IDENTIFICATION OF COMMON FACTORS OF INNOVATION IN A SMME

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ABSTRACT

Small, Medium and Micro Enterprise (SMME) businesses in manufacturing contribute significantly to the economic growth of a nation, yet most of the research on innovation management in manufacturing industries has been focused on big firms. The current study identifies factors in SMME's that are common between the external and internal systems of innovation that supports firms in their management of innovation. The study gathered data through qualitative and quantitative interviews of 20 companies out of which 5 manufacturing firms in Western Cape, South Africa selected for this research. The study found that SMMEs acquire new knowledge from the external ecosystem to supplement their limited internal system based on the product or process development. This study identifies the common factors that the SMMEs can use as a guiding framework to pursue new innovative opportunities for development of product or process.

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CHAPTER 1: INTRODUCTION

1.1. Chapter Introduction

This study focuses on identifying internal and external indicators of innovation for small medium and micro-sized enterprises (SMMEs). Through the lens of innovation systems, this research looks to propose a unified framework of internal and external indicators that contributes to the increasing literature of innovation in SMMEs. The proposed research can also be translated into a consulting framework wherein the SMME's can use the factors as a guiding structure for their decision making during the planning and strategizing stage of the innovation process for a new product or process.

SMME's are being increasingly recognised as a central contributor to innovation playing a vital role in the national economy of countries around the world. The increasing fluctuation in the business environment and impact of technology has stimulated research on factors of innovation that have either been studied together or in isolation, primarily on large companies with a focused research and development approach to innovation (Bayarçelik, Taşel and Apak, 2014). The current study examines the resource constrained SMMEs in the metals industry based in Western Cape, South Africa to understand their current interaction with the external system and subsequent impact on their internal structure in pursuit of new product or service development to remain sustainable. Together with the industry and literature analysis of the external business ecosystem and understanding the internal structure of the SMMEs, this research aims to contribute to the innovation system and its influencing factors for SMMEs.

Innovation as a concept has been studied in singularity from a strategic standpoint as an indicator of a firm's performance. However, to extrapolate this performance into a sustainable outcome argues for more systemic level research. This study will attempt to propose a framework that derives from a systems level thinking to identify the common factors between the two systems by understanding the internal capacity of innovation in the firm and the position of the firm relative to the external innovation ecosystem in which it thrives.

1.2. Research Background

Innovation is fast becoming the focus of the next generation of economic growth (Tidd and Bessant, 2013). Just as a biological ecosystem is a complex system comprising of resources and living habitat whose functional goal is to maintain an equilibrium state, an innovation system in a similar way allows for a fluidic relationship between the business ecosystem and

the firm to maximise the business opportunities towards economic sustainability (Jackson, 2011). Therefore, studying the integrated and systemic effects of innovation on a firm within the ecosystem as a theoretical lens is important to explain its relationship with a firm's sustainability.

The early focus on innovation in businesses was via the output method i.e. the outcome of the R&D expenditure in the form of patents or new products. This was based on the understanding that innovation output was dependent on the volume of resource and the utilisation of internal and external resources (Oerlemans, 2001b). The research was later transformed by a new theory of "innovation system" that not only looked at the output but also laid an emphasis on the input, the internal and external factors that had an influence on the firm and their behaviour. This new understanding of innovation systems formed the basis of innovation in small firms in particular who do not have dedicated research functions, but could now create and tap into a network of knowledge and technology (Freel, 2005) the same way as a bigger firm.

In a dynamic, knowledge based environment, new paradigms of innovation are emerging; one that is not bounded by traditional understanding and frameworks, but one which is fluid in terms of adaptation and new stakeholders (Tidd, 2013). Currently, firms are operating in a more shared environment, competing and collaborating simultaneously to adapt together to face such impending disruptions (Tidd, 2013). Therefore, a hyper knowledge-based strategy requires adept internal structures to quickly re-orient themselves for this new stimulation in the form of information and be prepared for any pivoting strategies.

Firms working within a business ecosystem constantly look to create value by connecting networks with different stakeholders to bring in knowledge, process, business opportunity to maintain its growth trajectory and remain sustainable (Freeman, 1982). An important discussion to consider is the level of integration of the new knowledge within the company and whether the firm has the internal capacity to execute (Rogers, 2003). This information at an early stage of innovation would allow resource-constrained (time and finance) SMMEs to quickly make a strategic pivot or decision for a new product or process.

