio (IMR) ²	0.416442	0.256256	1.63	0.118
Constant	-1.93284***	0.36436	-5.3	0.000
F(16, 23)	40.36	-	-	0.0000
R-squared	0.9628	-	-	-
Root MSE	0.20026	-	-	-
Link-test: hat	0.85277***	-	-	0.0000
hat square	0.04107	-	-	0.121
Mean VIF	3.16	-	-	-
Breusch-Pagan test	13.61	-	-	0.0002
Number of observations	40	-	-	-

Notes: Asterisk *** denotes significance at 1 percent level of significance $p < 0.01$; ** denote significance at 5 percent level $p < 0.05$ and * denote significance at 10 percent level $p < 0.1$

Source of data: Own computation

Going by the estimation results presented in Table 4.4, the coefficient for log of physical capital intensity variable was found to be positive with a magnitude of 0.32. The coefficient was also statistically significant at one per cent level of significance. The results implies that the elasticity of innovation intensity to physical capital intensity was 0.32. This in turn means that a one percentage point increase in MSE's physical capital intensity, results in 0.32 percentage points increase in innovation intensity, *ceteris paribus*. The finding was in line with studies by Crepon, *et al.*, (1998) and Loof and Heshmati (2006) who found physical capital intensity to have positive and statistically significant influence on innovation intensity. According to Vivarelli (2014), MSEs with higher physical capital intensity are also likely to be firms that have acquired external knowledge embedded in machinery and equipment.

The finding also suggests that MSEs with higher physical capital resources per employee in terms of machinery, equipment, vehicles, land and buildings, are likely to devote more resources and investments towards innovative activities. This is because firms with higher physical capital intensity tend to be in the growing stage where the return on innovation expenditures is likely to be relatively higher (Tavassoli, 2014). Another intuition from this result could be that MSEs with relatively higher physical capital intensity are the high growth sectors such as pharmaceutical or ICT firms that also tend to spend relatively more resources on research and development as well as the innovation inputs.

The results presented in Table 4.4 indicate that annual cost of training did not have a statistically significant influence on innovation intensity. The estimated coefficient for annual total cost of formal training variable though positive was found to be statistically insignificant. Ordinarily, firms train their workers with an aim of imparting practical skills to the workers. This finding, therefore, seems to contradict that of Crepon, *et al.*, (1998) and Loof and Heshmati (2006) who found human capital skills levels to have positive and statistically significant influence on innovation intensity.

The results may be an indication that in Kenya MSE's innovation does not entail formal training of their workers. Alternatively, it is also possible that as much as MSEs spend on training, the skills imparted through formal training do not match the MSE's skills requirements. Some of the skills that enable MSEs to innovate are passed on through unpaid for apprenticeship training activities. In reality, MSEs gain much more from tailor-made informal/on the job training or skills upgrade which is meant to respond to specific skills gap identified and not through formal training. Thus the overall annual cost of formal training for MSEs has no statistically significant influence on innovation expenditure per employee.

Based on the results summarised in Table 4.4, access to finance by a MSE had a positive impact on innovation intensity. The variable was estimated as a categorical variable with varying degrees of MSEs' access to finance. The category "very severe obstacle" was used as the reference. The study found the estimated coefficient for the access to finance "not an obstacle" category was positive 0.48

and statistically significant at five per cent level of significance. The coefficients for the other levels of access to finance categories including “minor obstacle”, “moderate obstacle” and “major obstacle” were found to be positive though not statistically significant. The finding implies that reducing access of finance from “very severe obstacle” to “not an obstacle” increases MSE’s innovation intensity by 48.5 percentage points, other factors held constant.

The finding resonates with the finding by Kiraka, *et al.*, (2013) who found innovative intensity by MSE’s in Kenya to be largely confined to introduction of new products in the period immediately after obtaining a loan. Similarly Oum, *et al.*, (2014) also found ease of access to external financial resources to be an important determinant of MSEs innovation intensity in ASEAN countries of Thailand, Indonesia, Malaysia, Philippines, Vietnam, Cambodia, Lao PDR and China. Based on this finding, it could, therefore, be argued that eliminating access to finance barriers for MSEs has a positive and statistically significant influence on the level of MSE’s innovative intensity.

The estimated coefficient for market share variable was found to be negative 0.067. The coefficient was statistically significant at a one per cent significance level. This finding gives an indication that a one per cent increase in the MSE’s market share resulted into the reduction of the MSE’s innovation intensity by about 6.7 percentage points. Vossen (1999) found similar results and concluded that possession of market power is not conducive for innovation activities. The finding seems to contradict the Schumpeterian assertion that monopolistic firms have more

incentive to devote higher expenditures to innovation activities compared to competitive firms as they are in a better position to appropriate returns to innovation (Klette & Kortum, 2004).

The finding seems to suggest that a relatively larger market share for MSE acts as a deterrent to innovation intensity. This may arise from the fact that MSEs with higher market shares are able to erect entry barriers to MSEs with small market shares. This way they do not have to spend more on innovation activities as the threat of entry is limited. The result was, however, rather paradoxical given that MSEs in Kenya are associated with high levels of competitive behaviour and entry barriers are substantially low. Thus MSEs with higher market share would be expected to constantly engage in innovative activities to retain their market leadership. One possible explanation for this result is that even for MSEs with larger market shares, their innovation is the marginally imitative type of innovation that does not require higher innovation intensity.

The estimation results presented in Table 4.4 show that the estimated coefficient for the manager's years of experience variable was negative and statistically insignificant. Thus from this study, a manager's experience does not have a statistically significant influence on the MSE's innovation intensity. The negative sign on the coefficient for managers experiences allude to the fact that more experienced managers are likely to be more risk averse compared to the relatively inexperienced managers. Thus the MSEs they manage are likely to spend relatively less on innovation activities.

Micro and small enterprise's export participation was found to have a statistically significant influence on its innovation intensity. The estimation results summarised in Table 4.4 show that the coefficient of the proportion of export sales variable was positive and statistically significant. The estimated coefficient was found to be positive with a magnitude of 0.003 and was statistically significant at a 5 per cent level. This means that other factors remaining constant, a one-percentage point increase in a MSE's proportion of export sales increased its innovation intensity by 0.3 percentage points.

The finding is in line with the study findings by Ayyagari, *et al.*, (2007) who found foreign competition to be a predictor of MSEs' levels of innovation activities. Exporting firms often face stiff competition at the international market levels and have, therefore, to put more resources towards innovation to ensure their survival. Ayyagari, *et al.*, (2007) also argued that exporting MSEs may have relatively higher and better access to external financial resources which they can devote toward innovation.

Micro and small enterprise's affiliation was measured as a categorical variable where "No" was the reference category. The estimated coefficient for MSEs' affiliated to other firm(s) was found to be positive with a magnitude of 0.42 and statistically significant at one per cent level. This implies that a MSE by being affiliated, increases its innovation intensity by 42 percentage points compared to a MSE that is not affiliated. The finding corroborates the results by Dutz and O'Connell (2013) and Goedhuys (2013) who found external firm linkage to be a

statistically significant factor in influencing innovation intensity among firms. The finding may be due to the fact that affiliated MSEs have more diversified resource base such as skilled labour, financial resources and markets which exert some positive spillover to its affiliates. Operation of different MSE establishments at different localities may also be interpreted as one way of risk diversification and management strategy. Operators of such MSEs are, therefore, likely to put relatively higher investments towards the equally risky and uncertain innovative activities.

Physical location of a MSE was found to be a predictor of its innovation intensity. The physical location variable was specified as a categorical variable with Nairobi region as the reference. Results presented in Table 4.4 show that the coefficient for physical location category for Nyanza and Mombasa regions, were negative and statistically insignificant. The coefficient for Nakuru region was found to be positive but also statistically insignificant. The coefficient for Central region was found to be negative with a magnitude of 0.27 and statistically significant at 5 per cent levels of significance. This implies that holding other factors constant, a MSE located in the Central region would be associated with a 0.27 percentage points lower innovation intensity as compared to one located within Nairobi region. The finding corroborates study results by Tavassoli (2014) who found that larger functional regions are associated with better purchasing power, superior supply and demand conditions and knowledge spillover. These characteristics spur a firm's innovation expenditure and hence innovation intensity.

Thus the finding on physical location may be attributed to the fact that functional regions like Nairobi presents relatively larger market opportunities, better accessibility to financial resources and higher skills levels, which may in turn act as an incentive for higher levels of innovation activities by the MSEs. Similarly, Nairobi region encompasses higher competition and MSEs have to invest relatively more resources towards innovation activities in order to ensure their survival. For the other regions, the coefficients had a negative sign confirming that location away from Nairobi, the capital city offers MSEs less opportunity and inadequate challenge to intensify their innovation activities.

The coefficients for predicted value for the MSE decision to innovate variable was found to be negative and statistically insignificant. This finding implies that the decision to innovate did not influence the MSE's innovation intensity. The finding is line with ILO (2017) study, which reported that innovation intensity in developing countries tend to be relatively low. The finding may also be an indication that innovations among MSEs in Kenya do not require high innovation related expenditures such as research and development, training activities or purchase of innovation related equipment/machinery. This is probably because most of the MSE's innovations tend to be marginally imitative innovations that entail simple product and process replications. It is also likely that MSE operators/owners interviewed may have had differing understanding of what constitutes research and development or innovation related expenditures leading to underestimation of innovation expenditures.

In summary, the estimation results summarised in Table 4.4 show that log of physical capital intensity, affiliation to other MSEs, physical location, proportion of export sales, market share and access to finance were statistically significant factors influencing the intensity of MSEs' innovation activities. The results also indicate that cost of formal training, predicted innovation decision and manager's experience did not exert statistically significant influence the intensity of MSEs' innovation activities. The coefficients for these variables were found to be statistically insignificant.

4.3.3 Determinants of innovation capability

The third objective of the study was to ascertain the determinants of innovation capability among MSEs in Kenya. The objective sought to analyse factors that determine MSE's ability to successfully introduce product innovation, process innovation, organizational innovation or marketing innovation during the 2010-2012 period. The choice of the 2010-2012 study period was based on the fact this was the period during which World Bank survey data on innovation was available.

Following Mohnen and Hall (2013), innovation capability was measured through use of dummy variables for the four types of innovations namely; product innovation, process innovation, organisation innovation and marketing innovation. The dummy variable for each of the four categories of innovation took a value of one if the MSE reported to have successfully introduced a new product, new process, new organisation or new marketing innovation and a value of zero otherwise. Four equations were, therefore, estimated using a Probit model for each

category of innovation. The estimation results are presented in the sections that follow.

Determinants of product innovation capability

Successful introduction of a new product for the period 2010-2012 was taken as positive outcome indicating the MSE's product innovation capability. Equation 3.24 was estimated where the dependent variable was a dummy variable equal to one if the MSE reported to have introduced a new product and zero if no new product was introduced between 2010 and 2012.

The explanatory variables in the model included predicted innovation intensity, log of physical capital intensity, proportion of skilled fulltime employees, average length of employment for temporary employees, MSE affiliation status, proportion of domestic ownership, size of MSE, age of MSE, local market size, own source of innovation funds dummy, mobile money use dummy, proportion of employees using computers and average number of education years for production employee. The estimation results for the Probit model are presented in Table 4.5.

As presented in Table 4.5, the Wald χ^2 test statistic was found to be 33.62 with a p-value of 0.0039. Since the Wald χ^2 statistic was statistically significant at one per cent level, the results show that the explanatory variables in the model jointly predict product innovation capability. The pseudo R^2 for the model was 0.563 indicating that the explanatory variables account for about 56 per cent of the changes in the dependent variable. To verify model specification, a link-test was

performed and as shown in Table 4.5 the p-values for *hat* and *hat squared* were 0.022 and 0.714, respectively. The model was thus correctly specified (Pregibon, 1980). The test for the null-hypothesis of goodness of fit using Hosmer-Lemeshow (H-L) test shows a chi-square value of 1.13 and a p-value of 0.771. This H-L test result implies that the null hypothesis was not rejected. According to Hosmer and Lemeshow (2000), the specified Probit model fits the data. A test for multicollinearity found a mean VIF of 6.43. According to Verbeek (2012) this was an indication that multicollinearity was within the acceptable levels of below 10.

Results presented in Table 4.5 show that the estimated coefficient of predicted innovation intensity variable was positive with marginal effect of 0.240 and statistically significant at one per cent significance level. This implies that a one per cent increase in the predicted innovation intensity, holding other factors constant, increased the probability of the MSE successfully introducing a new product by 24 per cent. Thus, innovation intensity for MSEs, was associated with a successful introduction of new products. The finding was line with studies by Tavassoli (2014) and Goedhuys (2007) in Tanzania which found that a firm's research and development intensity positively influences its product innovation capability. The results suggest that higher expenditures directed towards innovation activities is likely to contribute to successful introduction of new product innovations by MSEs.

