Mapping Capability Building- Processes Among Food Processing Firms in Kenya.
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By
Herbert Wamalwa.
PhD Student – Institute for Development Studies (IDS), University of Nairobi, Kenya

Abstract

Agroprocessing is a very important sub-sector for many SSA economies making significant contribution to export, employment creation and GDP. Nevertheless, the sector tends to be stagnated and inward looking. On the other hand, food markets are now globalised. Liberalisation has increased competition. Additionally, the sector has to contend with stiffer and numerous regulatory standards. This dynamism makes a case for innovation as a key corporate activity holding hopes for driving profitability. However, there is little knowledge on the nature and impact of firm-level innovation activities and investments in knowledge capital in Kenya.

This paper seeks to contribute in filling this gap by focusing on how food processing firms in Kenya build their technological capabilities. These include production, investment, and linkage capabilities. To map the technological capability building processes, the paper pays close attention to technological learning among the firms. These entail both internal and external learning mechanisms. These mechanisms constitute technological effort which presumably has a bearing on firm performance.

The paper will draw on two sets of datasets to address the research question. The first set consists of six case studies of snacks processing firms drawn from the Nairobi Metropolitan Area while the second set consists of a 2013 World Bank Innovation Survey for Kenya. The innovation survey analyses 103 food processing firms drawn from Nairobi, Central, Nakuru, and Nyanza. Preliminary results indicate that though there are considerable variations, on the whole internal learning mechanisms dominate. A majority of the firms do on-job training. Similarly, many are putting effort at research and development. As for external mechanisms, private mechanisms such as learning from buyers, suppliers and inter-firm spill overs supersede collective learning mechanisms. However, even in these, there are variations.

1 Herbert Wamalwa, Email: wnyukuri@gmail.com
1 Introduction

1.1 Background to Kenya’s food processing sector

In Kenya, the food-processing sector has been an important contributor in the country’s industrialisation process, being one of the sectors to emerge early in the country’s industrialisation (McCormick and Atieno, 2002). Its contribution in terms of value added and employment has been considerably above the national manufacturing average. The sector’s importance in the economy is reflected in its employment creation, income generation, foreign exchange earnings and the stabilisation of farm incomes through the processing of perishable agricultural products. Recent statistics indicate that the earnings from agro-processing accounted for 30% of total export value, an equivalent of 70% of total manufacturing by 2007 (Atieno, 2012). This notwithstanding, the potential of the agroprocessing sector has not been fully realised. In Kenya as of 2002, most agro-processing firms tended to be inward looking and stagnated (McCormick and Atieno, 2002). Most firms only catered for the local market, shielding them from world market competition and contributing to the low quality products. Recent studies indicate that this may not have changed much. A 2012 study points out that productivity levels in agro-industry are low, reflecting the limited scale of activities mainly due to dispersed sources of raw materials as well as backward technologies and weak managerial and technical skills (Atieno, 2012).

On the other hand, over the past few decades, the Kenyan food industry has faced dramatic changes in its competitive environment. The internationalisation of the global food market and the mergers among supermarkets has put pressure on the prices that can be realised by the suppliers of both the fresh and processed food. As a result of these pressures, food manufacturing, which is generally viewed as a mature and relatively low technology industry, has been forced to introduce changes that have affected many aspects of operation (Tessa et al., 2003; Wellington and Mwangola, 2006). Food companies now need to keep up with new regulatory standards. On top of this, increased competition has pushed food companies to become more efficient in processing, to reorganise management, develop new products and explore new markets in order to meet the needs and wants of consumers competitively (Tessa et al., 2003; Reardon et al., 2004; Jaffee et al., 2005; Ouma, 2010; Ouma & Whitfield, 2012).

1.2 Research Problem

In 1999, Kenya was listed among 51 countries as an emerging economy. These economies are characterized by a rapid pace of economic development, and government policies favouring economic liberalisation and the adoption of free market system (Hoskisson et al., 2000). At the same time as domestic policies are becoming more market-oriented, emerging economies’ governments are opening their countries to foreign markets and joining regional trading associations. New relationships are emerging between foreign and domestic enterprises as strategic alliances replace export–processing zone and subcontracting arrangements. The business environment in many of these economies has long been characterised as unfriendly. Economic and political shocks have greatly increased the uncertainty and risk for both domestic firms and foreign investors. Missing institutional features (for instance, shortages of skilled labour, thin capital markets, infrastructure
problems) as well as political and economic instability and public suspicion of foreign firms have deterred inward foreign direct investment (FDI). Lack of strong legal frameworks has allowed a large increase in opportunism, rent shifting, bribery, and corruption (Hoskisson et al., 2000).

The Global Competitiveness Report 2011-12 ranks Kenya at position 102 out of 142 in the overall competitiveness index (WEF, 2011). The report cites corruption, access to financing, inadequate supply of infrastructure, crime, tax rates, inflation, and inefficient government bureaucracy as some of the worrisome areas. Empirical observations among various sectors such as the food industry confirm some of the observations above. In Kenya, reports indicate that food processing has experienced declining growth in recent years. Growth in 2011 was 1.6% from a high of 8.7% in 2007. This fall in growth has been attributed to generally weak economic conditions, high cost of fuel, and drought conditions that reduced availability of raw materials (Republic of Kenya, 2012). Apart from this, competition has intensified on the local as well as foreign markets. Opening markets implies sharing the local market with global players who may have competitive advantages based on such factors as low production costs, better quality, large and consistent volumes among others. Expanding and venturing into the foreign markets also expose African firms to the same competition (Reardon et al., 2004; Jaffee et al., 2005; Ouma, 2010). Enterprise strategies in emerging economies are therefore facing strong environmental pressure for change, yet this change is neither smooth, automatic, nor uniform across different markets (Hoskisson et al., 2000).