The motivation for this research is to add a new framework to the literature on firm level innovation, focusing on SMMEs. Although, literature has focused on the determination of innovation factors in SMMEs (Bayarçelik, Taşel and Apak, 2014), types of innovation and the influencing factors affecting SMMEs (Talebi, Ghavamipour and Irandust, 2012), it does not

address the strategic position of an SMME in terms of the internal structure for innovation aligned to the external one. SMMEs need a strategic position in terms of innovation which can address the internal infrastructure based on the external business environment and therefore a unified framework of factors of innovation as proposed here addresses that gap in literature.

From a practical point of view, identifying indicators of innovation, this research looks to add value in the form of a guideline for SMMEs and consultants to use for their decision making and planning. It would act as a supporting framework for users during the planning stage which requires multi-dimensional and multi-scalar approach. SMMEs have a distinct advantage in the decision-making, risk taking and market adaption which helps in scaling opportunities and being specialist resources for a larger firm (Vossen, 1998). Previous studies have shown that SMMEs relied on utilising knowledge gained from outside of their existing ecosystem more than the knowledge generated from within (Laforet, 2011). The new constructed theories show that innovative SMMEs balance the knowledge acquisition from inside and outside of their ecosystem much more than previously thought (Huggins and Johnston, 2009). Successful SMMEs stay competitive by accessing knowledge from across different domains and regions and integrating it into their current limited capacity (Davenport and Bibby, 1999).In the current economic climate and the well documented constraints of SMMEs, a deep-rooted analysis for identifying external and internal conditions is time consuming and expensive, therefore a uniform framework as proposed here would benefit the target firms. A framework proposed through this research has the potential to help SMMEs plan on acquiring a new value or system (knowledge, process) from the ecosystem and redesign the internal structure simultaneously. It could potentially be a tool for managers and policy makers to help them in designing new processes and business plans.

Literature on innovation in SMMEs has largely focused on the benefits of network (Laforet, 2011) and external ecosystem on the resource constrained SMME (Nooteboom, 1994), as well as resource pooling (Propris, 2000) when it comes to the factors of innovation. While, the factors have been studied in isolation and as a singular impact on the SMME, one of the research questions this work attempts to answer is whether a unified framework can be established to consider both the internal and external factors. The outcome of this research would look to add to literature of innovation for SMME leading to a practical assessment to support the strategic decision making for an SMME through the indicators identified and defined through this work.

1.4. Factors of Innovation

Research on innovation in firms has shown that they typically look towards a very narrow domain of knowledge outside to add value to their innovation processes (Helfat, 1994). This isolated and 'in silo' approach to value addition has been detrimental to the long-term sustainability of the firm and therefore a need for strengthening the internal capacity of the firm in context with the external factors is of utmost importance especially for the small sized firms (Helfat, 1994). In the knowledge based economy of today, where flow of information is in constant flux and easily accessible, firms need to search for new knowledge more broadly either through other domains, ecosystem or geographic locations (Ahuja and Katila, 2004).

With the advent of globalisation and technology, the flow of knowledge has become the main driver of economic growth. This knowledge needs to be channelled, shared and fed into the ecosystem in a constant feedback loop. Internal structure is paramount at this stage, for knowledge to be acquired, assimilated and then implemented to create an economic value. Without this integrated approach of knowledge diffusion, the innovation fails to commercialise or succeed. One starts to see the effect of a successful diffusion system, when innovation is acquired by other firms which in turn transcends to growth in economic activity. (Rogers, 2003) This flow of knowledge is at the core of many studies through the diffusion of innovation which although not the focus of the current study, does provide a theoretical viewpoint.

For innovation to take place in a firm, it depends on the interaction of the business ecosystem and organizational structure to successfully translate an idea from the firm to the market (Nagano, Stefanovitz and Vick, 2014). Executing it in a systemic way requires many factors integrated with the market value and strategy to succeed (Hall, Matos, Silvestre and Martin 2011). Therefore, a successful innovation strategy of achieving competitive advantage depends on how the external ecosystem shapes the internal organisational structure (Freeman, 1982). As the focus of literature have shifted from products and raw material to intangible assets such as knowledge acquisition and innovation capability, it shows that it is important to not only study how the external factors affect the firm transition towards sustainable future, but also to understand how and when innovation is accepted, diffused and managed internally within the firm (Hall, Matos, Silvestre and Martin 2011). This approach would help the small companies and start-ups to assess or plan for their internal structure in preparation of the new information coming in.

The process of decision making in innovation consists of two steps: first, a decision whether to innovate; and second, how to innovate (Veugelers and Cassiman, 1999). Factors influencing the first step has received ample attention since the work of Schumpeter in 1940s and recently the second step is the subject of much attention Most of the research on the second step focusing on the factors influencing the firm: external (market competition) and internal (company size) was often inconclusive (López-Fernández, Serrano-Bedia and Gómez-López, 2011). This led to a more inclusive approach in defining factors such as region and sector (external) and firm specific variables (internal) therefore took prominence to define the innovation decision and process (Coronado, Acosta and Fernández, 2008).