Table 4.5: Probit Estimates for the determinants of MSEs product innovation capability

Dependent variable = 1 if MSE reported product innovation (between 2010 and 2012), 0 otherwise					
	Coefficient	Std. Err.	Z	P value	Marginal effect
Independent Variables					
Predicted innovation intensity (p2)	2.18975***	0.802872	2.73	0.006	0.240774
Log physical capital intensity	0.342648*	0.185997	1.84	0.065	0.037676
Prop. skilled fulltime employees	-1.192531**	0.469743	-2.54	0.011	-0.13112
Av. no. of yrs of educ. Prod. employee	0.0070018	0.079002	0.09	0.929	0.00077
Av. employ. length temporary employees	0.0074387*	0.004176	1.78	0.075	0.000818
Prop. of employees using computers	0.0227005	0.015351	1.48	0.139	0.002496
Local market size	0.8939995	1.198949	0.75	0.456	0.097735
Market share-2010	-0.6147487**	0.312165	-1.97	0.049	-0.06759
MSE Age	0.1928079*	0.106612	1.81	0.071	0.0212
MSE Age Squared	-0.0031858**	0.001640	-1.94	0.052	-0.00035
MSE size -2010	-0.2293591	0.142216	-1.61	0.107	-0.02522
Prop. of domestic ownership	0.0347803**	0.014457	2.41	0.016	0.003824
Affiliated : No (Reference)					
: Yes	3.805264***	1.287445	2.96	0.003	0.281962
Own source innovation. funds : No(Reference)					
: Yes	-0.6052487	0.957312	-0.63	0.527	-0.08776
Mobile money use: No (Reference)					
: Yes	0.6457029	0.878743	0.73	0.462	0.073898
Constant	-21.82702***	7.401991	-2.95	0.003	-
Wald $\chi^2(15)$	33.62***	-	-	0.003	-
Link-test: hat	1.099**	-	-	0.022	-
: hat square	-0.1095	-	-	0.714	-
H-L $\chi^2(3)$	1.13	-	-	0.771	-
Mean VIF	6.43	-	-	-	-
No. of observations	37	-	-	-	-
Pseudo R ²	0.5634	-	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; ** denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own computation

Physical capital intensity for the MSE was found to positively influence the probability of the MSE introducing new product. Results presented in Table 4.5 show that the estimated coefficient for log of physical capital intensity variable was positive with a marginal effect of 0.037 and statistically significant at the 10 per cent significance level. Thus holding other factors constant, a one percentage point increase in physical capital intensity was associated with an increase of 0.037 in the probability that the MSE will introduce a new product. Jienwatcharamongkhol and Tavassoli (2014) and Hall, *et al* (2008) also found physical capital intensity to have a positive influence on product innovation.

The result suggests that MSEs with higher physical capital per employee are likely to benefit from knowledge embedded within the physical capital such as equipment and machinery thereby increasing their prospects of producing innovative products. Higher physical capital intensity is also normally associated with high growth sectors such as chemical manufacturing and pharmaceutical manufacturing, information technology where prospects of introduction of new products are usually higher. This is because innovation expenditures, especially research and development, is relatively higher within the high growth sectors compared to low growth sectors.

The estimated coefficient for proportion of skilled fulltime employees' variable was found to be negative with a marginal effect of 0.131. It was found to be statistically significant at 5 per cent significance level. This implies that a one per cent increase in the proportion of skilled fulltime employees increased the

probability that the MSE will not introduce a new product by 13.1 per cent. The result contradicts the findings by Jienwatcharamongkhon and Tavassoli (2014) which established that human capital skills have a positive and statistically significant influence on product innovation. The finding is also a departure from Romer (1994) where the expectation would be that a higher proportion of skilled employees would positively influence MSE's ability to introduce new products.

One possible explanation for the inconsistency in this finding would be that MSEs in Kenya are not attractive to the highly skilled labour. This is partly because of the negative perceptions about it, the precarious nature of employment in the sector and the fact that it presents a low potential for professional development and personal growth for skilled workers. It is therefore likely that skilled workers working for MSEs are part of the underemployed worker force who are searching for better job opportunities. Such workers tend to be demotivated and a high proportion of such workers in a MSE may reduce its capability to introduce new products.

The estimated coefficient for average number of years of education for a typical production worker variable was found to be positive but statistically insignificant. The finding seems to suggest that more years in formal education for MSE production workers without matching technical skills that are relevant for MSEs has no statistically significant influence on the MSE's product innovations. The finding contradicts the results shown in Table A1 for the mean comparison test (t-test) on the number of years of education for the skilled production worker for

innovative and non-innovative MSEs. The mean difference was found to be statistically significant at 5 per cent level. The mean number of years of education for the skilled production worker was 11.653 years while that of a non-innovative MSE was 10 years.

The 10 years of education in Kenya implies that such a worker was probably a primary school graduate. Results in RoK (2016a) also show that 71.1 per cent of informal MSEs workers had primary level of education as their highest educational attainment. The findings may thus be a pointer that the low skills level that characterizes production level workers within the MSE sector in Kenya hinders MSE's product innovation capability.

The results summarised in Table 4.5 showed that the average length of employment period for temporary employees by a MSE, had a positive influence on the capability of the MSE to introduce a new product. The estimated coefficient for average length of employment period for temporary employees variable was found to be positive with marginal effect of 0.000818 and statistically significant at a 10 per cent significance level. The finding implies that, other factors remaining constant, an increase in the average length of employment period for temporary employee by one per cent increases the probability that a MSE would successfully introduce a new product by 0.08 per cent.

The finding conforms to the ILO (2017) study, which found that innovative firms tend to employ more temporary workers than non-innovative firms. According to

the ILO (2017), the incidence of temporary employees has been on the rise with the onset of internet. The finding, however, seems to allude to the fact that by shortening the average length of full-time temporary workers through use of practices such as online outsourcing, MSEs could be undermining their product innovation capabilities.

The estimated coefficient for the proportion of employees regularly using computers variable was also found to be positive but statistically insignificant. Thus advanced information technology skills such as computer skills are yet to have a positive influence on MSE's product innovation capability. The findings on education levels of a production worker and computer skills level are in contrast to the study by Jienwatcharamongkhol and Tavassoli (2014) who found advanced human capital skills positively influencing a firms' product innovation. This may be an indication that in Kenya, MSE product innovation is limited to simple imitations where highly skilled workers are not a necessity.

The estimated coefficient for local market size variable was also found to be positive but statistically insignificant. The finding contradicts the results of a study by Karlsson *et al.*, (2009) who found that local demand conditions such as proximity to relatively larger local markets act as stimulants for firms to introduce new products. Higher market share of a MSE was, however, found to negatively influence MSE's capability to introduce new products. The estimated coefficient for market share variable was found to be negative with marginal effect of 0.068 and statistically significant at 5 per cent significance level. The implication of the

finding was that a one per cent increase in the market share of a MSE was associated with a decrease of 0.068 in the probability that the MSEs would introduce a new product. Vossen (1999) found similar results and concluded that possession of market power is not conducive for innovation activities. The expectation would be that MSEs with higher market share would constantly engage in innovative activities to retain their market leadership. The finding thus seems to suggest that MSE's market power dampens its incentive and capability to pursue new product innovation.

Age of the MSE was found to be an important predictor of its product innovation capability. The relationship was, however, found to be non-linear. The estimated coefficient for the age variable was found to be positive with a marginal effect of 0.021 and statistically significant at 10 per cent significance level. The estimated coefficient for the age squared variable, on the other hand, was found to be negative with marginal effect of 0.00035 which was statistically significant at a 10 per cent significance level. This implies that increase in the age of a MSE increased the probability that the MSE would introduce a new product, holding other factors constant. Beyond a certain age limit, however, increase in the age of a MSE reduces its chances of introducing a new product into the market.

The finding was in line with results by Aghion and Howitt (1992) who found a non-linear relationship between age of a MSE and its product innovation capability. The implication of this finding was that product innovation tends to be associated with newly launched MSEs rather than the older MSEs. Furthermore,

newly launched MSEs are considered more flexible in general management practices and more experimental than older MSEs.

The proportion of domestic ownership of a MSE was found to have had a positive influence on the capability of a MSE to introduce a new product. As illustrated in Table 4.5, the estimated coefficient for proportion of the MSE's domestic ownership was found to be positive with a marginal effect of 0.00038 and statistically significance at 5 per cent significance level. This implies that other factors held constant, a one per cent increase in the proportion of domestic ownership of the MSE increased the probability that it would introduce a new product by 0.04 per cent.

Contrary to this finding, studies by Roper and Love (2006) and Dachs, *et al.*, (2007) found that firms with higher proportion of foreign ownership tend to be associated with higher levels of product innovation capability compared to those that have lower foreign ownership. The authors argued that foreign owned firms have better access to multinational capital knowledge flows. Goedhuys (2007), however, found a weak linkage between foreign firm spillover and firm's product innovativeness in Tanzania. This finding may thus be an indication that the MSEs in Kenya with high foreign ownership lack technology absorption capacity. For this reason, such MSEs are unable to benefit from foreign knowledge capital spillover and improve their product innovativeness capabilities.

Micro and small enterprise's affiliation to other firms positively influenced the MSE's product innovation capability. The affiliation status variable was specified as a categorical variable with a category of "No" as the reference category. From the results presented in Table 4.5, the estimated coefficient for "Yes" category was found to be positive with a marginal effect of 0.282 and statistically significant at one per cent significance level. Thus, holding other factors constant, an affiliated MSE had 28 per cent higher probability of introducing a product innovation compared to a MSE that was un-affiliated.

The finding conforms to the study findings by Roper and Love (2006) who found a positive relationship between affiliated firms and their product innovation capability. The finding seems to suggest that MSEs that are part of larger group are able to tap into wide resources, wide markets and are, therefore, able to introduce new products. As affiliates of other firms, such MSEs are also likely to be less risk averse to product innovation.

The estimated coefficient for own source of innovation funds variable was found to be negative and statistically insignificant. This finding suggests that MSE's internally generated finances were not statistically significant as a source of resource for financing product innovations. It was thus possible that due to limited financial resources, MSEs without external source of funds would rather devote more of their financial resources to other production activities as opposed to product innovation. This gives the impression that product innovation was a low priority MSE's expenditure item. The finding was in line with the RoK (2016a)

survey that found that MSEs in Kenya devoted only about 0.3 per cent of their total expenditures in 2015 to innovation activities.

Use of mobile money by MSEs in its operations was found not to have had a statistically significant influence on the MSEs product innovation activities. In the estimation, use of mobile money variable was specified as a categorical variable with “no” response as the reference category. The estimated coefficient for the “yes” category was positive but was statistically insignificant. The finding suggests that MSEs’ use of mobile money transactions was yet to gain traction as a source of credit that could be invested for purposes of product innovations. This could have been due to the short-term nature of mobile money credit or the relatively high cost of such credit. Most MSEs also tend to use mobile money platform for making and receiving payments and not necessarily as an instrument for saving and receiving credit.

To sum up, the determinants of MSEs product innovation capability include innovation intensity, physical capital intensity, age of MSE, average length of employment for temporary workers, affiliation status and proportion of MSE domestic ownership. Higher proportions of skilled fulltime labour and higher market shares seems to act against higher product innovation capability.

Determinants of process innovation capability

In the analysis of process innovation capability, introduction of a new process innovation during the period 2010-2012 was taken as positive indicator of MSE's process innovation capability. Process innovation in the survey data encompassed activities such as automations of manual systems and adoption of new efficient production technologies. Equation 3.25 was estimated whereby the dependent variable was a dummy variable equal to one if the MSE reported to have introduced a new process innovation and zero if no new process innovation was introduced between 2010 and 2012.

The explanatory variables included in the model were predicted innovation intensity, log of physical capital intensity, age of MSE, proportion of skilled fulltime employees, mobile money use, access to finance, proportion of export sales, legal status, unregistered firm competition, own source of innovation funds and annual total cost of labour. The estimation results are summarised in Table 4.6.

The estimation results presented in Table 4.6 shows that the Wald (χ^2) test statistic was 47.45 with a p-value of 0.0002. Thus the Wald (χ^2) test statistic was statistically significant at one per cent level of significance. This implies that the explanatory variables in the model jointly predict process innovation capability. The pseudo R^2 for the model was found to be 0.4566 indicating that the explanatory variables accounted for about 46 per cent of the changes in the dependent variable.

Table 4.6: Probit Estimates for the determinants of MSEs process innovation capability

Dependent variable = 1 if MSE reported process innovation (between 2010 and 2012), 0 otherwise					
Independent Variables	Coefficient	Robust Std. Err.	Z	P>z	Margin al effect
Predicted innovation intensity (p2)	0.8666518	1.344247	0.64	0.519	0.005901
Log. physical capital intensity	-1.369245	1.174105	-1.17	0.244	-0.00932
Prop. skilled fulltime employees	2.626974**	1.306468	2.01	0.044	0.017886
Annual cost of labour	-0.8951531**	0.434278	-2.06	0.039	-0.00609
Prop. export sales to total sales	-0.0326266**	0.016566	-1.97	0.049	-0.00022
Unregistered firms competition: No (Reference)					
:Yes	-3.420985*	2.019539	-1.69	0.09	-0.49871
MSE Age	-0.0640991	0.132649	-0.48	0.629	-0.00044
MSE Age Squared	0.0048155	0.002988	1.61	0.107	3.28E-05
Mobile money use : No (Reference)					
: Yes	6.553242**	3.271074	2	0.045	0.727535
Access to Finance: Severe obstacle (reference)					
:Not an obstacle	-5.270508*	2.869194	-1.84	0.066	-0.97554
:Minor obstacle	-4.2703	2.678263	-1.59	0.111	-0.72118
:Moderate obstacle	0.0300681	1.745795	0.02	0.986	0.000205
:Major obstacle	2.760672	2.183967	1.26	0.206	0.008352
Own source of innovation fund: No (Reference)					
: Yes	4.003002**	2.008493	1.99	0.046	0.024781
Legal ownership status: Shareholding listed (Reference)					
:Shareholding non-listed	10.52403*	5.708954	1.84	0.065	0.41205
:Sole proprietor	1.274723	2.105514	0.61	0.545	0.007477
:Partnership	-5.65418***	2.039845	-2.77	0.006	-0.98965
Constant	32.02671***	11.09622	2.89	0.004	-
Wald (χ^2) (18)	47.45***	-	-	0.0002	-
Link-test: hat	2.904**	-	-	0.023	-
: hat square	-1.241	-	-	0.117	-
H-L (χ^2) (3)	5.13	-	-	0.1628	-
Mean VIF	9.41	-	-	-	-
Pseudo R ²	0.4566	-	-	-	-
No. of observations	36	-	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; **denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own computation

Link-test for model specification results presented in Table 4.6 showed that the p-values for *hat* and *hat squared* were 0.023 and 0.117, respectively. Thus according to Pregibon (1980), the model was correctly specified. The test for the null-hypothesis of goodness of fit using Hosmer-Lemeshow (H-L) test found a chi-square value of 5.13 and a p-value of 0.163. Thus following Hosmer and Lemeshow (2000) the null hypothesis was not rejected implying that the data fitted the Probit model well. The test for multicollinearity using the VIF test found a mean VIF of 9.41. As argued by Verbeek (2012) this VIF mean was within the allowable level of less than 10.