This notwithstanding, a limited number of empirical studies suggest that the internal capabilities of African firms are improving: entrepreneurs are growing in impact and diversity; firms are building organisational and managerial capabilities that allow them to be successful not only in domestic markets but also in regional and global markets; and more firms are reaching a critical size that enable them to obtain scale and scope economies (Jorem et al., 2012). The business environment notwithstanding, such firms are demonstrating growth and success. In the quest to bring to light the possible drivers for such growth and this study focuses on firm level capabilities. Focussing on technological capabilities among the firms, the study seeks to analyse the capability accumulation process among food processing firms and to establish the extent technological capabilities explain the differentiated performance among them.

1.3 Research Question

This study sought to answer the following broad question: To what extend and how have food processing firms in Kenya acquired capabilities to be competitive? To answer this question, the study addresses the following specific questions

1. At what level of technological capabilities do the firms operate?
2. What are the learning processes that have supported the development of that level of capabilities?

The following are two guiding hypothesis:
1. Technological capabilities among firms in the food processing sector are low compared to the rest of the world.
2. The learning and linkage mechanisms to enhance these technological capabilities are underdeveloped.

2 Technological Capabilities and firm innovation

2.1 Introduction
In the initial stages of industrial development, a vast majority of developing countries, including those in Africa, sheltered their industries for long periods, their governments often owning firms and directing resource allocation (Lall, 2002). Many countries also restricted inflows of technology via foreign direct investment (FDI), licensing and capital goods. In some parts of the developing world, this fostered technical inefficiency, technological lags, poor capabilities, and uncompetitive firms. As Lall (2002) and many others have noted, this is changing rapidly and irreversibly as industry moves into a more open environment. Lall contends that revitalisation of industrial growth in this context has to cope with rapid change, globalisation and policy liberalisation. To be internationally competitive, among other things, enterprises need to access new technologies and deploy them efficiently, and improve them in line with technical change. In the past, firms could afford to be inward looking assured that local markets are secured and protected. Liberalisation and globalisation has ensured that these firms have to share their clients be it local or regional with firms from the international marketplace that outcompete on many measures. Whereas governments could bail out struggling firms in the past, enterprises are now expected to fully fund their activities including when businesses are low.

Joseph Schumpeter, in 1911, had already recognised the relationship between economic development and technical progress. He put technical change and entrepreneurship at the root of economic development (Perez, 2010). But he saw technology and other institutions as exogenous thus outside the domain of economic theory. He focussed on the entrepreneur in explaining role of innovation in economic growth. Neo-Schumpeterians expanded this and analysed technical change and innovation by looking at firms, clusters and systems by looking at the common features in the process of evolution, in the interrelationships and in the breakthroughs that occur in the most diverse technical areas (Perez, 2010). Deriving from that, today there is a widespread recognition in the business world that technological innovation is the master key to success for industrial firms. As Morrision et al., 2008:pp39 clearly note, “Nowadays, nobody would resist the contention that learning and innovation are key determinants of competitiveness and growth for nations, regions, clusters and firms”. At the macro level, the existence of innovative firms implies not only greater overall economic competitiveness, but also the creation of technological spill over into the remaining economic agents, which has a knock-on effect on the development path adopted by a given country. This underpins the concept of economic development based on innovation.

2.2 Technological Capabilities
Compared to developed economies where most of learning is through intensive efforts directed at research and development (R&D), learning among firms in less developed
economies is predominantly no-R&D driven, including information search, debugging, incremental and adjustment and the like. The learning process is conscious and purposeful, costly and time-consuming, non-linear and path dependent and cumulative causing firms to accumulate the capabilities, bundles of related routines governing exploitation of their resources (Pack and Westphal, 1986; Lall, 1992; Lall et al., 2002; Caniels et al., 2003; Marcelle, 2005; Kragelund, 2005). The Oslo Manual (2005) notes that a firm’s capability is what mainly allow it to take advantage of market opportunities and knowledge about these capabilities and the firm’s efforts to increase them is crucial in understanding its present and future performance.

Various capabilities are important. However, there is an argument that technological ones constitute the foundation upon which non-technical ones are built. Technological capabilities are the technical, managerial, and institutional skills that allow productive enterprises to utilise equipment and technical information efficiently (Dahlman et al., 1987; Lall, 1992). It is a collection of firm specific assets including elements with intensive scientific and technological content and tacit knowledge about production processes, as well as elements that enhance the ability of a firm to benefit from the presence of the technical components (Marcelle, 2005). Non-technical elements of a firm’s technological capability are components that support acquisition of technological knowledge and learning, both at the individual and firm-wide level. They are a firm-specific form of institutional knowledge made up of the combined skills of its members accumulated over time. Three main constituent elements of technological capabilities - embodied, non-embodied and organisational integration - are all necessary for firms to realise benefits for strategic competitiveness.

The term Technological Capabilities was first coined in the early 1980s by researchers probing intra-firm technological dynamics in developing countries, where firms operate far from the world’s technological frontier. These firms encounter frustrations associated with transfers of technologies and knowledge from abroad due to tacitness associated with new knowledge and the fact that foreign technologies are often less than perfectly suited for local environments (Lall, 1992; Pack and Westphal, 1986; Caniels et al., 2003; Lall et al., 2002; Kragelund, 2005). Accumulating technological capability requires time and resources to assimilate, adapt and improve known technologies, and ultimately create new technologies in-house (Caniels et al., 2003). Acquired capabilities help firms improve their economic performance, and by assumption regional and national performance as well. Making reference to East Asian firms, Pack and Westphal (1986) argue that industrial development is a process of acquiring technological capability in the course of continual technological change. They note that rather than creating radically new technologies, most of the technological changes are minor in a cumulative manner sometimes leading to increases in productivity by 100 percent propelling firms to international competitiveness within a decade.