Modern research has elaborated that the factors should not be studied as an isolated event but as a process (Tidd and Bessant, 2013). Some authors argue the case for studying innovation from a systemic perspective, as the relationship between the factors and developing routines maximize and speed up the process of innovation. Most existing innovation studies analyse internal and external factors separately (Coronado, Acosta and Fernández, 2008) and therefore a joint effect of internal and external factors is the approach of this research to better understand the relationship between the two.

This is an important departure point for this research to not only focus on the isolated impact of each factor on innovation in a firm, but to look at the simultaneous interaction between the external and internal factors of innovation from firm level point of view. A better understanding of how one affects the other and influences the innovation strategy can lead to a more linear approach of thinking and executing, especially for an SMME.

Firms look to enhance their innovative capability by accessing their business network such as suppliers, consumers, retail outlets or even competitors (Chesbrough, 2007). This need has been characterized in the form of volume (no. of partners), types of partners (relatives, customers, firms, universities) and their role in the resourcing (finance, manpower, mentorship, knowledge) (Freel, 2003).

Identifying a need for homogeneity between the external and internal factors puts the focus on the position of the firm within its innovation ecosystem. Innovation in SMMEs is limited by the resource constraint of finance, time and personal to pursue an elaborate study of the external and internal factors (McAdam and Keogh, 2004). Once the external factors have shaped ideas, strategies, input and knowledge resource, the various internal functions (R&D, Marketing, Production, Consumer Assistance, Procurement, Sales and Quality) need to get

involved in cross-functional co-ordination. The role of the R&D has been the only focus of study to understand the internal capacity for the new information coming in (Galende and de la Fuente, 2003). Further research on the internal factors is important at this stage of the innovation process due to the resource and time dependency associated with the product development (Wheelwright and Clark, 1992) which is of importance to the resourced limited small companies. The internal organizational structure should be capacitated to be able to absorb this new information, make sense and then execute which if not thought before time, can lead to substantial financial strains and time (Freeman, 1982). The current pool of research on innovation focuses on the contextual factors of each pattern and ignores the organizational stimulus that motivates and leads the process internally (Ussman, Almeida, Ferreira, Mendes and Franco, 2001). This research therefore, would look to fill in the gap in bridging the external and internal factors for the firm.

Firm level studies have primarily focused on the characteristics or structures within a firm that affects their innovative behaviour. Research needs to highlight the innovative characteristics of the internal factors within firms, be it tangible or intangible or strategic in nature. Most of the studies on internal factors of innovation have adopted the Resource Based View (RBV) of the firm to highlight the heterogeneity of firms and the internal features that influence the business strategy (Wernerfelt, 1984; Vega-Jurado, et al., 2008) and the organizational structure theory. Internal structure form an important source of competitive knowledge that is scarce and that does not reduce in time (Roos and Roos, 1997). Therefore, the organizational structure supporting this change needs to adapt itself to be able to acquire new information whenever a new product or process is to be implemented (Sethibe and Steyn, 2016).

The tangible factors are easy to measure and have been extensively studied since the initial work of Schumpeter. Factors such as age of the firm (Del SmCanto and Gonzalez, 1999) and size of the firm have been extensively studied (Galende and de la Fuente, 2003) to co-relate with the degree of innovation. But it does not expand to the scenario of current high growth age where one year old and small sized companies are disrupting some of the age-old ones. Marissa and others identified nine organisational/internal factors for innovation: management style, leadership, resources, organisational structure, corporate strategy, technology, knowledge management, employees and innovation process (Smith, Collins and Clark, 2008) that looked from the perspective of the firm within a system. The same work assessed the

factors in an organization from the point of view of management of innovation but did not elaborate on re-designing the internal structure to bring in innovation.

Thus, mapping out of factors common between the two would help in building up an innovation strategy for the firm. As Tidd and Bessant (2013) describe the process of innovation to be a 3-stage process- analysis (understanding the alternatives), choice (selecting which options to put resources) and planning (deciding how innovation should happen), the informational background being set up through these proposed indicators would help in better understanding the prospective processes of developing a new product or service.