Results presented in Table 4.6 indicate that the estimated coefficient for the predicted innovation intensity variable was positive but not statistically significant. The statistically insignificant finding for this variable conforms to the study results by Hervas-Oliver, *et al.*, (2014) who found MSEs' innovation intensity to be statistically insignificant in influencing MSEs' process innovation capability. Thus based on this finding a MSE's innovation intensity does not seem to have a statistically significant influence on the MSE's process innovation capability. The study finding may, however, be a pointer to the low innovation related expenditures by MSEs in Kenya. The RoK (2016a) MSE survey for instance reported that these enterprises allocated only about 0.3 per cent of their total expenditures to innovation activities in 2015. Thus due to the insignificant resources devoted as inputs into innovation activities, there was no statistically significant influence of innovation intensity of process innovation capability.

Similar to innovation intensity, the variable for physical capital intensity was found to have no statistically significant influence on the MSE's process innovation outcome. Based on estimation results in Table 4.6, the estimated coefficient for the physical capital intensity variable was found to be positive but statistically insignificant. The result was in contrast to study finding by Parisi, Schiantarelli and Sembenelli (2006) that found a statistically significant relationship between a firm's physical capital and the likelihood of the firm introducing a new process innovation in Italy. The sample data used in the Parisi, *et al.*, (2006) study was, however, skewed towards larger enterprises with more than 250 employees. The result in Table 4.6 may thus be an indication that in Kenya MSEs' innovations are largely confined to non-technological innovations whereby physical capital is rarely used to compliment process innovations.

Skilled labour was found to have a positive and statistically significant influence on process innovation. As shown in Table 4.6, the estimated coefficient for the proportion of skilled fulltime employees' variable was found to be positive with a marginal effect of 0.0179. The parameter estimate was statistically significant at 5 per cent significance level. This implies that holding other factors constant, a one per cent increase in the proportion of skilled fulltime employees led to a 1.8 per cent increase in the probability that the MSE would introduce a successful process innovation. The finding was in line with study findings by Gebreeysus (2009) and Oum, *et al.*, (2014) that established that successful process innovation requires relatively higher proportions of skilled labour.

The estimated coefficient for annual cost of labour variable was found to be negative with a marginal effect of 0.006. The coefficient of the variable was statistically significant at 5 per cent level of significance. Thus other factors remaining constant, a one per cent increase in the annual cost of labour resulted into a 0.6 per cent reduction in the probability that the MSE would introduce a new process innovation. This finding corroborates the study by Dewar and Dutton (1986) who found that acquisition of skilled labour required to boost MSEs process innovation capability is a costly undertaking. It requires a firm to have a relatively larger pool of technical skills. Thus even though skilled labour is a necessary input in the MSE's process innovation capability, MSEs are likely to cut down on costly skilled labour in favour of the unskilled labour as the annual cost of labour rises. This, in effect, is likely to reduce process innovation capability among MSEs.

Participation by MSEs in the export market was found to have a negative influence on process innovation capability. The estimation results summarised in Table 4.6 show that the coefficient for the proportion of MSE's export sales to total sales variable was negative with a magnitude of 0.00022. The estimated coefficient of the variable was statistically significant at 5 per cent level of significance. This means that a one per cent increase in proportion of export sales by a MSE was likely to lead to a decrease in the probability that the MSE would introduce a new process innovation by 0.02 per cent. The finding contradicts the results by other studies such as Dutz and O'Connell (2013); and Ayyagari, *et al.*, (2007), which found that participation in exports increases a firm's innovation capability. A possible explanation for the finding could be that exporting MSEs in Kenya have

weak absorptive capacity to benefit or learn from their export/import partners. Such low absorptive capacity may be due to the low levels of skilled labour among the MSEs (RoK, 2016a). It is also likely that most of the MSEs that participate in the export market are affiliates of other parent firms and, therefore, have their process innovation activities emanating from their parent firms abroad.

Competition from unregistered firms was found to have a negative influence on MSEs' ability to introduce process innovation. A categorical variable for the presence of competition from unregistered MSE was used to measure this variable with "No" as the reference category. The estimated coefficient for "Yes" category was found to be negative with a marginal effect of 0.4987. The estimated coefficient of the "Yes" category was found to be statistically significant at 10 per cent level of significance. The results implies that, other factors held constant, a MSE that competes with an unregistered firms had a 50 per cent less likelihood of introducing a new process innovation compared to MSEs that did not face competition from unregistered firms.

The finding thus suggests that competition emanating from unregistered firms diminishes the prospects of MSE's process innovation capability. The finding suggests that the unfair practices found amongst unregistered firms ones works against MSE's process innovation capability. A study by Hall and Lerner (2009) suggest, for example, that the lack of enforceability of intellectual property rights among unregistered firms negatively affects appropriation of innovation benefits and thus dissuade MSEs from carrying out technological innovations.

The estimated coefficient for age of a MSE variable was found to be negative but statistically insignificant. The estimated coefficient for age-squared variable was, however, found to be positive and statistically insignificant. Even though the age and innovation relationship was not statistically significant, the signs of the coefficients corroborate the finding by Oum, *et al.*, (2014) on the non-linear relationship between age and process innovation capability.

The practice of using mobile money in the MSE transactions was found to positively influence process innovation capability of MSEs. A categorical variable was used to measure this variable with “No” response as the reference category. The estimation results indicated that the coefficient of “Yes” category was positive with a marginal effect of 0.7275. The coefficient was statistically significant at 5 per cent level of significance. This means that other factors being held constant, the probability that a MSE that used mobile money in its transaction would introduce a process innovation was 72 per cent higher than that of a MSE that did not use mobile money in its transactions.

The finding suggests that mobile money plays a facilitative role towards introduction of process innovations by MSEs. In Kenya mobile money transactions by MSEs is usually associated with greater financial inclusion and flexibility (Islam, *et al.*, 2016). It is possible that use of mobile money improves MSE’s access to finance which in turn positively influences the ability of MSEs to introduce new processes innovation. It could also imply that MSEs using mobile money

transactions are relatively more flexible and would for instance automate operations with much more ease compared to MSEs that do not embrace use of mobile money technology. The finding is also in line with those of Gebreeysus (2009) who established that access to external finance is an important factor in facilitating a firm's innovation capability in Ethiopia.

With regard to access to finance, a categorical dummy variable with various levels of access to finance was used to measure the variable. "Severe obstacle" level of access was used as the reference category. From the results presented in Table 4.6, the estimated coefficients for the categories indicating various levels of access to finance were found to be statistically insignificant. This was with the exception of the category where access to finance was reported as "not an obstacle". In this case the sign of the coefficient was negative with a marginal effect of 0.9755. The coefficient of this variable was statistically significant at 5 per cent level of significance.

The finding implies that other factors held constant, the probability of a MSE whose access to finance was perceived as "not an obstacle" introducing a new process innovation, was 97 per cent lower compared to a MSE whose access to finance was reported as "severe obstacle". This finding seems to indicate that access to finance had negative and statistically significant influence on process innovation capability. The finding contradicts Gebreeysus (2009) and Oum, *et al.*, (2014) who established that access to finance has a positive effect in facilitating process innovation capability. When access to finance was perceived by the MSE

as "major" and "moderate" compared to "severe obstacle" the probability of the MSE introducing a new process innovation was found to be positive though statistically insignificant with reference to when access to finance was perceived by a MSE to be "severe obstacle". A possible explanation of this contradictory finding could be that MSEs with access to credit tend to be the relatively larger and more bureaucratic ones and thus less willing to undertake process innovations such as automations whose returns are less certain.

The estimation results presented in Table 4.6 found that a MSE own source of innovation finance had a positive and statistically significant influence on its process innovation capability. A categorical dummy variable representing own source innovation funds was used with "No" as the reference category. The estimated coefficient on the categorical variable for "Yes" was found to be positive with marginal effect of 0.0248. The coefficient was found to be statistically significant at 5 per cent level of significance. This implies that the likelihood of a MSE with own source of innovation finance introducing process innovation was 2.5 per cent higher than that of a MSE that does not have own source of innovation funds.

The legal status of the MSEs was another factor that was found to influence MSEs' process innovation capability. Legal status variable was specified as categorical dummy variable with "shareholding listed" category as the reference variable in the Probit model. The coefficient of the "partnership ownership" category was found to be negative with a marginal effect of 0.9896 and statistically significant at one per cent level of significance. Thus, for MSE whose ownership structure

was a partnership, the probability of introducing process innovation was 98 per cent lower than for an MSE with “shareholding listed” as the legal ownership structure.

Robson, *et al.*, (2009) found that legal ownership structure influenced MSEs’ innovation in Ghana. The finding also echoes those of Gebreeysus (2009) and ILO (2017) that access to external finance, which becomes available with the capital structure associated with public listing of firms, positively influences a MSE’s innovation capability. One interpretation of this finding could be related to the financial resource limitations imposed by, for instance, family partnerships or sole proprietorship forms of MSEs businesses ownership structure in Kenya. According to the 2015 MSE survey, MSEs that opened their business ownership structures by publicly listing their enterprises were able to tap into equity financing as additional sources of finance thus enhancing their process innovation capabilities (RoK 2016a).

Based on the results presented in Table 4.6, the determinants of MSEs process innovation capability include skilled workforce, cost of labour, export participation, source of innovation financing, competition from unregistered firms, legal MSE ownership status and use of mobile money. Innovation intensity, physical capital intensity and age were found not to be important in influencing MSE’s process innovation capability.

Determinants of organization innovation capability

Organisation innovation capability in this study was measured from the perspective that if a MSE reported to have introduced a new organisational change during the study's reference period of 2010-2012, then it possessed some organisation innovation capability. Such organisation innovations include outsourcing practices, new managerial reporting systems and performance tracking by the MSEs. Equation 3.26 was estimated, with the dependent variable being a dummy variable representing if a MSE reported organisation innovation. The dummy variable took a value of one if the MSE introduced a new organization innovation during the 2010-2012 period and zero otherwise.

The explanatory variables included in the model were predicted innovation intensity, log of physical capital intensity, annual cost of labour, proportion of skilled full time employees and proportion of employees using computers. Other MSE control variables included age, size, market share, managers experience, domestic ownership proportion, legal ownership structure and use of mobile money technology. The results of the estimated Probit model were presented in Table 4.7.

Table 4.7: Probit estimates for the determinants of organization innovation capability

Dependent variable = 1 if MSE reported organization innovation (between 2010 and 2012), 0 otherwise					
Independent variables	Coefficient	Robust Std Err.	z	P-Value	Marginal effect
Predicted innovation intensity (p2)	-4.161967*	2.47596	-1.68	0.093	-0.4871555
Log. of physical capital intensity	-1.412656	0.94907	-1.49	0.137	-0.1653505
Prop. skilled fulltime employees	-1.748757**	0.69333	-2.52	0.012	-0.2046909
Av. no. of educ. yrs production employee	-0.3029158*	0.16799	-1.8	0.071	-0.0354561
Prop. employees using computers	0.0695813**	0.02778	2.5	0.012	0.0081444
Manager's experience	0.0752738	0.04641	1.62	0.105	0.0088107
Age of MSE	0.1002814	0.08836	1.13	0.256	0.0117379
Age of MSE Squared	-0.0022077	0.00150	-1.46	0.144	-0.0002584
MSE Size (2010)	0.6216689	0.93963	0.66	0.508	0.0727659
Market share (2010)	0.5607931*	0.33003	1.7	0.089	0.0656405
Prop domestic ownership	0.0296708*	0.01660	1.79	0.074	0.003473
Mobile money use: No (Reference)					
: Yes	-0.3535984	0.91293	-0.39	0.699	-0.0420092
Legal ownership status: Shareholding listed (Reference)					
: Shareholding non listed	-0.6529999	2.85359	-0.23	0.819	-0.0996144
: Sole proprietor	0.6250073	1.16525	0.54	0.592	0.0630028
: Partnership	-2.937235*	1.75522	-1.67	0.094	-0.8358026
Constant	-5.632136	6.49138	-0.87	0.386	
Wald χ^2 (15)	28.93**	-	-	0.0164	-
Link-test: hat	1.00606**	-	-	0.017	-
: hat square	0.14082	-	-	0.673	-
H-L χ^2 (21)	21.06	-	-	0.4556	-
Mean VIF	9.52	-	-	-	-
Pseudo R ²	0.4314	-	-	-	-
No. of observations	37	-	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; **denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own Computation

The Probit estimation results presented in Table 4.7 shows that Wald (χ^2) test statistic was 28.93 with a p-value of 0.0164. Based on the estimated p-value, the Wald (χ^2) was statistically significant at five per cent level of significance. This result is an indication that the model's independent variables jointly predict the MSE's organisation innovation capability. The pseudo R^2 for the model was found to be 0.4314 an indication that the explanatory variables account for approximately 43.1 per cent of the variations in the dependent variable.