2.3 The Technological Capabilities Conceptual Framework
Morrision et al., 2008 argue that the Technological Capabilities approach represents a radical alternative to the neoclassical framework, which rests upon the well-known conceptualization of technology as freely available, absorbed without any risks and costs and efficiently used by every enterprise. As a necessary consequence, learning is not required and any
inefficiency is due to government interventions, or externalities. They argue further that in contrast, the Technological Capabilities literature draws upon the evolutionary approach of Nelson and Winter (1982) and stresses the importance of learning in markets that are prone to imperfections and populated by firms with a satisfying – not optimizing - behaviour. The framework therefore focuses on innovation and learning in developing countries (Morrison et al., 2008). Taking this further, Marcelle, 2005 posits that the capabilities approach is characterised by three main arguments. The first is the notion that technology includes tacit elements: the skills, technical knowledge, and organisational coherence required to make technologies function in a firm. The second is that the tacit elements cannot simply be transferred, but have to be learnt and that learning process requires conscious effort. Lastly, the industry level and national level environments in which firms operate affect their decisions and ability to invest in developing new technological capabilities (Marcelle, 2005).

Lall (1992, 2001) has inspired a useful categorization of TC based on two classificatory principles: the functions they perform and their degree of complexity (Morrison et al., 2008). On the basis of the first taxonomy, it is possible to single out ‘investment’, ‘production’ and ‘linkage’ capabilities, which are different although they can be interrelated, partly overlapping and often strongly interdependent. Drawing on the same literature, the Bogota Manual proposes a similar typology but in addition to ‘production’, ‘investment’, and ‘linkage’ capabilities there are also ‘innovation’ capabilities. As per the manual, investment capabilities include project management (the organisation and monitoring of the activities involved in installing and expanding productive capability, or project engineering), provision of the information required to make the technology operational in a specific context, purchase of necessary equipment and services, abilities to implement start-up, and reach predetermined operational standard, training of workforce, and prefeasibility studies. In addition to this, investment capabilities also include the ability to recruit and train skilled personnel required.

Production capabilities include productive management (the ability to monitor and improve the operation of installed plants, or production engineering), procurement and use of the information required to optimise operations, maintenance and repair of physical capital, and the discovery of new uses and markets for current products (Bogota Manual). Morrison et al. (2008) add that process, product and industrial engineering capabilities are part of the subset of skills needed under production capabilities. They note further that among the large number of operations that require adequate skills are the assimilation of technology, its adaptation and improvement, quality control, inventory control, the monitoring of productivity, the coordination of different production stages and department and finally, the process and product innovations related to basic research activity. Linkage capabilities are required to receive (and pass on) information, experience and technology from components and raw materials suppliers, subcontractors, consultancy firms, service firms and technological institutions. Morrisson et al., 2008 argue that linkage capabilities are useful because of high transaction costs in inefficient markets, where the setting up of extra-market linkages is often an efficient strategy necessitating the need for special skills to establish technology linkage among enterprises, between them, with service suppliers and with science and technology
institutions. Lastly, innovation capabilities consist of creating new technical capabilities and putting them into economic practice.

In each of the categories described above there are technological capabilities with different degrees of technological complexity, which are used for routine, adaptive and replicative activities or for innovative and risky actions. These correspond to basic, intermediate and advanced levels of technological capabilities as elaborated in the table below. The different degrees of complexity of technological capabilities indeed explain the diverse levels of industrial performance across countries (Morisson et al., 2008).

<table>
<thead>
<tr>
<th>Forms of TC</th>
<th>Production capabilities</th>
<th>Investment capabilities</th>
<th>Innovation capabilities</th>
<th>Linkage capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels of TC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced</td>
<td></td>
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<td>Intermediate</td>
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<tr>
<td>Basic</td>
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The capabilities have an impact on the firm’s productive efficiency and innovative capability as well as on the intensity of technology diffusion at a macroeconomic level and the degree to which industrial structure is reinforced. Most innovative activity in developing countries consists of modification or improvement of existing technologies. Nevertheless, these may lead to significant growth in productivity in certain areas. To be truly competitive, it is argued that firms need to master the capabilities from across the typology.

3 Literature review

3.1 Introduction

This section is divided in three parts. The first part gives a broad picture of the food processing industry in Kenya. This highlights the importance of the industry to the Kenyan economy. While acknowledging the key contribution of the industry to the economy, it is noted nevertheless that the industry tends to perform below its potential. This is followed by a discussion of the potato processing industry in Kenya which forms the basis of the study in-depth interviews. The growing importance of the potato processing industry is demonstrated by the steady increase of potato processing firms especially in major urban centres in Kenya.

3.2 Food Processing in Kenya

This study focuses on the food-processing sector in Kenya. The sector falls within the larger agri-business industry. The agri-business industry is one of the major sectors in the Kenyan economy in terms of its contribution to GDP. The manufacturing sector is the third largest
contributor to GDP with a share of 10%, after agriculture (24%) and wholesale and retail trade (11%) (Atieno, 2012). The Economic Recovery Strategy (ERS) and the Vision 2030 recognise the mutually reinforcing relationship between agriculture and industry, and that a vibrant and productive agricultural sector provides a crucial foundation for industrialisation. Agribusiness has the potential for strengthening industrial linkages and contributing to technological innovation and regional development (Atieno, 2012). The sector’s contribution to employment is also noted. It is estimated that 20% of those employed in the formal sector and 15 percent in the informal sector are engaged in agro-industrial activities.

The domestic market is competitive, but competition does not reach the level experienced by producers for the world market. Many export processors have had problems surviving in recent decades with a number having to close down. Quality standards in the international market are high and competition can be lethal (Reardon et al., 2004; Jaffee et al., 2005; Ouma, 2010; Ouma & Whitfield, 2012). Production costs are inflated by poor infrastructure in the production areas and high costs of packaging materials. In most cases, the raw materials offered for sale are of poor quality, especially because farmers can sell their first-quality produce against higher prices in the local fresh market. Many firms face problems with raw material supply, which are related to factors such as overestimation of potential supply and lack of sufficient varieties for processing. Less than one-third had problems with market demand, caused by factors such as overestimation of prospective demand, misjudgement of consumer tastes, and underestimation of competition from other sources (Reardon et al., 2004; Jaffee et al., 2005; Ouma, 2010).