It looks from a SMMEs point of view of how limited resource affects the acquisition of new knowledge rather than the other way around as is the case for more resourceful firms. In an ideal scenario, SMMEs would like to generate new value fitting their business focus by bringing in new resource (idea, information, process) from outside (Wernerfelt, 1984). But for them to seek innovative product or process they would have to start internally: infrastructure, personal, time and finance which would influence the new information they would seek from the ecosystem. This study however, does not elaborate on the relationship and stimulus that the external factors place on the internal one for the firm to execute on the new value acquired, but looks at the static relationship between the two.

1.5. Research Design

SMMEs having limited resources need to implement innovative approaches to remain sustainable in today's competitive business environment. A detailed research study to determine the most critical implementation factors needs to be done. A study of factors affecting SMMEs is critical in understanding the sustainability and growth of the firm which further strengthens the economic development of a country (Chittithaworn, Islam, Keawchana and Yusuf, 2011). Researchers have demonstrated the importance of studies on innovation to explain the unique processes and resources involved (Anderson and Eshima, 2013) (Achtenhagen, Naldi and Melin, 2010), it however focuses on the identification of critical factors in predicting SMME performance in the immediate future. This research aims to study the critical factors in SMMEs from system point of view in business and innovation that they function in, towards their long-term sustainability.

Currently, literature focuses on individual factors of innovation, such as financial factors (Laforet, 2011), skilled workforce (Laforet, 2011), firm size (O'Cass and Weerawardena, 2009), institutional factor (Volchek, Jantunen and Saarenketo, 2013), technological capability

(Subrahmanya, 2009), consumer preferences (Lamprinopoulou and Tregear, 2011) cultural factor (Hogan and Coote, 2013), market (Martinez, Guzman and Castro, 2013), managaement skills (Kelley, O'Connor, Neck and Peters, 2011) and learning capability (Sok and O'Cass, (2011). While these individual factors show its impact as a unit of innovation in a SMME, it does not 1) identify most important factor, 2) show the collective relationship between these factors and 3) new factors emerging from the relationship. Departing from this enquiry, it raises a need for systems based study on the collective impact of the factors. Although, the individual factors can be clustered into a higher category of external and internal factors, a system based identification of factors specific for SMMEs, proposed here would add valuable insight and contribute to the conceptual framework of current literature.

Previous studies have suggested that organizational and business environment influence the development of innovation capacity in a firm which has further been related to their performance (Chang, Hughes and Hotho, 2011). However, little is known about such antecedent affecting innovation in SMMEs and how it influences their performance and sustainability.

From an internal perspective, organisational learning covers most of the literature to understand the condition within the firm to acquire new knowledge (Rogers, 2003) (Jiménez-Jiménez and Sanz-Valle, 2011). Jimenez and Valle focused on the size and age of the firm to assess the impact of the relationship with the business environment based on the above two internal factors (Jiménez-Jiménez and Sanz-Valle, 2011). While the age and size of a firm was not the unit focus of this research, it did however come up in analysis as an interruptive factor that did not allow any of the firms interviewed from innovating on a bigger scale.

Literature on internal structure however explained the unit focus on the capacity of the firm to create, adopt and use new knowledge (Rogers, 2003). Keeping the flow of knowledge as a foundation to innovate, Carlo studied the position of the internal capacity of the firm to understand how the firm 1) adopts external and 2) generates internal knowledge (Carlo, Lyytinen and Rose, 2012). This research uses Carlo's enquiry as a guiding template to explore the internal capacity of the firm. While a lack of R&D prompts small firms to look at external system much more than bigger firms, small firms have an advantage of dynamism at workplace in terms of faster decision making (Bos-Brouwers, 2010), less operational layers (Terziovski, 2010) which they use to acquire new projects. The research agreed with this characteristic of a small firm and leverages on this relationship as an essential factor for

innovation within a firm and how it fabricates the decision making towards a long-term future of the company.

The study takes a multi-dimensional approach of the SMME in question, to understand "how" they obtain new knowledge and "how" does their internal capacity balance this new information with what they have. Through a qualitative analysis of the cross-case study methodology, this research looks to group the qualitative data into first and second level cluster to identify those unique channels that answer the "how" of the above context. Using the inductive logic of reasoning, this study extracts the points of knowledge and its acquisition to cluster them into channels and thereby identify the factors of external and internal innovation.

The theoretical lens for this study was based on the innovation system and knowledge based view of the firm. The lens allows for a contextual study of the external and internal environment by keeping the firm as the focal point. It allowed for a simultaneous study of factors between the two conditions that provided a base to identify common ground between the two and how they are linked. Although, the scope of this study does not focus on the dynamics between each factor, it helps in identifying the factors. Through the literature survey of national (Lundvall, 2002) and regional innovation system (Malerba, 2005), this study focuses on "what" and "how" do the firms interact with these systems. During the interview, focus of the questions was on their current interaction and how they would like to adapt to the changing external environment going ahead. This led to the discussion on the limitation of their internal structure and the influence it has on their interaction with the external system as elucidated by Romero and Martínez-Román, 2012. This was the key part of the data gathering process, as it highlighted the flux between the two systems for the participating firm.