As shown in Table 4.7, the p-values for *hat* and *hat square* were 0.017 and 0.673, respectively. Since the *hat square* did not have explanatory power the specification of the model was correct (Pregibon, 1980). A test for the goodness of fit using the Hosmer-Lemeshow (H-L) test shows a chi-square value of 21.06 and a p-value of 0.4556. The implication of the H-L test is that the data fits well the Probit model. A test for multicollinearity showed that the mean VIF was 9.52 implying that the level of multicollinearity was within tolerable levels of less than 10.

The estimation results presented in Table 4.7 show that the estimated coefficient for the predicted innovation intensity variable was negative with marginal effect of 0.487. The coefficient of the variable was statistically significant at 10 per cent level of significance. This finding implies that a unit increase in predicted innovation intensity, holding other factors constant, was likely to lead to 49 per cent decrease in the probability of a MSE introducing a new organization innovation.

The result contradicts findings by Fu, *et al.*, (2016) who found that innovation intensity has a positive and statistically significant influence on organisational innovation capability. The finding, however, corroborates the study by Hervas-Oliver, *et al.*, (2014) who found SMEs' innovation intensity to be negatively associated with MSEs innovation capability, even though, the relationship was statistically insignificant. One possible explanation for this result is that firms with high innovation intensity tend to be larger firms where there is room for organisation innovations. A firm with 50 workers, for example, may outsource its book-keeping function in order to cut overhead costs. For micro enterprises, which are, largely one worker and informal firms with little or no organised accounting practices, there is limited room for such an organisational innovation.

The estimated coefficient of log of physical capital intensity variable was found to be negative and statistically insignificant. The finding contradicts the study findings by Jienwatcharamongkhol and Tavassoli (2014) who found physical capital intensity a key factor in positively influencing a firm's innovation capability. It is, however, possible that as a MSE becomes more capital intensive, it reduces its relative labour force and, therefore, the scope of implementing organisational innovations.

The results summarised in Table 4.7 show that the coefficient of proportion of skilled fulltime employees' variable was negative with marginal effect of 0.2047. The coefficient was statistically significant at 5 per cent level of significance. The estimated coefficient of the average years of education for the production worker

variable was also found to be negative with marginal effect of 0.035. The coefficient was found to be statistically significant at 10 per cent level. Thus from the estimation results in Table 4.7, increasing the proportion of skilled fulltime employees by one percentage point decreases the probability that the MSE would introduce an organisation innovation by 20.5 percentage points.

Similarly, estimation results summarised in Table 4.7 show that increasing average length of education for production worker by one per cent reduces the likelihood that the MSE would introduce a new organisation innovation by 3.6 per cent. These two findings, which relate to the size and level of advancement of human resource skills, contradicts results by Fu, *et al.*, (2016) that found advanced levels of human capital skills essential for facilitating MSE's organisation innovation in Ghana.

One possible explanation for the contradictory findings on human capital may be due to the fact that about 81 per cent of MSEs in Kenya belong to micro enterprises that are characterised by one to nine workers (RoK 2016a). For micro enterprises that are family managed, the owner/operator carries out most of the activities of the MSE including accounting, administration and marketing functions due to the fear of losing control (Robson, *et al.*, 2009). In such a scenario, MSEs have limited scope for implementing new organisational innovation. It is thus possible that as workers that are more skilled are employed, the MSE becomes more resistant to introduction of new organisational changes.

The estimated coefficient for the proportion of employees using computers variable was found to be positive with marginal effect of 0.0081. The coefficient of the variable was also found to be statistically significant at 5 per level of significance. This means that holding other factors constant, an increase in the proportion of employees using computer skills increased the likelihood that an MSE would introduce organisational innovation by 0.81 per cent. The finding conforms to those of Jienwatcharamongkhon and Tavassoli (2014), Oum, *et al.*, (2014), Crepon, *et al.*, (1998) and Loof and Heshmati (2006) who found advanced human capital skills to be an important factor driving innovation capability among firms.

The estimation results presented in Table 4.7 show that the estimated coefficient for the manager's experience variable was positive but statistically insignificant. This implies that a manager's number of years of experience in a sector did not have a statistically significant influence on the MSE's ability to engage in organisation innovation. The result contradicts the study findings by Ayyagari, *et al.*, (2007) that found a manager's experience to be an important determinant of a firm's innovation capability. The finding was, however, in line with the study findings by Dewar and Dutton (1986) that found managerial experience did not have a statistically significant influence on small firms innovation capability.

Results in presented in Table 4.7 show that the coefficient for age of MSE variable was positive and statistically insignificant. The coefficient for age of MSE squared was found to be negative statistically insignificant. The finding confirms the non-linear relationship between MSE's age and the probability of introduction of new

organisation innovation though the relationship was statistically insignificant. Oum, *et al.*, (2014) also found a non-linear relationship between the age of a MSE and its innovation capability. According to Oum, *et al.*, (2014) younger firms are, therefore, more likely to introduce organisation innovations compared to older MSEs.

The size of a MSE as measured by the number of fulltime employees in the year 2010 did not have a statistically significant influence on the MSE's organisation innovation capability. Results presented in Table 4.7 found the estimated coefficient for the MSE size variable to be positive and statistically insignificant. This result negates the study findings by Mel, *et al.*, (2009) who found that a firm's size play a positive and important role in organisation innovation. One explanation for the finding could be that the larger the MSE, the more difficult it becomes for it to carry out organisation innovations, especially those involving staff layoffs. This is largely due to the labour regulations that protects workers' rights.

The market share of the MSE for its main product was found to have a statistically significant influence on MSE's organisation innovation. The estimated coefficient for market share was found to be positive and with a marginal effect of 0.066. The coefficient was also found to be statistically significant at 10 per cent level of significance. The results implies that a higher market share for MSE's main product increased the likelihood of a MSE introducing organisation innovation by 6.6 per cent. According to the results, MSEs with products that commanded a

higher market share were more likely to engage successfully in organisational innovations.

Domestic ownership of a MSE was found to have a positive influence on organisation innovation. From the estimation results presented in Table 4.7, the estimated coefficient for the proportion of MSE domestic ownership variable was positive with marginal effect of 0.003473. The coefficient was found to be statistically significant at 10 per cent level significance. This implies that increasing the proportion of MSEs' domestic ownership was likely to have increased the probability of a MSE introducing organisation innovation by 0.3 per cent. The finding corroborates the results of the study by Love, *et al.*, (2014) who found that higher domestic ownership positively influence organisational innovations among firms. This result suggests that higher domestic ownership entails higher flexibility with regard to organisational changes.

Estimation results presented in Table 4.7 show that use of mobile money by MSEs did not have a statistically significant influence on the MSE's organisational capability. To measure this variable, a categorical variable for MSE's use of mobile money transactions was used. The reference category was designated as "No". The estimation results found that the coefficient for "Yes" category was negative and statistically insignificant. The results contradicts the findings by Gebreeysus (2009) and Oum, *et al.*, (2014) who found a firm's access to finance to have a positive and statistically significant influence on its ability to innovate. It is, therefore, likely that use of mobile money by MSEs is still limited to the person to

person or business to business payments. Use of the mobile money as a source of credit may still be limited, especially given the high cost of such credit.

To estimate the influence of MSE's legal ownership status on organisation innovation capability, a categorical variable was used. The reference category was specified as 'shareholding listed'. Estimation results presented in Table 4.7, show that the coefficient for the "partnership" variable was negative with a marginal effect of 0.8358. The coefficient of the variable was also found to be statistically significant at 10 per cent level of significance. The implication of this result is that the probability that a MSE that had a "partnership" legal ownership structure would introduce an organisational innovation was 83.6 per cent less than that of a MSE that had "shareholding-listed" legal ownership structure.

The "Shareholding not listed" category was found to be negative and statistically insignificant. The category for "sole proprietorship" was, however, found to be positive but statistically insignificant. The results on legal ownership variable thus seems to suggest that governance structures including laws and regulations governing publicly listed MSEs play facilitative role with regard to MSEs ability to introduce new organisational innovations. From a financial resource constraint perspective, it is likely that by becoming a listed shareholding a MSE is bound to expand its sources of finance thus availing more resources to finance innovative activities. This finding was consistent with the Penrose (1956) resource theory, which says that each firm possess repositories of firm specific resources that gives it a competitive edge. It also supports the empirical study by Gebreeysus (2009)

who found that access to external finance has a positive influence on MSE's innovation capability.

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In summary, therefore, determinants of MSEs organisation innovation capability include human capital skills levels and especially computing skills as well as proportion of skilled full time employees. Other important determinants of organisation innovation include predicted innovation intensity, proportion of MSE domestic ownership, MSE's market share and MSE's legal ownership status.

Determinants of MSE's marketing innovation capability

Marketing innovation capability among MSEs was captured by enquiring whether a MSE had introduced a new marketing procedure, new branding, new customer loyalty schemes or new advertising during the year 2010 to 2012. A positive response was taken as an indication of MSE's marketing innovation capability. In the analysis, equation 3.27 was estimated. The dependent variable was a dummy variable taking a value of one if MSE introduced a new marketing innovation in the period 2010-2012 and zero otherwise. Explanatory variables included predicted innovation intensity, log of physical capital intensity, average years of education for the production worker, affiliation status, age of MSE, size of MSE, manager's experience, own source of innovation funds and annual labour costs. Table 4.8 presents the estimation results of the Probit model.

Table 4.8: Probit estimation results for determinants of marketing innovation capability

Dependent variable = 1 if MSE reported marketing innovation (between 2010 and 2012), 0 otherwise					
Independent variables	Coefficient	Robust Std. Err.	Z	P-Value	Marginal effect
Predicted innovation intensity(p2)	17.71965**	7.214469	2.46	0.014	0.534356
Log. physical capital intensity	6.055826**	2.698858	2.24	0.025	0.524378
Av. no. of educ. yrs production employee	0.426084*	0.233214	1.83	0.068	0.036895
Annual cost of labour	-0.81996	0.692083	-1.18	0.236	-0.071
Manager's experience	-0.18723***	0.061224	-3.06	0.002	-0.01621
MSE Age	-14.7287*	7.979781	-1.85	0.065	-0.27537
MSE Age Squared	3.1137*	1.722151	1.81	0.071	0.269617
MSE Size (2010)	2.558988	1.969188	1.3	0.194	0.221584
Affiliated: No (Reference)					
: Yes	8.019405**	3.919606	2.05	0.041	0.694405
Own source innovation funds: No (Reference)					
: Yes	4.196074***	1.222224	3.43	0.001	0.363341
Constant	-2.61273	7.118669	-0.37	0.714	-
Wald χ^2 (11)	29.78	-	-	0.0017	-
Link-test: hat	1.013395**	-	-	0.012	-
: hat square	-0.02129	-	-	0.085	-
H-L χ^2 (27)	14.17	-	-	0.9795	-
Mean VIF	9.04	-	-	-	-
Pseudo R ²	0.7093	-	-	-	-
Number of observations	39	-	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; ** denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own computation

From the estimation results presented in Table 4.8, the Wald χ^2 test statistic was found to be 29.78 with a p-value of 0.0017. Thus the Wald χ^2 was statistically significant at one per cent level of significance. This result means that the explanatory variables in the model jointly predict the changes in marketing

innovation capability. As shown in Table 4.8, the pseudo R^2 for the model was found to be 0.7093. This implies that the explanatory variables account for about 71 per cent of the variations in the dependent variable. The p-values for *hat* and *hat* square as reported in Table 4.8 were 0.012 and 0.085, respectively. A rounding-off the p-value of *hat* square results to a one decimal point would thus give a *hat* square value of 0.1 thus making the *hat* square statistically insignificant at 10 per cent level of significance. This thus means the model specification fits the data (Pregibon, 1980).

The test for the null-hypothesis of goodness of fit using Hosmer-Lemeshow (H-L) test shows a chi-square value of 14.17 and a p-value of 0.9795. Based on this H-L test, the null hypothesis was not rejected as the data fit the Probit model well (Hosmer & Lemeshow, 2000). The test for multicollinearity was carried out through the VIF test. The results presented in Table 4.8 show that the mean VIF was 9.04 indicating that the level of multicollinearity was within tolerable levels (Verbeek, 2012).

The estimation result presented in Table 4.8 show that predicted innovation intensity was an important determinant of MSE's marketing innovation capability. The estimated coefficient for the predicted innovation intensity variable was found to be positive with marginal effect of 0.53. The coefficient was also found to be statistically significant at 5 per cent level of significance. The result implies that holding other factors constant, a per cent increase in the predicted innovation

intensity was associated with 53 per cent increase in the probability of the MSE introducing a new marketing innovation.

The finding is in line with studies by Pakes and Griliches (1984), Tavassoli (2014) and Goedhuys (2007) that found innovation intensity to be a statistically significant determinant of a firm's innovation capability. The finding on predicted innovation intensity was supported by the descriptive analysis presented in Table A1. The mean comparison test (t-test) between innovative and non-innovative MSE found that the innovation intensity for innovative MSEs was statistically significant at 5 per cent level significance. The finding seems to suggest that MSEs that invest in innovation related activities are also more likely to complement their innovation investments by introducing new marketing innovations.

The coefficient for log of physical capital intensity variable was found to be positive with a marginal effect of 0.524378. As shown in Table 4.8, the coefficient was statistically significant at 5 per cent level of significance. The results implies that, holding the other factors constant, a one percentage point increase in the physical capital intensity, increases the probability of the MSE introducing a new marketing innovation by 52 per cent. Studies by Crepon, *et al.*, (1998) and Loof and Heshmati (2006) also found physical capital to be positive and statistically significant determinant of innovation activities. The finding implies that MSEs that have invested relatively more in terms of physical capital per employee are also more likely to engage in marketing innovations for their products and services. It is also likely that for a MSE to invest in relatively higher levels of physical capital,

it faces relatively higher risks if it fails to capture the relevant market for its new product or service. Such a MSE will, therefore, tend to engage in relatively higher marketing innovations activities.