The horticultural processing discussed above is part of the large food-processing sector. The importance of the food-processing sector in the Kenyan economy draws from the sector’s direct linkage to agriculture, which is the major player in the country’s economy (Dijkstra, 1997; McCormick and Atieno; 2002, Atieno, 2012). The food-processing sector has been an important contributor in the country’s industrialisation process, being one of the sectors to emerge early in the country’s industrialisation. Its contribution in terms of value added and employment has been considerably above the national manufacturing average. The sector’s importance in the economy is also reflected in its employment creation, income generation, foreign exchange earnings and the stabilisation of farm incomes through the processing of perishable agricultural products (McCormick and Atieno 2002; Atieno, 2012). Recent statistics indicate that the manufacturing sector contributes a large proportion (about 17%) of private sector wage employment (Republic of Kenya, 2012).

The sector is characterised by a high level of diversity, reflected in the large number of subsectors and the many firms in each subsector. The main products are meat products, grain mill products, edible oils, sugar, dairy products, canned fruits and vegetables, bakery and confectionery products (McCormick and Atieno, 2002; Atieno, 2012). Most firms in this subsector produce a variety of products, using a range of production technologies, from simple labour-intensive to highly sophisticated capital-intensive methods of production. One of the main characteristics of the sector is its direct dependence on agriculture for raw
materials, making it highly susceptible to factors affecting the agricultural production. This is also related in the seasonality of its production, and the location of firms in the sector.

Additionally, the large number of firms in the industry makes it more competitive than other sectors, though this varies somewhat from one subsector to another. The production technology is labour intensive, and local firms, in particular, employ mainly unskilled labour. As is the case with most Kenyan manufacturing, technology is mainly embodied in machinery and equipment. Food processing firms’ technological performance appears closely related to the size of the enterprise, with larger firms scoring higher than small or medium ones on most measures of technological competence (McCormick and Atieno, 2002).

3.3 Potato processing in Kenya

In 1927, colonial settlers introduced potatoes (Irish Potatoes - Solanum tuberosum) to the favourable Kenyan agro-ecological conditions. Today, approximately 500,000 small holder farmers grow potatoes in the high rainfall parts of Central Kenya and the Rift Valley. An estimated production of than 1 million tons is achieved per year, on approximately 110,000 hectares. This is entirely marketed in the domestic market, which is liberalised with little government regulation. There is now increasing demand for potatoes linked to changes in consumption habits, mainly in urban centres, where chips became a more and more popular part of the diet during the past decade (Walingo et al., 1997; ECAPAPA, 2006).

Today, almost 30 percent of the total Kenya population live in urban centres. Urbanisation, income growth, international influences, and modernisation of the urban society have changed the food consumption patterns over the past decade. Maize, the number one staple food is gradually substituted by wheat, rice, and potatoes and increasing incomes stimulate more demand for dairy products, meat, fresh fruit, and vegetables. Chips and crisps production is determining factor of growth in demand for potatoes. For 2003, total urban demand for potatoes was 600,000 tonnes, whereby 12 percent were processed into chips and 1 percent processed into crisps. Three quarters of the urban household consume potatoes regularly, on average 5 kilograms per adult at a cost of 0.5 euro per month.
In Kenya, there has been an explosive growth of fast food restaurants and snack bars selling chips in the urban areas. The processing of potato crisps is also rapidly expanding due to changing lifestyles and eating habits of urbanised Kenyans. Apart from this, expanding tourism over the past decades has also spurred demand for processed potatoes in Kenya (Walingo and Kabira, 2007). The demand for fried potato chips and crisps is also increasing in Kenya as evidenced by new entries in the processing market. In addition to this, several large companies are also processing frozen chips for sale in leading supermarkets for product diversification (Walingo et al., 1997; Walingo and Kabira, 2007). Studies reveal that processing of crisps had undergone tremendous growth over the last three decades in Nairobi moving from five processors in the early 1980s, to at least 15 in 1995 to more than 20 by 2004 (Walingo et al., 1997; Abong et al., 2010). This research builds on these important studies but focus on the firm technological capabilities as its point of departure. As of the 1990s, the main weaknesses found in the industry were found to be technical (Walingo et al., 1997). Processing operations were the batch type with no automation of processing procedures and equipment used was rudimentary. Similarly, skilled employees such as food technologists were very few then.

4 Methods and Research Design

4.1 Introduction
This study adopts a mixed methods research design. It has both qualitative as well as quantitative aspects to it. Mixed methods combine quantitative and qualitative approaches. They utilise the strengths of both qualitative and quantitative research (Creswell, 2009). Various definitions are available for the mixed methods research design. It is an approach to inquiry that combines or associates both qualitative and quantitative forms. It involves philosophical assumptions, the use of qualitative and quantitative approaches, and the mixing
of both approaches in a study (Creswell, 2009). According Creswell, mixed methods is more than simply collecting and analysing both kinds of data. It also involves the use of both approaches in tandem so that the overall strength of a study is greater than either qualitative or quantitative research. Tashakkori and Teddlie, 2003 say mixed methods is a type of research design in which qualitative and quantitative approaches are used in type of questions, research methods, data collection and analysis procedures, and or inferences. Johnson et al. 2007 give us yet another definition. “It is a type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration” (p.129). They elaborate by saying that

Mixed methods research is the research paradigm that (a) partners with the philosophy of pragmatism in one of its forms (left, right, middle); (b) follows the logic of mixed methods research (including the logic of the fundamental principle and any other useful logics imported from qualitative or quantitative research that are helpful for producing defensible and useable research findings); (c) relies on qualitative and quantitative viewpoints, data collection, analysis, and inference techniques combined according to the logic of mixed methods research to address one’s research question(s); and (d) is cognizant, appreciative, and inclusive of local and broader socio-political realities, resources, and needs (p.129).

Why would a researcher adopt a mixed methods research design? There are various reasons. Some of them quite practical while others philosophical. Creswell, 2009 argues that it is to broaden understand, use one approach to better understand, explain or build on the results from the other approach. Mixing of the two might be within one study or among several studies in a program of inquiry. Most mixed methods methodologists espouse pragmatism. Pragmatism is a deconstructive paradigm that debunks concepts such as ‘truth’ and ‘reality’ and focuses instead on ‘what works’ as the truth regarding the research questions under investigations. Pragmatism rejects the either or choices associated with paradigm wars, advocates for the used mixed methods in research, and the researcher play a large role in the interpretation of results (Tashakkori and Teddlie, 2003a, p.713).