The average years of education of production worker was found to have a positive influence on the MSE's marketing innovation capability. The estimated coefficient for the average years of education of production worker variable was found to be positive with a marginal effect of 0.0368. The coefficient was statistically significant at 10 per cent level of significance. This indicates that a one per cent increase in the average years of education for the production worker increased the probability of MSE engaging in marketing innovation by 3.7 per cent. The finding support the study findings by Oum, *et. al.* (2014) and Robson, *et. al.*, (2009) who found that higher skills level has positive and significant relation with marketing innovation capability.

The results presented in Table 4.8 show that cost of labour did not have a statistically significant influence on a MSE's marketing innovation. The estimation results indicate that the estimated coefficient for the annual cost of labour variable was negative and statistically insignificant. Even though the results was statistically insignificant, the negative sign for the coefficient indicates that an increase in the annual cost of labour was associated with a reduction in the probability that a MSE would engage in marketing innovation.

The results show that the estimated coefficient for the manager's experience variable was negative with a marginal effect of 0.0162. The coefficient was statistically significant at the one per cent level of significance. The finding means that, holding other factors constant, a unit increase in the manager's length of experience in a sector, decreases the probability of a MSE introducing a marketing innovation by 0.0162 units. The result agrees with the findings by Engel, Rothgang and Trettin (2013) who found that less experienced MSE managers have a greater scope to increase their market share through marketing innovation compared to their more experienced counterparts. The findings implies that MSE managers who are relatively inexperienced, are more likely to introduce marketing innovation as they attempt to increase the MSE's market foothold. Experienced managers, on the other hand, are perceived to have a better understanding and knowledge of the market and may thus avoid the risks associated with new marketing innovations.

As presented in Table 4.8, the estimated coefficient for the age of the MSE variable was found to be negative. The results also show that the coefficient was statistically significant at 10 per cent level significance. The estimated coefficient for the age squared variable was, however, found to be positive. It was also found to be statistically significant at 10 per cent level significance. The finding implies that increase in age reduces the probability of a firm introducing a marketing innovation up to a point, other factors remaining constant. Thereafter, increase in the age of an MSE increase the probability of the MSE introducing a marketing innovation.

The finding is in line with the study findings by Aghion and Howitt (1992) on product life cycle theory that found age of MSE and its innovation capability to have non-linear and U-shaped relationship. The finding on the non-linear relationship implies that the relatively older MSEs are more likely, than younger MSEs to engage in marketing innovations. The finding on the U-shaped relationship suggests that in the very early years of operation, MSE still have large scope of markets to pursue but as years go by that market scope become smaller thereby reducing their marketing innovations. As they grow much older, however, MSEs acquire more resources and this relationship becomes a positive one.

The size of the MSE was found to have statistically insignificant influence on the MSE's marketing innovation capability. Results presented in Table 4.8 show that the estimated coefficient for the size of MSE variable was positive but statistically insignificant. The finding contradicts the results by Oum, *et al.*, (2014) and Robson, *et al.*, (2009) that found size of a firm to be a positive and statistically significant determinant of firm's marketing innovation capability. According to Oum, *et al.*, (2014), relatively larger firms have more resources. Such firms can, therefore, use more resources in marketing and advertising thereby, positively influencing their marketing innovation capability.

From the estimation analysis presented in Table 4.8, MSE affiliation status variable was specified as a categorical variable with "No" response as the reference category. The estimation results presented in Table 4.8 show that the coefficient for the "Yes" category was positive with a marginal effect of 0.694405. The

coefficient was found to be statistically significant at the 5 per cent level of significance. The finding indicates that the probability of an affiliated MSE to introduce a new marketing innovation was 69 per cent higher than that of an unaffiliated MSE. The finding was in line with results by Roper and Love (2006) who found affiliation to other firms opens up new avenues for knowledge spillover and access to external resources thereby facilitating a firm's marketing innovation capability.

Own source of innovation funds was also found to have a positive and statistically significant influence on the ability of a MSE to engage in marketing innovations. In the analysis, "own source of funds" for innovation variable was specified as a categorical variable with "Yes" response as the reference category. The estimation results presented in Table 4.8 shows that the coefficient for "No" category was positive with a marginal effect of 0.363341. The coefficient was also found to be statistically significant at one per cent level of significance. The result implies that use of "own source" to finance a MSE innovation increased the probability that such a MSE engaged in a marketing innovation by 36.3 percent relative to a MSE that did not use an "own source" to finance its innovation activities.

The study finding on internally sourced finance validates other evidence in the RoK (2016a) which found that 71.9 per cent of MSEs rely on own sources for financing their enterprises activities. Thus MSEs that are able to raise resources internally are more likely to engage in other activities such as innovation than MSEs that rely on external source of funds. This may be explained by the fact that innovation is a

risky under-taking whose result is usually uncertain. Firms would thus be hesitant to use external financial resources to finance innovation activities as this would increase their financial leverage in case of failure of the innovation activity.

In summary, therefore, based on the estimation results presented in Table 4.8 this study concluded that the determinants of MSEs marketing innovation capability included; innovation intensity, physical capital intensity, managers experience in a sector, own source of innovation financing, MSE affiliation status, number of years of education for the production worker and age of the MSE.

4.6 Effect of innovation capability on the growth of a MSE

The fourth objective of the study was to establish the effect of innovation capability on growth of MSEs in Kenya. To achieve this objective, equation 3.28 and 3.29, which are augmented Knowledge Production Functions, were estimated using OLS estimation technique. The choice of OLS estimation technique was based on the fact that Knowledge Production Function does not assume any interaction between innovation output and MSE growth (Hall, 2011). According to Engel, *et al.*, (2013) and Gebreeysus (2009), changes in employment and sales turnover are normally related to the growth of a firm. Thus following Gebreeysus (2009), growth of a MSE was proxied by the percentage growth in employment during the period 2010 to 2012 for equation 3.28.

After estimating equations 3.24, 3.25, 3.26 and 3.27 their respective predicted innovation values were estimated and saved. These four predicted innovation values, which measured innovation outcomes in the four innovation capability equations, were used in the MSE growth equations 3.28 as independent variables of interest. The four variables were used to jointly represent innovation capability or knowledge capital of a MSE. According to Classen, *et al.*, (2013), it is this MSE innovation capability that should influence firm growth. Thus individual MSEs being endowed with varying innovation capabilities should grow at different growth rates.

Other independent variables included in the model were the predicted innovation intensity, log of physical capital intensity and sales per employee. Characteristics of MSEs such as age, size of MSE, physical location, manager's years of experience and access to finance were also included as independent variables. The inclusion of predicted innovation capability for product, process, organization and marketing innovation serve as Instrumental Variables to address potential endogeneity problem in the model (Hall, 2011; Engel, *et al.*, 2004). With the inclusion of the four predicted innovation capability variables as the instrumental variables, the estimation of the employment growth equation was carried out through an OLS estimation technique. Table 4.9 presents the estimation results for the effect of innovation capability on MSE's employment growth.

From Table 4.9, the estimation results indicates that *R* squared was 0.6932. This implies that the explanatory variables in the model explain about 69.3 per cent of

the variation in the MSE employment growth rate. The F-test statistic for overall model fitness was found to be 10.03 with a p-value of 0.0000. This F-test result implies that the independent variables included in the model jointly determine the changes in the dependent variable. The link-test for model specification show that the p-values for *hat* and *hat* square were 0.000 and 0.177, respectively. Thus according to (Pregibon, 1980), the link-test result means that the model was correctly specified and fits the data well.

The results revealed the presence of multicollinearity. The mean VIF was found to be 12.54 which is slightly above 10 (Verbeek, 2012). The relatively higher level of multicollinearity may have arisen due to inclusion of some variables that were derived within the model, especially the predicted innovation outputs variables. However, as argued by Murray, Nguyen, Lee, Remwenga and Smith (2012), a larger VIF may not warrant removal of independent variables from the model especially where there is a theoretical basis for inclusion of the variable. The authors advise that interpretation of the results should take cognisance of the existence of some level of multicollinearity.

Table: 4.9 OLS estimation results for the effect of innovation capability on MSE's employment growth

Dependent variable : Percentage change in employment between 2010 and 2012				
Independent variables	Coefficient	Robust Std. Err.	t	P-values
Predicted product innovation (p3)	0.075205	0.0776246	0.97	0.348
Predicted process innovation p4)	0.0089876	0.0377824	0.24	0.815
Predicted organization innovation(p5)	-0.2346797***	0.0729956	-3.21	0.006
Predicted marketing innovation (p6)	0.0445838**	0.0167486	2.66	0.018
Log of physical capital intensity	0.2449451	0.1633099	1.5	0.154
Age of MSE	-0.0575826**	0.0254127	-2.27	0.039
MSE Size : Micro (Reference)				
: Small	-1.137099**	0.456052	-2.49	0.025
Manager's experience	-0.0289509	0.0178491	-1.62	0.126
Physical location : Nairobi region (Reference)				
:Central Region	-0.0965342	0.5187396	-0.19	0.855
:Nyanza Region	-0.2049447	0.8659382	-0.24	0.816
:Mombasa Region	-0.3638694	0.6188935	-0.59	0.565
:Nakuru Region	0.8553535	0.754594	1.13	0.275
Log annual cost of labour	-0.4796038*	0.2487996	-1.93	0.073
Log annual sales per employee	-0.2169467	0.1283845	-1.69	0.112
Access to Finance: Severe obstacle (Reference)				
:Not an obstacle	1.08105	1.339811	0.81	0.432
:Minor obstacle	1.110047	0.9428079	1.18	0.257
:Moderate obstacle	0.1383635	0.792879	0.17	0.864
:Major obstacle	-0.0950554	0.7332607	-0.13	0.899
Mobile money use: No (Reference)				
:Yes	1.850755**	0.6958725	2.66	0.018
Affiliation : No (Reference)				
:Yes	-2.640531**	0.9249019	-2.85	0.012
Constant	9.883533***	3.353295	2.95	0.01
F (20, 15)	10.03***	-	-	0.0000
R-squared	0.6932	-	-	-
Link test: hat	0.799641***	-	-	0.0000
: hat square	0.1203342	-	-	0.177
Shapiro-Wilk normality test	0.88624**	-	-	0.0014

White test	6.56**	-	-	0.0105
Mean VIF	12.54	-	-	-
Number of observations	36	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level; **denotes significance at 5 per cent level and * denotes significance at 10 per cent level

Source of data: Own computation

Breusch-Pagan and Cook-Weisberg test for heteroskedasticity showed that heteroskedasticity could not be ruled out as the Chi square value was 6.56 and it found to be statistically significant at 5 per cent level of significance. Thus the model was estimated using robust standard errors to tackle heteroskedasticity. A test for normality showed that the error term was normally distributed. The Shapiro-Swilk test statistic was found to be 0.88624 and it was statistically significant at one per cent level of significance. This means that the model could be estimated using an OLS estimation technique.

Based on the estimation results in Table 4.9, the estimated coefficients for predicted product innovation and predicted process innovation were found to be positive but statistically insignificant. Product and process innovation capability variables in the model represented technological innovation capability while organisation and marketing innovation capability variable represented non-technological innovation capability. The finding thus implies that though the effect of technological innovation capability on employment growth rate was positive, it had no statistically significant effect.

The result contradicts empirical findings by Roper (1996), Engel, *et al.*, (2004), Roper, *et al.*, (2006), Audretsch, *et al.*, (2014) and Gebreeysus (2009) whose studies found technological innovation capability coefficients positive and statistically significant. The finding was, however, in line with the study finding by Robson, *et al.*, (2009) that found technological innovation capability had no effect on MSE's employment growth rate in Ghana.

The study by Goedhuys (2007) in Tanzania also found a weak link between MSE's innovation capability and its employment growth. In Kenya, Kiraka, *et al.*, (2013) found the effect of MSE's innovation capability on the growth of a MSE lasted for only one period after the enterprise had accessed credit. Thus in general, innovation capability variables seem to have mixed effect on MSE's employment growth rate in Africa. The intuition from this finding suggest that even though MSEs engaged in product and process innovations activities, the innovation outcomes may not have been radical enough to spur MSEs to employ more workers. Another possibility could have been that since the innovation outcomes were self-reported in the dataset used for this study, MSEs may have over reported their product and process innovation activities during the survey.

With regard to predicted organisation innovation capability, the results presented in Table 4.9 show that the estimated coefficient for predicted organization innovation variable was negative with a magnitude of 0.2346797. The coefficient was found to be statistically significant at the one per cent level of significance. This means that a one unit increase in MSE's organization innovation capability

led to a 23.5 per cent reduction in the MSE's employment growth. The finding suggests that MSEs that introduced organization innovations during the study period were associated with reduced employment growth rates.

The finding resonates with the findings by Fu, *et al.*, (2006) who found a negative effect between organization innovation and firm growth for informal firms in Ghana. It is thus likely that MSEs in Kenya only engage in organization innovation with a view to reducing the cost of labour by declaring redundancies. Thus, encouraging Kenyan MSEs to engage in organisation innovation would be a counter-productive measure in view of Kenya government policy whereby MSEs are expected to generate 80 per cent of the one million new jobs annually (RoK, 2013b).