Over time, three main communities of research in social and behavioural sciences have emerged (Teddle and Tashakkori, 2009). First is the quantitative oriented social and behavioural scientists school (QUANs). This works within the post-positivists / positivist paradigm and are principally interested in numerical data and analyses. Second there is the qualitative oriented social and behavioural sciences school (QUALs). This works within the constructivist paradigm and are principally interested in narrative data and analyses. Lastly, we have the mixed methodologists working primarily within the pragmatist paradigm and interested in both narrative and numeric data and their analyses. Teddlie and Tashakkori (2009) state that mixed methods research emerged as an alternative to the dichotomy of
qualitative and quantitative traditions during the past 20 years. Mixed methods advocate the use of whatever methodological tools required to answer research questions under study.

For several decades, there was debate on whether qualitative and quantitative research designs could be used together. At the heart of contention was what has been called the incompatibility thesis. It stated that quantitative and qualitative research designs find their foundations in conflicting philosophical paradigms. It therefore followed that the two could not mixed in a single study. However, this debate waned in the mid to late 1990s with the rise of the compatibility thesis. Espousing pragmatism, the thesis says qualitative and quantitative methods are compatible. It rejects the either-or choices presented by the incompatibility thesis. It supports the view, beginning to dominate practice that combining quantitative and qualitative methods is a good thing and denies that such a wedding is epistemologically incoherent (Howe 1988,p.10). The following are notable classical characteristics of mixed methods according to Teddlie and Tashakkori, 2009: the use of both predetermined and emerging research questions to guide the study, the use of both qualitative and quantitative data sources, the use of both qual and quant data analyses, and the innovative use of mm techniques to integrate the quant and qual findings in a manner that made sense.

Mixed methods research elicits the concept of mixing. But when does this mixing occur in a study? At one point in the research process does the mixing occur? Similarly, how does this mixing occur. Creswell, 2009 gives a useful discussion about this. He notes that mixing may occur at data collection, data analysis, interpretation or at all the three stages. Three forms of mixing are connected, integrating, and embedding. In connected mixing, quantitative and qualitative research are connected between a data analysis phase of the first phase of research and the data collection of second phase. Integrating on the other hand entails collecting both quantitative concurrently and integrate or merge the two databases by transforming the qualitative themes into counts and comparing these counts with descriptive quantitative data. In embedding, the researcher collects one form of data (say quantitative) and have the other form of data (say qualitative) provide supportive information. The researcher embeds a secondary form of data within a larger study having different form of data as the primary data. An alternative design is a modification of the embedding strategy called concurrent embedding (Creswell, 2009). In this strategy, qualitative and quantitative data are collected simultaneously. However, one design is selected to guide the study and the other one to give a supportive role. Often, the supportive data may be addressing a different question or analysis at a different level. The data is then integrated at analysis and results compared. In other cases, this comparison does not happen and instead the two data “may reside side by side as two different pictures that provide an overall composite assessment of the problem” (Creswell, 2009,p.215).

This study adopts a modified concurrent embedding research design. My overarching design is qualitative case study. In this, I collected primary data from six firms drawn from the Nairobi Metropolitan Area. All firms interviewed were processing potato crisps and related products. Data collection was carried over a period of two years starting in 2013 and ending in 2014. The study then uses a quantitative dataset from the World Bank. The quantitative
dataset (2013 World Bank Innovation Survey for Kenya) has 108 food processing firms drawn from Nairobi, Central, Nakuru and Kisumu regions of Kenya. This dataset complements the qualitative dataset especially by focusing on the learning mechanisms used by the firms under survey.

Figure 2. Visual model of the research strategy

4.2 Data collection
This study’s research design progressed in three phases. The first is the introductory and mapping phase. This included literature study, solidifying of the theoretical and conceptual framework, mapping within the food industry to identify potato processing firms. The second phase comprised in-depth case studies. Finally, data from the World Bank firm innovation survey was acquired and modified to isolate food processing firms to be used in the analysis.

4.3 Case studies
In December 2013 and January 2014, a first round of interviews was done for firms who had at least five employees and were established by 2007. From the list of 39, I was able to access and interview 14 firms. Out of the 14, only 8 met the criteria I had set above. In addition to this 8, I included an additional firm that is very new but demonstrates immense potential. In 2014, one additional firm was added bringing the total to nine. Three smaller firms that had been interviewed earlier were dropped leaving six. One of the firms is large; one is medium; while the remaining four are small. These six were visited once more in subsequent interviews. A structured innovation survey questionnaire was used to capture firm information in the first round of interviews. During the subsequent in-depth interviews the focus was on firm’s technological capabilities encompassing investment, production, linkage and innovation capabilities. In the analysis, these are collapsed into investment, production and learning mechanisms/linkage capabilities.
5 Preliminary results

5.1 Case studies
See table 1 for a summary of the basic characteristics of the six cases.

Table 1: Basic firm characteristics.