The results presented in Table 4.9 show that predicted marketing innovation variable was positive with a magnitude of 0.0445838. The estimated coefficient was found to be statistically significant at five per cent level of significance. The implication of this result was that a one unit increase in MSE's marketing innovation capability led to 4.5 per cent increase in the MSE's employment growth. The result corroborates the study findings by Walobwa, *et al.*, (2013) that estimated that a one per cent increase in SMEs marketing innovation contributed to a 71 per cent increase to the SME's business growth. The study by Walobwa, *et al.*, (2013) was, however, based on limited sample of garment making SMEs located Jericho estate within Nairobi unlike this study whose data was national and from diverse geographical regions making it more nationally representative. Furthermore, the

Results presented in Table 4.9 indicated that the size of a MSE had a negative effect on its employment growth. Following Robson, *et al.*, (2009) the size of the MSE was specified as a categorical variable. If a MSE had up to 10 workers it was categorised as “micro” and if it had between 11 and 50 workers it was classified as “small”. The “micro” category was specified as the reference category. The estimated coefficient for the “small” category was found to be negative 1.137099. The coefficient was found to be statistically significant at the five per cent level of significance. This means that a small enterprise experienced less employment growth rate compared to a micro enterprise. The result confirms empirical findings by Gebreeysus (2009) in Ethiopia that found that micro enterprises had higher employment growth rates than small enterprises. The negative relationship between the size of MSE and its employment growth suggest that at formation, micro enterprises create relatively more jobs than small enterprises.

The age of a MSE was another factor that was found to affect its employment growth. Based on the results presented in Table 4.9, the variable for age of MSE was found to be negative with a magnitude of 0.0575826. The coefficient for the variable was found to be statistically significant at five per cent level of significance. The result implies that an increase of the age of a MSE by one unit reduces the MSE’s employment growth by 5.8 per cent. The result was consistent with the study findings by Bigsten and Gebreeysus (2007) and Gebreeysus (2009) who found that firm growth decreases with firm age until a certain age where the relationship gets reversed. In other words, younger MSEs generate more jobs

relative to older firms. The negative portion of this relationship captures the learning process where as a MSE grows older it experiences uncertainties about its optimal costs operating positions. This process sometimes leads to a decrease in its employment growth as time progresses.

The estimated coefficient for a manager's experience variable was found to be negative and statistically insignificant. In contrast to this result, Mel, *et al.*, (2009) found a manager/operator's experience to be a positive and statistically significant predictor of firm growth. Gebreeysus (2009) also established that owner's experience has a negative though statistically insignificant effect on MSE's growth in Ethiopia. One possible intuition behind the negative and statistically insignificant result could be that many MSEs in Kenya are operated as family businesses where management and ownership functions are rarely separated. The manager's experience variable may thus have captured more of the owner's experience, like in the case of the study by Gebreeysus (2009), rather than technical managerial experience.

To capture local environment conditions in which MSEs operate, a five regional categorisation representing diverse regions of Kenya was used. In the estimation results presented in Table 4.9, the "physical location" variable was specified as a categorical variable with "Nairobi region" as the reference category. Other categories included "Central region", "Nyanza region", "Mombasa region" and "Nakuru region". The estimated coefficients for "Central region" "Nyanza region", "Mombasa region" were found to be negative and statistically insignificant. The

coefficient for “Nakuru region” was found to have been positive though statistically insignificant. The negative sign for “Central region” “Nyanza region”, “Mombasa region” implied that MSEs located in these regions experienced slower growth compared to those located in the Nairobi region. Micro and small enterprise located in Nakuru region were, however, found to have experienced faster growth given the positive sign for the Nakuru region coefficient. The physical location influence on MSE’s employment growth was, however, found to be statistically insignificant for all the regions.

The finding on physical location variable was contrary to study findings by Audretch and Feldman (2004), Tavassoli (2014) and Kiraka, *et al.*, (2013) who found that larger functional regions are associated with higher MSE’s employment growth. This is because larger functional regions such as capital cities like Nairobi are associated with better purchasing power, superior supply and demand conditions which support MSE’s employment growth. This finding may have been due to over sampling of MSEs located within the larger cities and towns such as Nairobi, Mombasa, Kisumu at the expense of other rural locations where purchasing power relatively lower and supply and demand conditions tend not to be supportive of MSEs employment growth.

According to the results presented in Table 4.9, high cost of labour contributed to slower employment growth among MSEs. The results showed that the estimated coefficient for log of annual cost of labour variable was negative 0.4796038. The coefficient was statistically significant at 10 per cent level of significance. This

means that a unit rise in the cost of labour contributed to about 48 per cent reduction in MSE's employment growth. The finding seems to emphasise that MSEs employment growth tend to be relatively sensitive to labour costs. A small increase in labour costs is, therefore, likely to lead to reduction in employment growth among MSEs.

The estimated coefficient for log of sales per employee variable was found to be negative with magnitude of 0.2169467. The coefficient of the variable was also found to be statistically insignificant. The negative sign implies that as sales per employee improves, MSE's workers were likely to have been displaced. The finding corroborates with study findings by Audretsch, *et al.*, (2014) that found the relationship between labour productivity and employment growth could either be negative or positive. Thus as MSEs' productivity increases, unskilled labour is laid off, constituting a displacement effect. The finding also echoes the prevalence of unskilled labour which characterises Kenya's MSE sector. The finding seems to suggest that increasing labour productivity among the MSEs will lead to labour displacement where relatively large unskilled labour get displaced by relatively smaller number of skilled workers.

Lack of access to financial resources has been highlighted as a constraint to MSEs growth in Africa. Estimation results presented in Table 4.9 indicated that access to finance by MSEs did not have a statistically significant effect on MSE's employment growth. In the estimation, "access to finance" variable was specified as a categorical variable with "very severe obstacle" as the reference category. The

other categories included “not an obstacle”, “minor obstacle”, “moderate obstacle” and “major obstacle”. The signs of the estimated coefficients for “not an obstacle” “minor obstacle”, “moderate obstacle” were found to have been positive while the coefficient for “major obstacle” was found to have been negative. All the coefficients were found to be statistically insignificant.

This finding contradicts the results by McCormick and Kinyanjui (1997) who found that access to finance was a positive and statistically significant predictor of MSEs employment growth in Kenya. The result, however, resonates with the study findings by Kimuyu and Omiti (2013), Atieno (2001), Kiraka, *et al.*, (2013) and Mwangi and Wanjau (2013) who found the credit access not to have had a statistically significant effect on MSEs growth. The authors argued that it is possible that by virtue of being owned by the poor who often divert borrowed loans to smoothen their consumption patterns, MSEs require more than credit to grow.

Mobile money technology was found to be one of the factors that affected the MSEs’ employment growth. According to the results presented in Table 4.9, the use of mobile money variable was specified as a categorical variable with the “No” response as the reference category. The estimated coefficient for “Yes” category was found to be positive with a magnitude of 1.850755. An MSE that used mobile money transactions increased its employment growth by about 1.85 per cent compared to a MSE that did not use mobile money transactions. The study result confirms the study findings by Esselaar, *et.al.*, (2007) in 14 African countries

which found that SMEs using ICT and especially mobile phones technology have a higher growth performance.

Finally, estimation results presented in Table 4.9 showed an inverse relationship between a MSE affiliation status and its employment growth. A MSE was considered affiliated to other establishment if for instance the sampled establishment was part of a branch of another establishment. The affiliation variable in the estimation was specified as a categorical variable with the "No" response as a reference category. The estimated coefficient for the "yes" category was found to be negative 2.640531. The coefficient was statistically significant at five per cent level of significance. This means that employment growth for an affiliated MSE was 264 per cent less compared to an un-affiliated MSE.

The results conforms with study finding by Roper, *et al.*, (2006) which found that being a part of a multinational group had a negative effect on a firm's growth. The result could be an indication that most affiliated firms tend to be relatively more capital intensive as opposed to labour intensive. Alternatively, such firms tend to be in their mature product growth stage where their focus is on cost cutting process innovations that tends to displace labour (Roper, *et al.*, 2006).

As presented in equations 3.7 and 3.8 another channel through which the effect of a firm's innovation capability may be transmitted is through increased sales. As argued by Hall (2011), innovation capability should lead to a shift in a firm's demand curve as sales turnover increases. Through innovation activities, firms

introduce new or higher quality products and services thus increase their sales turnover. Based on this argument, this study used sales per employee for 2012 as the second measure to proxy the effect of innovation capability on MSEs growth performance.

Sales per employee variable was measured as a ratio of the annual sales in 2012 divided by number of fulltime employees in 2012. This variable was used as the dependent variable. It was then regressed against independent variables of interest including predicted values of innovation outputs obtained after the estimation of equations 3.24, 3.25, 3.26 and 3.27. The predicted values represented innovation outcomes from MSEs' product innovation, process innovation, organization innovation and marketing innovation. Thus jointly, the predicted values represented MSE's innovation capability variable. Other independent variables in the model included the MSE's inputs such as physical capital intensity and the size of the labour force. The age of the MSE, proportion of export sales and physical location were included as control variables. Results given in Table 4.10 present the estimated results for the effect of innovation capability on the growth of MSEs in Kenya.

As shown in the estimation results presented in Table 4.10, the value for R-squared was 0.9608 implying that the explanatory variables included in the model explained about 96.1 per cent of the variations in the MSEs sales growth rate. The test for overall model fitness showed that the F test statistic was 67.37 with a p-value of 0.0000. This was an indication that the independent variables included in

the model jointly determined the changes in the dependant variable. Based on the link-test results presented in Table 4.10, the p-values for *hat* and *hat* squared were found to be 0.000 and 0.432, respectively. Since the predicted *hat* square did not have explanatory power, the link-test result gives an indication that the model specification was correct (Pregibon, 1980).

The test for multicollinearity found the mean VIF was high at 32.89. The high multicollinearity was, however, unavoidable as it was due to squaring of such variables as age and size of MSE as well as inclusion of predicted values of innovation capability as independent variables. The squaring of these variables was necessitated by the need to capture the non-linear relationships among these variables while inclusion of predicted values for innovation capability was in line with the endogenous growth theory.

The test results for heteroskedasticity showed that heteroskedasticity could not be ruled out as the Chi square was 3.66 and it was statistically significant at 10 per cent level of significance. For this reason, the model was estimated using robust standard errors to tackle heteroskedasticity. A test for normality using the Shapiro-Swilk test for normality found the test statistic to be 0.87016. The statistic was also found to be statistically significant at one per cent level of significance. Thus the error term was normally distributed and an OLS estimation technique was justifiable.

Table 4.10: OLS estimation results for the effect of innovation capability on MSEs' sales growth

Dependant Variable: Sales per employee 2012				
Independent Variables	Coefficient.	Robust Std. Err.	T	P-Value
Predicted product innovation (p3)	0.1671535*	0.0838993	1.99	0.059
Predicted process innovation (p4)	0.1202481**	0.0501721	2.4	0.026
Predicted organization innovation (p5)	-0.0688014**	0.0310355	-2.22	0.038
Predicted marketing innovation (p6)	0.1095701**	0.0475429	2.3	0.031
MSE size (2010)	-3.531607**	1.63646	-2.16	0.043
MSE size squared (2010)	0.4503958*	0.2612616	1.72	0.099
Log physical capital intensity	0.9252661***	0.1216728	7.6	0.000
Proportion of export to sales	-0.007173	0.0044906	-1.6	0.125
MSE Age	-0.1587548*	0.0791833	-2	0.058
MSE Age Squared	0.0034495**	0.0015892	2.17	0.042
Physical location: Nairobi region (Reference)				
:Central Region	0.9608595**	0.4329955	2.22	0.038
:Nyanza Region	-0.9549421	0.5826137	-1.64	0.116
:Mombasa Region	0.02889	0.2955494	0.1	0.923
:Nakuru Region	0.4578492	0.9091957	0.5	0.62
Constant	10.56966***	3.064594	3.45	0.002
F(14, 21)	67.37***	-	-	0.0000
Link-test: hat	1.147372***	-	-	0.0000
:hat square	-0.00724	-	-	0.431
Shapiro-Wilk normality test	0.87016***	-	-	0.00057
White test χ^2	3.66*	-	-	0.0577
R-squared	0.9608	-	-	-
Root MSE	0.7124	-	-	-
Mean VIF	32.89	-	-	-
Number of observation	36	-	-	-

Notes: Asterisk *** denotes significance at 1 per cent level of significance $p < 0.01$; **5 denotes significance at 5 per cent level $p < 0.05$ and * denotes significance at 10 per cent level $p < 0.1$

Source of data: Own computation

The estimation results presented in Table 4.10 indicated that MSE's innovation outputs impacted on the sales growth performance of MSEs. Starting with product

innovation, the estimated coefficient for predicted product innovation variable was found to be positive 0.1671535. The coefficient was statistically significant at 10 per cent level of significance. This implies that one per cent increase in MSE's predicted product innovativeness contributed to 16.167 percentage points increase in the MSE's sales per employee during the study period.

With regard to process innovation, the estimated coefficient for the predicted process innovation variable was found to be positive with a magnitude of 0.1202481. The coefficient was also found to be statistically significant at five per cent level of significance. The finding suggests that a one per cent increase in predicted process innovation capability, led to 12 percentage points increase in MSE's sales per employee. The findings, on product and process innovation, were in line with the study findings by Jienwatcharamongkhon and Tavassoli (2014) who found that firm growth performance increased by 16.1 per cent for a one unit increase in innovation output in Scandinavian countries. In a similar study, Walobwa, *et al.*, (2013) estimated that a unit increase in technological innovation, which encompasses product and process innovation, contributed 0.52 units to MSE's business growth in Kenya.

The estimated coefficient for organisational innovation variable was found to be negative with a magnitude of 0.0688014. The coefficient was statistically significant at five per cent level of significance as presented in Table 4.10. This implies that MSE's sales per employee decreased by 6.8 percentage points for every one per cent increase in the MSE's organisation innovation capability during

the study period. Thus similar to the relationship between employment growth and organisation innovation presented in Table 4.9, introduction of organisation innovation seems to have resulted into reduced MSE's performance in terms of sales growth.

This finding seems to suggest that due to their relatively small size, MSEs usually have limited room for organisation innovation. A possible explanation for this finding in Kenya may relate to the dominance of family ownership and management of MSEs (RoK 2016a). Due to this ownership and management structure, organisation innovation amongst MSEs tends to involve retrenchment of the non-family workers. These workers may possess skills that are critical to the MSEs growth. As a result organisation innovation negatively affect the sales growth of the MSEs.

Results presented in Table 4.10 show that the estimated coefficient for marketing innovation capability variable was positive with a magnitude of 0.1095701. It was also found to be statistically significant at the five per cent level of significance. The result imply that a one per cent increase in MSE's marketing innovation capability led to 11 percentage points increase in MSE's sales per employee. The finding confirms the result by Walobwa, *et al.*, (2013) who estimated that a unit increase in marketing innovation contributed to a 0.71 units increase in MSE performance in Kenya. The magnitude of the coefficient on marketing innovation variable in Walobwa, *et al.*, (2013) results was, however, much higher that the finding in the current study. This may be due to difference in the study

methodology where Walobwa, *et al.*, (2013) failed to take into account the econometric problems of selectivity bias and endogeneity. The study by Walobwa, *et al.*, (2013) was also based on a smaller sample of garment making MSEs in Jericho estate of Nairobi. These factors may have contributed to an over-estimation of the marketing innovation coefficient.

Overall the estimated coefficients for three innovation capabilities variables comprising of product, process and marketing innovations outcomes seems to confirm the endogenous growth theories espoused by Romer (1994) and Aghion and Howitt (1992). The authors posited that investments in innovation capability or knowledge capital leads to spillover effects that reduces the diminishing returns to capital and thus contributes to a firm's growth. This, the authors argued, is because the positive externalities of knowledge capital constitutes a partial public good that endogenises firm growth process. Knowledge capital generated by MSEs, unlike other factors of production, need not be limited by diminishing returns to scale. This is because competitive MSEs continually generate new knowledge through the innovation process (Aghion & Howitt, 1992).

Other factors also affected MSEs growth performance in terms of sales turnover. Among these factors included the size of a MSE. As presented in the estimation results in Table 4.10, the size of a MSE was one factor that had an effect on its growth performance. The size of MSE variable was represented by the number of fulltime employees in the year 2010. The estimated coefficient for the size of MSE variable was found to have been negative with a magnitude of 3.531607. The

coefficient was found to be statistically significant at five per cent level of significance. This means that increasing the size of a MSE by one worker, resulted into a 3.5 percentage point decline in the MSE's sales per employee.

Estimation results presented in Table 4.10 indicate that the coefficient for the log of physical capital intensity variable was found to be positive with a magnitude of 0.9252661. The coefficient of the variable was statistically significant at one per cent level of significance. This implies that a one percentage increase in the physical capital intensity resulted into 0.93 percentage points growth in sales per employee. The finding was in line with empirical findings in the study by Bigsten and Gebreeysus (2007) who found high capital-labour ratios had a positive and statistically significant impact on manufacturing firms' growth in Ethiopia.

The finding confirms the theoretical propositions by firm growth theories advanced by Solow (1956), Romer (1994) and Aghion and Howitt (1992). These theories posit that physical capital accumulation as a factor of production contributes to firm growth. The relatively large coefficient of the variable also seems to allude to the fact that most MSEs in Kenya operate with minimal physical capital and, therefore, a marginal increase in MSEs' physical capital stocks would almost double their growth performance in terms of sales growth. The large coefficient on the physical capital intensity variable coupled with relatively high standard error could also have resulted from an over-estimation due to the presence of a high degree of multicollinearity within the model.

A firm's export participation was one of the factors that has been hypothesised to positively affect firm's growth. The estimation results presented in Table 4.10, however, failed to detect a positive and statistically significant relationship between export participation and MSEs sales growth. Instead, the estimated coefficient for the proportion of export sales was found to be negative and statistically insignificant. This finding thus contradicts results of studies by Jienwatcharamongkhon and Tavassoli (2014) and Ayyagari, *et al.*, (2007), Dutz and O'Connell, (2013) who found export participation to have a positive impact on growth of firms. The negative and statistically insignificant result may be interpreted to mean that the MSEs that had high proportions of export sales lacked adequate absorptive capacity to harness the knowledge capital inflows associated with export participation. As a result, export linkage did not facilitate the MSEs to grow their sales per employee.

The coefficient for age of MSE was found to be negative and statistically significant at 10 per cent level of significance. This means that increase of the age of a MSE, reduced its sales per employee. The age and sales per employee relationship was found to be non-linear. Thus the estimated coefficient for the age of MSE squared was positive and statistically significant at the five per cent level of significance. The findings thus confirmed the existence of a non-linear relationship between firm age and growth found by the Bigsten and Gebreyesus (2007) study in Ethiopia. The non-linear relationship imply that in the initial years of a MSE formation, a MSE faces opportunities for expanding its markets. The younger the MSE, the higher its sales growth potential but as the MSE grows older,

the less its sales growth opportunities. The situation is, however, reversed after a certain age. The relatively older MSEs are thus able to increase their sales performance due to their longer learning curve.

Physical location of a MSE was found to have a mixed effect on the growth MSEs. The physical location variable was specified as a categorical variable for the five physical regions that included Nairobi, Central, Nyanza, Mombasa and Nakuru regions. Nairobi region was specified as the reference category region. According to estimation results presented in Table 4.10, the estimated coefficient for Central region was found to be positive with a magnitude of 0.9608595. The coefficient of the variable was found to be statistically significant at five per cent level of significance. This result implies that a MSE located in the Central region experienced 0.96 percentage point higher sales per employee compared to MSEs located in Nairobi region. On the other hand, the estimated coefficients for Nyanza region was found to be negative and statistically insignificant while coefficient for Mombasa region and Nakuru region were found to be positive but statistically insignificant.

The finding was contrary to study findings by Audretch and Feldman (2004), Bigsten and Gebreeysus (2007), Tavassoli (2014) and Kiraka, *et al.*, (2013) which found physical location to have a positive impact on a firms' growth through channels such as purchasing power, superior supply and demand conditions. The expectation would be that MSEs located in Nairobi region enjoy more favourable purchasing power, superior supply and demand conditions given that Nairobi is a

capital city. Just like with case of employment growth rate, the inconsistent result may have arisen from sampling procedures giving undue weight to MSEs located in the major towns as opposed to the rural based MSEs.

In summary, based on the estimation results presented in Table 4.9, employment growth of MSEs was not affected by three of the four innovation capability variables. Coefficients of technological innovation capability variables of product and process innovation were found to be positive but not statistically significant. This results may have been an indication that even though MSEs had engaged in product and process innovations, the levels of innovation was not sufficient enough **to enable individual MSEs** to increase their employment growth. With regard to organisation innovation, the effect on employment growth rate at firm level was negative. It was only marketing innovation capability that was found to have a positive and statistically significant effect on the MSE's performance in terms of employment growth. The results also indicated that there were other factors that had statistically significant effects on MSEs employment growth. These factors included size of MSE, age of MSE, affiliation status, cost of labour and mobile money use.

With regard to MSE's sales growth, results given in Table 4.10 indicated that all the innovation capability variables impacted MSE's sales per employee growth. Coefficients of product, process and marketing innovation capability variables had a positive and statistically significant effect the MSEs sales per employee growth. The coefficient for organisation innovation had a negative and statistically

significant effect on MSE sales growth per employee. The other factors that had statistically significant effect on MSEs sales per employee included size of MSE, age of MSE, physical capital intensity and physical location.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter presents the summary of the study, conclusions and suggested policy implications from the study findings. It also highlights the study's contribution to knowledge and suggested areas for further study.

5.2 Summary

The role of MSEs towards the growth and development of the Kenyan economy is well documented. For instance data from the latest MSE survey data in 2015 showed that the sector contributed 24.7 per cent to the national wealth in 2015 while it employed about 14 million Kenyans (RoK, 2016a). The Kenya government has since independence put in place various policy and strategies (RoK, 1965; RoK, 1986; RoK 1992; RoK, 2005; RoK, 2007) efforts to ensure the sector continues to contribute to the country's gross domestic product, provide sustainable and quality jobs and act as a seedbed for industrial growth. In spite of these efforts the mortality rate of MSEs remains unacceptably high. In 2015, for instance 46 per cent of MSEs did not survive beyond their first year of operation (RoK, 2016a). While there exist empirical evidence of the role that innovation capability can play in expanding market opportunities for MSE's products, in the 2015 survey, 32 per cent of MSEs cited lack of market for their products as one of

the severest constraints to their growth (Astrid, 2010; Audretsch, Coad & Segara, 2014, RoK, 2016a)

This study sought to investigate the role played by innovation capability in the growth of MSEs in Kenya. The specific objectives of the study were to: analyse factors that influence MSEs' decision to engage in innovation activities in Kenya; establish factors that affect the intensity of MSEs' innovation activities in Kenya; ascertain the determinants of innovation capability among MSEs in Kenya; and establish the effect of innovation capability on growth of MSEs in Kenya.

This study used data from a national cross-sectional survey obtained from the World Bank enterprise data set for 2013. The World Bank survey had used stratified random sampling technique to collect data from 720 firms with more than five employees and another 360 firms with five or less employees (World Bank, 2013). For the purposes of this study, 575 enterprises with one up to 50 employees were used to carry out the analysis on MSE innovation capability. The unit of analysis was the physical enterprises where the interview was conducted. The data set provided measures for various variables of interest such as innovation inputs, innovation outputs and other enterprise characteristics.

In the analysis, the study extended the neo-classical firm production into a knowledge production function by incorporating an innovation capability variable (Pakes & Griliches, 1984; Hall, 2011). A recursive econometric model was then

used to estimate the link between innovation capability and the growth of MSEs (Crepon, *et al.*, 1998). Heckman maximum likelihood estimation and Heckman two-step estimations were conducted to verify possible existence of a self-selection econometric problem (Heckman, 1979). Results indicated there was no self-selection. Probit models and Ordinary Least Squares were, therefore, estimated using Sequential Instrumental variables

To achieve objective one that sought to analyse factors that influence MSEs' decision to engage in innovation activities in Kenya, a Probit model was estimated. Based on the estimation results the factors that had a positive and statistically significant influence on MSEs decision to engage in innovation included the average number of years of education for MSEs' production worker, age squared of a MSE, access to finance and size of a MSE. On the other hand, foreign ownership, manager's experience and age of a MSE were found to hinder MSEs decision to engage in innovation. Based on these results, years of education for the MSE's production worker, age, access to finance, size, foreign ownership and manager's experience are factors that influence the decision whether a MSE engage in innovation or not.

This study estimated a linear model by OLS to establish factors that affect the intensity of MSEs' innovation activities in Kenya. The estimation results identified a number of factors that had a positive and statistically significant influence on innovation intensity among MSE in Kenya. These factors included MSE's physical

capital intensity, sales per employee or labour productivity, affiliation status, proportion of export sales and accessibility to finance. Meanwhile MSE's high market share as well as location of MSE away from the Nairobi region had a negatively and statistically significant influence on MSE's innovation intensity.

The third objective was to ascertain the determinants of innovation capability among MSEs in Kenya, Probit models for determinants of product innovation, process innovation, organisation innovation and marketing innovation were estimated. From the estimation results on product innovation capability the variables that were found to be statistically significant included innovation intensity, affiliation status, proportion of skilled fulltime employees, market share, and average length of employment for temporary workers, proportion of domestic ownership, physical capital intensity, age and number of full-time employees.

With regard to process innovation capability, the variables that were found to have been statistically significant included the proportion of skilled fulltime employees, annual cost of labour, export participation, source of innovation financing, registration status, legal ownership status and use of mobile money transactions. The estimation results found the determinants of organisation innovation capability included predicted innovation intensity, computer skills levels, domestic ownership, number of years of education for production worker and legal status of the MSE. The determinants of marketing innovation capability were found to include predicted innovation intensity, physical capital intensity, managers'

experience, own source of innovation financing, affiliation status, number of years of education for the production worker and age of the MSE.

Overall, the estimation results show that determinants of MSEs innovation capabilities include innovation intensity, availability of skilled labour especially for production workers, cost of labour, physical capital intensity. Other determinants include age of MSE, size of MSE, affiliation status, mobile phones and computers usage, domestic ownership levels, export participation, source of innovation financing, legal ownership status, managers years of experience and MSE's registration status.

Two linear models were estimated by OLS to establish the effect of innovation capability on growth of MSEs in Kenya. The first model used MSE employment growth for the period 2010-2012 as the dependent variable. In the second model MSE's sales per employee was used as the dependent variable. The estimation result of the employment growth model showed that product innovation capability, process innovation capability and organisation innovation capability had no statistically significant effect on MSE growth employment growth. Only marketing innovation capability was found to have a positive and statistically significant effect on MSE's employment growth rate. From the results, one per cent increase in MSE's marketing innovation capability led to 4.5 per cent increase in the MSE's employment growth.

Based on the study findings the only other factor that was found to have a positive and statistically significant effect on MSE's employment growth rate was the use of mobile money technology in MSE's transactions. The results further indicated that affiliation to other firms, increases in cost of labour, size and age had statistically significant effect of slowing down MSE's employment growth.