<table>
<thead>
<tr>
<th>Case study firm</th>
<th>Year of Estab.</th>
<th>No. of Employees</th>
<th>Investment in innovation activities (KES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1972</td>
<td>240</td>
<td>90,000,000</td>
</tr>
<tr>
<td>B</td>
<td>1990</td>
<td>34</td>
<td>10,200,000</td>
</tr>
<tr>
<td>C</td>
<td>2003</td>
<td>8</td>
<td>1,061,000</td>
</tr>
<tr>
<td>D</td>
<td>2004</td>
<td>5</td>
<td>50,000</td>
</tr>
<tr>
<td>E</td>
<td>2007</td>
<td>5</td>
<td>25,000</td>
</tr>
<tr>
<td>F</td>
<td>2012</td>
<td>10</td>
<td>330,000</td>
</tr>
</tbody>
</table>

Production capabilities
Can be considered under two broad categories – product capabilities and process capabilities.
Product technological capabilities – improvements in product design or the introduction of new product designs
Process technological capabilities – comprehensive set of process related activities undertaken by firms subsequent to the installation and commission of the plant and equipment eg the design and layout of production, maintenance and repair of equipment to keep it running in an efficient manner, quality control mechanisms and industrial engineering
Production capabilities
In crisps production the key product capabilities include the following
1. Ability to process in sufficient quantities a range of crisps products meeting customer requirements as well as local food processing standards
2. Ability to pack using appealing packaging material (aluminium foil or transparent polythene packaging)
3. Ability to brand processed products
4. Ability to access markets for products including finding new markets
5. Ability to introduce new products on the market

The ideal complete chips production line comprises the following components
1. Washing and peeling machine
2. Slicing machine
3. Blanching machine
4. Dehydration machine
5. Frying machine
6. De-oiling machine
7. Seasoning machine
8. Nitrogen filling packing machine

These processes can be batch or continuous. Top crisps processors such as Frito Lay in the US have production capacities such as 7,000 kilograms per hour and 300,000 kilos daily of finished products. A Chinese manufacturer estimates that setting up a continuous automatic processing plant in Kenya with a production capacity of 150 kgs of crisps per hour would cost about USD 6,170,000 (KES 626,360,886). This is way beyond the small processors found in Kenya. Of the six firms, firm A is the only one with a continuous and automated line.

Firm B has all these process but in a batch format. They have an automatic peeler and washer; and slicer. It has a separate fryer and packaging machines. The packaging component has coding and hydrogen puffing and sealing components. The rest of the firms have similar components, apart from the hydrogen puffing component, but on a lower scale. In fact they are very basic. Based on a September 2013 interview with medium snack processing firm which is not part of the case study, it was established that a modern packaging machine for a medium crisp manufacture would cost about KES 5 million. The interview respondent (an accountant in the firm) indicated that if they had the capital to secure such a machine, they would be able to reduce their labour cost from 40 to 15 employees among other benefits.

Packaging

Aluminium foil packaging is the recommended design because it helps in preserving the product longer by minimising oxidation. But it is costlier and only firm A uses it. The rest use the transparent polythene bags. To address the apparent poor packaging standards in Kenya and the East African region, Messe Dosserldorf has been organising the annual Food Processing and Packaging Exposyum in Nairobi since 2013. In 2013 there were 21 exhibitors. This increased to 65 in 2014 with the majority of them being international exhibitors. In 2014, the exposyum attracted over 1,000 participants drawn from Kenya and the neighbouring African states. These are important learning opportunities for the region. In this way, local processors in the region now have a chance to sample latest technology; international exhibitors have a chance to showcase their products as well as to understand local processing needs; while the government has an opportunity to understand how to support local processors. The said support is very important for small processors. Left on their own, many who have attended such exposyums are unable to afford the processing and packaging lines on offer.

Related to packaging is the question of branding. This is accomplished by printing labels which are stuck on the side of the packaging material or printed packages. Labels are common with small processors while printed packages which are expensive are associated with large processors.

Table 1 gives a summary of the individual firm product capabilities

<table>
<thead>
<tr>
<th>Firm</th>
<th>Product capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Has over 250 shelve keeping units (SKUs) of these are 13</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
|   | crisps flavours. Of these about three are target the low income bracket.  
Packaging – mix of aluminium foil and transparent polythene  
Branding – state of the art labelling  
Country wide circulation of products. Working with the main supermarkets for retailing purposes  
Has sales team coupled with dedicated merchandisers at retail outlets |
| B | Fifty percent of their production is crisps.  
Packaging – transparent polythene  
Branding – labels are stuck on the side of the product’s packaging. This has been a barrier to access leading retail outlets as they consider this packaging not meeting the desired quality  
Had a country wide circulation of products but this now diminishing.  
Working with the mid-range supermarkets for retailing purposes.  
Has sales person coupled with dedicated merchandisers at retail outlets |
| C | Has four crisps flavours  
Packaging – transparent polythene  
Branding – labels are printed and clipped on the product’s packaging  
Targets mid-range supermarkets in Nairobi residential estates  
Planning to hire a salesperson. Pays non-dedicated merchandisers a commission to monitor his products |
| D | Processes crisps, popcorn, and ganthya  
Packaging – transparent polythene  
Branding – labels are printed and clipped on the product’s packaging  
Targets mid-range supermarkets in Nairobi residential estates  
Some of these supermarkets have closed leading to diminishing markets |
| E | Processes crisps (5 flavours), popcorn, and ganthya  
Packaging – transparent polythene  
Branding – labels are printed and clipped on the product’s packaging  
Targets mid-range supermarkets in Nairobi residential estates |
| F | Processes crisps, popcorn, and ganthya  
Four crisps flavours  
Packaging – transparent polythene  
Branding – labels are printed and clipped on the product’s |
Packaging targets mid-range supermarkets in Nairobi residential estates. Apart from supermarkets, targets petrol service stations.

**Process capabilities**

Include maintenance of plant/machinery; technical adaptation; troubleshooting, maintenance and repair; quality control systems; industrial engineering

All firms meet the basic Kenya Bureau of Standards quality requirements. It means that they have the basic capability to process products fit for human consumption. On top of this basic requirement, firm A has in place a quality team that checks raw materials and finished products to ensure that standards set by the firm are met. In firm B, the production manager ensures that this is in place. For the rest of the firms, the firm owners are charged with this responsibility. Using both internal and external resources, most firms are able to handle the repair and maintenance of their equipment.