The estimation of the sales growth model showed that product innovation capability and process innovation capability had positive and statistically significant effect on MSE growth in terms of sales per employee. In particular, a one percent increase in predicted product innovation capability resulted into 16.7 percentage point increase in MSE's sales per employee while a one percent increase in predicted process innovation capability resulted to 12.0 percentage increase in a MSE's sales per employee. A one per cent increase in predicted marketing innovation capability resulted to 11 percentage points increase in MSE's sales per employee. On the other hand, a one per cent increase in predicted organisation innovation capability of MSEs resulted to 6.9 percentage point decrease in MSE's sales per employee. Other factors that impacted on the growth of MSE's in terms of sales growth rate included the physical capital intensity, size of MSE, age of MSE and physical location of the MSE.

5.3 Conclusions

With regard to objective one which sought to analyse factors influencing MSE's decision to engage in innovation activities in Kenya, the study concludes that skills

levels for production level workers is a critical ingredient that can be used to stimulate MSEs innovativeness. The other factors of access to finance, age, size and foreign ownership relate to the MSE's resource endowment. Thus apart from availing skilled production workers, MSEs resource constraints is another factors that may be limiting MSEs innovativeness. In objective the aim was to establish factors that affect the intensity of MSEs' innovation activities. From the study findings, the study concludes that high growth sectors characterised by high physical capital intensity devote more resources towards innovation activities. The study also concludes that inadequate financial resources as well as market power limits MSEs innovation intensity.

In objective three which sought to ascertain determinants of innovation capability among MSEs in Kenya, the study findings highlights the existence of a diverse range of factors that influence the innovative capability among MSE in Kenya. Among the factors that influence the innovation capability, human capital skills, physical capital intensity, access to finance, size, external linkages, physical location, ICT adoption and usage and legal ownership structures. Most of these factors relate to enterprise resource constraints and lack of human capital skills at the production level.

In relation to objective four, the study set out to establish the effect of innovation capability on growth of MSEs in Kenya. The study found that whereas innovation capability appeared to have minimal effect on MSEs growth in terms of employment, it had a substantial positive effect on MSEs growth in terms of sales

per employee. This study thus concludes that the effect of MSE's innovation capability on the MSE's growth depends on the level of innovation and how growth of a MSE is measured. As long as MSEs continue to engage in a level of innovation that only imitates each other's product and services, the markets for their products will remain static. Creation of new markets will only materialise if the levels of innovation is focused on substantially new to markets products and services. Furthermore marginally incremental innovations or the imitations as practiced by MSEs in Kenya replace old products and services thus providing temporary growth in sales while destroying jobs elsewhere.

From the foregoing, it is evident that opportunities for MSEs growth in Kenya are mostly tied to their ability to develop relatively more radical innovations. Such innovations should entail introduction of products, process, organisation changes and marketing methods that are new to the markets and even to the country. For this to happen, resource constraints and availability of skilled workers, especially, at the production workers level should be tackled at both policy and enterprise level.

5.4 Contribution to knowledge

The study was different from other previous MSE innovation studies in Kenya in a number of ways. Firstly, it sought to establish the linkage between innovation inputs, innovation outputs and growth of MSEs using a structural model that mimics the logic of decision making at a micro firm level. Secondly, unlike

previous studies, the study adopted the econometric estimation approach, which took into account potential endogeneity and selection bias econometric problems thereby improving in robustness of the findings. Thirdly, this study focused on the MSEs' innovation unlike other studies whose focus is innovation by medium and large enterprise. It also used the latest and most comprehensive dataset on enterprises innovation unlike other past studies that have used small region survey data. Finally, this study analysed MSEs' innovation as a process that starts with a decision to engage in innovation, the innovation inputs and outputs and finally the effect of the innovation outputs on MSE growth. In this manner, this approach managed to disentangle the drivers of the four main types of innovation and their effect on the growth of MSEs in Kenya.

5.5 Policy Implications

Empirical results from this study have shown that while MSEs' innovation capability had a positive and statistically significant impact on MSEs growth in terms of sales, this capability did not have a statistically significant impact on MSEs growth in terms of employment. It is, therefore, likely that the level of MSE's innovation was marginally incremental and imitative. Such type of innovation only enables MSEs to imitate other MSEs and introduce new products for a short time before other competing MSEs imitate the product. This is typical of the Schumpeterian creative-disruptive forces. The marginally incremental innovation may not have been sufficient to warrant a MSE to hire additional

employees as its benefits are very short term. It also does not allow the innovative MSE to appropriate the benefit or recoup its costs of innovation activities.

Government innovation policies for MSEs should thus target at improving the MSEs innovation activities beyond the marginally incremental innovation, which is usually limited to short-lived imitations, to relatively more novel or radical innovations. This can be achieved through such interventions such offering technical training targeted at improving MSE production workers; skills, subsidising innovative MSE's training of production workers by facilitating MSEs to acquire intellectual property rights such as patent or copyright for their innovations.

The results have also demonstrated that MSEs' innovation intensity is a major factor influencing innovation capability outcomes. Converting innovation capability into MSE's employment growth, however, seems to be constrained by the low levels of innovation related expenditures. The study results show that MSEs' inaccessibility to finance has led to over reliance on own source of funds to finance MSEs innovation activities.

The negative relationship between size of MSE and its innovation capability points to a possibility of resources constraints facing MSEs. As a consequence, the resulting level of innovation does not facilitate growth of the MSE beyond introduction of a new product. Governments should design tax measures targeted at innovative MSEs with an aim of subsidising MSEs' expenditures on innovation

activities. Such support is justifiable given the positive externalities or spillover that characterise innovative activities by one of the most prevalent sub-sector in the economy. The owners and operators of MSE, on the other hand, should also pursue strategies aimed at broadening their access to capital by for instance listing their enterprises at the Securities Exchange.

Government should also promote the link between research and development at the tertiary institution of higher learning and research institutes to MSEs. This could be achieved through sponsoring internship programme where researchers/students are attached to innovative MSEs. Internal MSEs innovation strategies should also design and implement internal tailor-made apprentice training programmes targeted at their key production level workers.

Based on the finding in this study it is clear that human capital skills play a positive and statistically significant role in stimulating MSEs innovativeness and by enhancing their absorptive capacity. As indicated in the study findings, however, most MSEs' employees highest education attainment is the primary school level. It is, therefore, recommended that government should revamp technical training programmes with an aim of improving the technical skills of the average MSEs' production workers across the country. The education system should also reinvigorate practical technical skills at all levels of education by making sure technical skills are examinable. This will ensure those who drop out of the education system, especially at the primary level, have technical skills that are relevant to the MSE sector.

The study also found physical capital as one of the factors that had a positive and statistically significant influence on MSE's innovativeness. The study, however, found MSEs physical capital intensity to be quite heterogeneous with some MSEs being highly capital intensive while others operate had low physical capital intensity. To narrow this gap in physical capital intensity among MSEs, the National and County governments should provide shared physical capital infrastructure through shared work sites where machinery, equipment, housing and other services can be shared among innovative MSEs.

Empirical findings of this study also found ICT status of MSEs such as adoption and use of mobile money and computers to have a positive and statistically significant role in promoting MSEs innovative activities. This is particularly with reference to process and organisation innovation capabilities. It is therefore recommended that government improves MSE access to ICT by reducing the cost and improving related ICT infrastructure.

The study findings also indicates the importance of firm linkages and affiliation in promoting MSEs innovativeness. This study recommends that MSEs and larger enterprises should engage in more collaborative linkages. Such linkages can include sub-contracting, joint ventures and franchising. By fostering external linkages and partnership linkages amongst MSEs and with other larger firms, MSEs may leapfrog the technology ladder.

5.6 Areas for Further Research

This study used cross section data even though panel data would have been more insightful in the study on innovation capability and MSEs growth. In particular panel data would have captured the dynamics involved in the growth of a MSE across a number of years. Panel data on MSEs innovation activities was, however, not available at the time of this study. The study also used dummy variables to capture innovation outcomes or outputs yet literature argues that innovative sales is a more accurate measure of innovation outcomes. Only dummy variables were, however, available for innovation outcome for the four categories of innovation. Thus further areas of study could focus on:

- i) Effect of innovation capability on long term performance of MSEs.
- ii) Effects of innovation sales on MSE growth.

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APPENDIX

Table A1: Test for means differences between innovative and non-innovative MSEs

Variable	Innovative MSEs (1) N= 495	Non- Innovative MSEs (0) N=80	Difference (1-0)	P-Value
	Mean (SD)	Mean (SD)		
Empl. growth	0.16 (0.48)	0.106 (0.49)	0.054	0.368
Sales growth	4.751 (44.381)	0.412 (4.518)	4.339	0.473
Phy. capital	39,300,000 (173,000,000)	24,300,000 (56,200,000)	15,000,000	0.524
Innov. Expnd per employee	222,921.1 (893,844.6)	20,153.5 (75,181.95)	202,767.60**	0.046
Prop. skilled workers	0.00162 (0.00231)	0.0012 (0.00105)	0.000	0.375
Prop. emply. using computer	27 (31.141)	19.67 (28.884)	7.330*	0.067
No. years with internet	6.445 (4.654)	7.088 (4.914)	-0.643	0.452
Annual cost formal training	5,368,974 (45,300,000)	142,000 (9,227.14)	5,226,974.00	0.779
Av. yrs educ. Prod. worker	11.653 (3.522)	10 (4.628)	1.653**	0.033
Fulltime emply. 2010	16.29 (12.845)	15.17 (13.237)	1.120	0.848
Fulltime emply. 2012	18.923 (20.29)	15.238 (14.177)	3.685	0.119
Age	20.162 (15.694)	17.513 (15.975)	2.649	0.174
No. of market competitors	14.902 (48.556)	6.133 (7.269)	8.769	0.487
Managers yrs of experience	17.386 (10.943)	15.763 (9.744)	1.623	0.224
Prop. of foreign ownership	6.057 (21.034)	5.065 (20.302)	0.992	0.699
Prop. export sales	17.445 (34.108)	9.315 (28.026)	8.130**	0.049

Notes: N= Number of observations; SD=Standard deviation in parenthesis; Asterisk ** denotes level of significance at 5 per cent level, * denotes level of significance at 10 per cent level; P-Value is probability value

Source of Data: Own computation

Table A3: Determinants of MSEs Innovation Intensity in Kenya (Heckman – Two Step)

Variables	(1) log Innov.intensity	(2) Innov. Propensity	(3) mills
Log phy. Capital	0.263** (0.113)	-0.0646 (0.171)	
Log fulltime employee	0.665** (0.329)	-0.518 (0.427)	
Av educ. yrs prod. Emply	0.0562 (0.0726)	0.106 (0.0733)	
Age	0.000691*** (0.000163)	-1.64e-05 (0.000261)	
Use mobile (Yes)	-0.290 (0.540)	0.777 (0.602)	
Prop export sales	-0.00719 (0.00534)	-0.00318 (0.00864)	
Prop foreign own/ship	0.0262 (0.0290)	-0.0415* (0.0227)	
Managers experience	0.0121 (0.0241)	-0.0447 (0.0301)	
Market share (2010)	-0.342** (0.139)	0.178 (0.171)	
Access to Finance			
Not obstacle	-1.559 (1.029)	1.049 (1.587)	
Minor obstacle	-0.955 (0.805)	0.137 (1.069)	
Moderate obstacle	-0.231 (1.174)	1.982 (1.262)	
Major obstacle	0.821 (1.085)	1.114 (1.255)	
Physical location			
Central regions	-2.818 (2.290)	-7.031*** (0.995)	
Nyanza region	-3.691** (1.850)	5.664 (0)	
Mombasa region	-1.235* (0.727)	2.064 (1.587)	
Nakuru region	-1.572 (2.402)	-7.597 (0)	
No.Unregistered firm	0.229 (0.373)	0.396 (0.575)	
Local market size	-1.515 (2.085)	-6.489*** (1.027)	
Lambda			0.563 (1.299)

Table A2: Determinants of MSEs Innovation Intensity in Kenya (Heckman MLE)

VARIABLES	(1)	(2)	(3)	(4)	(5)
	log Innov.intsty	Innov. Decision	rho	sigma	lambda
Log phy. capital intensity	0.269** (0.120)	0.232** (0.103)			
Prop emply. using comp	0.0161** (0.00812)	0.00365 (0.0185)			
Av.educ.yrs prod. empl	0.0958 (0.0605)	0.0539 (0.0730)			
No.of unregistered firm	0.214 (0.492)	-0.981* (0.502)			
Use mobile (Yes)	-0.131 (0.486)	0.940 (0.816)			
Prop export sales	-0.00440 (0.00647)	0.000955 (0.00541)			
Prop foreign own/ship	0.0181 (0.0227)	-0.0476** (0.0228)			
Managers experience	-0.00490 (0.0247)	-0.0116 (0.0290)			
Access to finance					
Not an obstacle	-0.493 (1.085)				
Minor obstacle	-0.374 (0.965)				
Moderate obstacle	0.543 (0.918)				
Major obstacle	0.937 (0.860)				
Inverse mills ²		-0.829 (0.920)			
Innovation intensity ²		0.213** (0.0930)			
Constant	6.337*** (2.365)	-4.055** (1.837)	1 (6.19E-11)	1.4756 (0.1406)	1.4756 (0.1406)
Observations	61	61	61	61	61

Notes: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; No.of observation 61; Censored observation 8 Uncensored observation 53; Wald chi2(12) 31.82; Prob> chi2 0.0015 ; LR test of indep. eqns. (rho = 0): chi2(1) = 11.89 Prob> chi2 = 0.0006

Source of Data: Own computation

Constant	4.396 (3.539)	10.03** (3.957)	
Observations	64	64	64

Notes: Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1

Source of Data: Own computation