Firm A has embarked on a substantive investment in IT. For instance, it has put in place a multimillion shillings Enterprise Resource Planning (ERS) system to help with product planning; manufacturing; marketing and sales; inventory management; distribution and many other functions. This together with the automated production line increases the firm’s efficiency and put it at a considerable edge. Enterprise Resource Planning (ERS) systems are now touted as the foundation of a successful manufacturing organisation, responsible for promoting standards throughout the organisation, discovering potential efficiencies, and managing front and back-end processes of the enterprise (Paquin, 2015). This is especially important in manufacturing enterprises that are asset intensive, at the mercy of global commodity markets, and face both low margins and high-demand variability. In such scenarios, enterprises must devise ways to reduce operational costs as a means of staying viable but while continuing to ensure that the cost cutting measures are not at the expense of gaining new markets share or operational expense. ERS systems are supposed to help firms achieve that.

**Investment capabilities**

The outcome of a firm’s investment effort depends critically on its investment capabilities. Investment capabilities and information needed to identify feasible investment projects, locate and purchase suitable technologies, design and engineer the plant, and manage the construction commission and start-up.

**Investment**

<table>
<thead>
<tr>
<th>Firm</th>
<th>Capital Investment in 2012</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90,000,000</td>
<td>The firm is housed in industrial premises located in the main Nairobi’s industrial area</td>
</tr>
<tr>
<td>Firm</td>
<td>Investment capabilities</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>The firm directors often travel abroad for benchmarking purposes.</td>
<td>Suppliers of equipment help in the installation</td>
</tr>
<tr>
<td>B</td>
<td>The firm is housed in industrial premises located in the main Nairobi’s industrial area</td>
<td>Has an annual budget of KES 50 million to upgrade equipment</td>
</tr>
<tr>
<td>C</td>
<td>Located in an semi industrial premise located in the Kariobangi Light Industries</td>
<td>Has an annual budget of KES 50 million to upgrade equipment</td>
</tr>
<tr>
<td>D</td>
<td>Located in a rented facility near her rented residential house in Githurai about 12 kilometres from Nairobi CBD</td>
<td>Has an annual budget of KES 50 million to upgrade equipment</td>
</tr>
<tr>
<td>E</td>
<td>Located in a rented facility in the Kibera informal settlement.</td>
<td>Has an annual budget of KES 50 million to upgrade equipment</td>
</tr>
<tr>
<td>F</td>
<td>Located in a rented facility in the Kariobangi Light Industries</td>
<td>Has an annual budget of KES 50 million to upgrade equipment</td>
</tr>
</tbody>
</table>

**Fully automated production plant**
Has an annual budget of KES 50 million to upgrade equipment
Is in the process of setting up a cooling plant to address raw material challenges

**B** 10,200,000
The firm is housed in industrial premises located in the main Nairobi’s industrial area
Batch processing equipment
Major capital expenditure in recent times is a 200 litre capacity fryer costing KES 7 M

**C** 820,000
The processing unit is an extension of the firm owner’s residential house near Kiambu town. Has an office in rented facility in Kiambu town.
Key processing equipment include automatic dough mixer, potato peeler and sealing machine which stamps dates; electrical jiko/stove, and popcorn machine all worth KES 380,000.
Has a salon car for deliveries and is in the process of purchasing a motorcycle to increase versatility in delivery process

**D** 215,000
Located in an semi industrial premise located in the Kariobangi Light Industries
Batch processing equipment
Basic processing equipment including three popcorn fryers, three deep fryers, a peanut roaster, a weighing machine and a sealer totalling KES 405,000.

**E** 182,000
Located in a rented facility near her rented residential house in Githurai about 12 kilometres from Nairobi CBD
Batch processing equipment
Basic equipment including a peeling machine, three jikos/stoves, a sealer and slicer
Has a salon car for delivery of products

**F** 330,000
Located in a rented facility in the Kibera informal settlement.
Batch processing equipment including a potato slicer, an electric fryer and oven all valued at KES 190,000

**Investment capabilities**

<table>
<thead>
<tr>
<th>Firm</th>
<th>Identification of feasible projects, locating and purchase of technologies</th>
<th>Designing, engineering, construction, commission and startup of plant</th>
<th>Recruitment and training of skilled workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The firm directors often travel abroad for benchmarking purposes.</td>
<td>Suppliers of equipment help in the installation</td>
<td>Has an expatriate technical director</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Management has</td>
</tr>
</tbody>
</table>
Equipment is bought from abroad  
Most maintenance is done in-house  

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **B** | Directors involved in the setting up firm.  
Most equipment purchased locally  |
|   | Suppliers of equipment help in the installation  
Most maintenance is done in-house but relies on outside technical help in more complicated problems  |
|   | The supervisor has technical experience  
Has production staff but none of who are trained food technologists  |
| **C** | Based on need and available resources, the owner based on his experience takes the lead in all these processes  |
|   | In house installation of equipment  
Most maintenance is done in-house  |
|   | Has a supervisor incharge of production process  |
| **D** | Based on need and available resources, the owner based on his experience takes the lead in all these processes  |
|   | In house installation of equipment  
Most maintenance is done in-house  |
|   | Owner incharge of production process  |
| **E** | Based on need and available resources, the owner based on her experience takes the lead in all these processes  |
|   | In house installation of equipment  
Most maintenance is done in-house  |
| **F** | Based on need and available resources, the three directors based on their experience takes the lead in all these processes  |
|   | In house installation of equipment  
Most maintenance is done in-house  |

**Learning mechanisms**
Learning mechanisms include broad factors such as government policy towards education especially science and engineering affects supply of technical personnel that firms can access.
They also include efforts inside the firm to promote learning of capabilities. Learning mechanisms also include availability of micro-level learning support mechanisms external to the firm, which can be drawn on as the firm seeks to build its capabilities (Biggs et al., 1995). Internal processes include the following:

1. Research and development
2. Technical documentation and technical specification with the firm
3. Use of expatriate and technical personnel
4. On-job training of workers which is both an internal and external process

Private external learning mechanisms include learning from buyers, suppliers, and inter firm spill overs arising from inter-firm linkages. Collective external mechanisms on the other hand include access to government institutions, support from NGOs as well as interactions with business associations. The table below shows the presence of these mechanisms in the six case study firms and their degree of importance.

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Firm A</th>
<th>Firm B</th>
<th>Firm C</th>
<th>Firm D</th>
<th>Firm E</th>
<th>Firm F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On job training</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Research and development</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Technical documentation and technical specialisation</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Expatriate and technical personnel</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>N</td>
<td>N</td>
<td>L</td>
</tr>
<tr>
<td>Internet</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>External private</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buyers</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Suppliers</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Inter-firm linkages</td>
<td>H</td>
<td>H</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>Consultants, commercial labs or private R&amp;D institutes</td>
<td>M</td>
<td>M</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td><strong>External collective mechanisms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government or public research institutes</td>
<td>H</td>
<td>M</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>NGOs</td>
<td>H</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>L</td>
</tr>
<tr>
<td>Business associations, conferences, exhibitions</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

Legend: H - high; M - medium; L -low and N -none
5.2 The survey

The second dataset, which is used to complement the case studies, is a 2013 World Bank Innovation Survey for Kenya. The innovation survey analyses 103 food processing firms drawn from Nairobi, Central, Nakuru, and Nyanza. These 103 firms drawn from a population of 549 enterprises covering food; textiles and garments; chemicals, plastics and rubber; other manufacturing; retail; and other services. Of the 103 food processors, 50 are small (5-19 employees), 32 were medium (20-99 employees) while 21 were large (100+ employees). See highlights from the survey focusing on firm innovation activities.

5.3 Key highlights from the survey

**Firm size**

In terms of firm size, 49 percent were small, 31 percent were medium and 20 percent large.

<table>
<thead>
<tr>
<th>Sampling Size</th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small &gt;=5 and &lt;=19</td>
<td>50</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>Medium &gt;=20 and &lt;=99</td>
<td>32</td>
<td>31</td>
<td>80</td>
</tr>
<tr>
<td>Large &gt;=100</td>
<td>21</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**Use of technology from a foreign company**

Table 3 Use of technology from a foreign company

<table>
<thead>
<tr>
<th>Do You Use technology licensed from a foreign-owned company?</th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dk</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>No</td>
<td>80</td>
<td>81</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

**Expenditure on equipment**

Firm’s annual expenditure on equipment ranged from KES. 3,000 to a high of KES. 460,000,000. But the median was KES. 5,500,000.

**Production staff**

The number of permanent employees last fiscal year ranged from 1 to 1,000 while those who were production workers and fulltime ranged from 1 to 900. Fourteen percent of the firms had two fulltime and skilled workers. Eleven percent had ten fulltime skilled production workers while the rest ranged from one to four percent.

Average years of education for a typical production staff. The highest percent was at 36 who had 12 years. This means they had a high school education. This is followed by ten firms who had their production staff at 15 years signifying that they had some form of tertiary education.
This closely followed nine firms with their staff having 16 years of education perhaps signifying that they were graduates.

The companies were also asked about what percentage of their fulltime had completed high school education. Twenty five firms or 24 percent had all their fulltime with high school education. This was followed by 17 firms with 80 percent of their fulltime workers with high school education.

**Formal training of employees**

Table 4 Formal training of employees

<table>
<thead>
<tr>
<th></th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>53</td>
<td>51</td>
<td>51</td>
</tr>
<tr>
<td>No</td>
<td>50</td>
<td>49</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

An impressive 53 firms out of 103 or 51% indicated that they conduct formal training for their permanent and fulltime employees. Looking specifically at production staff, 36% of firms (18 out of 50) said that 100% of their production staff go through formal training. This is followed by 14% (7 firms out of 50) who indicated that 50% of the production workers go through formal training.

**Research and Development**

On internal research and development, 28 firms out of 103 or 27% said they undertake internal research and development. The cost of the internal R&D ranged from KES. 21,000 to 10,000,000. Four firms spent 300,000 each. As for external R&D only five firms indicated that they undertake this representing five percent. The cost of external R&D compared to internal one is high as it ranged from KES. 100,000 to 500,000,000.

A relatively large number of firms 49 or 48% had conducted formal training for its employees with costs ranging from KES. 7,000 to 700,000,000. Only 3 firms out of 103 reported purchasing or licensing any patented or non-patented inventions, or other types of knowledge. The figures for the cost seem faulty as one indicated they do not know, another one 3 and the last one KES. 100,000.

**Funding innovation activities**

With regard to funding of innovation activities, 74% chose own funds. Twenty eight percent chose private or state owned banks while only one percent selected government agencies / departments. On the other hand, five percent selected NGOs/International organisations. Eight chose other sources which included money lenders and relatives.

Firms were also asked whether they received any non-financial support from the government for innovation related activities. On this, only five or five percent answered to the affirmative. On linkages, firms were asked to state the most important source of information for their innovation activities. See table 2.
Table 5 Most important source of information

<table>
<thead>
<tr>
<th>Most important source of information</th>
<th>Freq.</th>
<th>Percent</th>
<th>Cum.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dk</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Business associations and conferences/exhibits</td>
<td>1</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>Universities and research institutes</td>
<td>1</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>Recent hires from other firms</td>
<td>2</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Professional journals and trade publications</td>
<td>2</td>
<td>2</td>
<td>34</td>
</tr>
<tr>
<td>Suppliers</td>
<td>4</td>
<td>4</td>
<td>24</td>
</tr>
<tr>
<td>Knowledge from parent or another firm</td>
<td>6</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Consultancy firms</td>
<td>7</td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>Government ministries or programs</td>
<td>7</td>
<td>7</td>
<td>50</td>
</tr>
<tr>
<td>In-house R&amp;D and personnel</td>
<td>9</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Products or services available in the market</td>
<td>9</td>
<td>9</td>
<td>43</td>
</tr>
<tr>
<td>Internet</td>
<td>10</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Customer feedback</td>
<td>41</td>
<td>40</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

An overwhelming majority selected customer feedback as the most important source of information at 40%. This is followed by internet at 10%. Universities and research institutes tail at a paltry one percent. Firms were asked if they had applied for a patent concerning product/service and process innovations. Three and four percent respectively replied to the affirmative. Five percent had applied for utility model, six percent had registered an industrial design and only one percent had applied for a copyright.
References