The qualitative interview of the CEO helped the study in understanding their (1) current view of innovation, (2) actions for bringing in new work to remain sustainable and (3) adaptation of their internal structure. Combined with the internal system focusing on the organizational structure, firm level innovation and knowledge based view of the firm, this study extended the scope of this theoretical lens to the external systems and how the two influenced each other. The focus of the study as detailed in Chapter 2, falls in between the two systems to identify the common factors of innovation. The cross-case study methodology equated the diverse data from the 5 participating firms to identify first level data. This was further

contextualised with current literature to identify second level data for each internal and external factor. The conclusion of the study was to provide with the common factors for both.

1.5.1. Research Question and Scope

SMMEs are important elements of economy responsible for driving innovation and competition in various industry sectors. To remain competitive, SMEs need to take strategic decisions continuously in the evolving business environment to be successful. Complexities arise in the decision phase to align with these changing market conditions and therefore a thorough assessment of the internal and external factors are required to understand the ambiguity of the market changes and sustainable action (Bayarçelik, Taşel and Apak, 2014).

The research focuses on the systems context that the SMMEs operate in. It focuses on the factors that emerge from the system interaction between the external business environment and the internal structure in balance. While the relationship between internal capabilities and openness towards knowledge sharing has been shown to improve innovative performance in big firms (Caloghirou, Kastelli and Tsakanikas, 2004), this study is formulated on similar relationship, but extrapolates it to SMMEs and aims to understand the unique relationship of the two in resource constrained environment.

While it is a well-known fact that the behaviour of a firm to search, and acquire external knowledge influences their productivity and even innovative performance (Hwang and Lee, 2010), the study basis it on knowledge based view of the firm as reported by Grant (Grant, 1996). In a resource constrained environment of an SMME, it is an important departure point for this research and the basis of the interview with CEOs of the SMMEs. How do SMMEs factor in their internal capacity based on external business environment and customer needs?

While the focus of interview was on the “how” of their current strategy towards new product or service development, the scope of the questions also allowed for identification of the unique characteristic features that were common amongst all the firms to help extrapolate them as factors of innovation. Literature identifies individual factors of innovation for different industries and business environment, while this work aims to understand the flux of knowledge for innovation based strategies in between external and internal systems of innovation to identify the mutual factors.

The Research Question that guided this study was not only to identify the factors of innovation from external and internal system for an SMME but to formulate a common thread between the two systems.

"*What are the factors of innovation for an SMME that are common in the external and internal structure of the innovation system?"*

The Research question aims to engage interviewees in a qualitative description to identify their understanding of innovation, their current capacity and their relationship with other systems of innovation. The design of the research questions was such to engage the CEOs in a discussion of their current and future strategy and how they plan to achieve it. The framework of questions was such to bring out the lateral points other than their biased opinion of innovation. The question is limited by the scope of the research thesis by focusing only on the per unit factors of innovation and not the relationship between them. This scope of research to understand relationship is set for a more advanced form of research on innovation that is not time dependent as was the case in this study.

While CEOs were clear on the role of innovation in driving their respective firms towards sustainable future, they had a very biased opinion of what it was and were not sure how to achieve it. While it was clear that limited cash flow would be the biggest influence in their decision making, there were enough reasons identified through this research such as flexibility and quick decision making that could facilitate innovation in these firms. The firms interviewed for this research had strong ties with different stakeholders such as other firms, government bodies and knowledge centres, corroborating to literature in networking for knowledge (Crick and Spence, 2005). However, this research further adds to 1) internal structural capacity for this knowledge flow and 2) the view of the firm towards external innovation system for SMMEs.

The data emerging out from the interviews were further analysed to propose a potential practical framework that could be used in the future decision making by managers and change makers towards a strategic pivot of introducing new product or process in their firm. This new thinking of innovation systems could potentially change the paradigm from an understanding of Output – Input = Value to a more balanced Input ~ Output, leading to new strategies that makes use of a unified framework like the one proposed here.

1.5.2. Research Setting

The research was done in Western Cape, South Africa and included 5 SMMEs from the metals and manufacturing sector participating in the United Nations Environment Programme's (UNEP's) Eco-Innovation Pilot Programme. The structure of the study was however not influenced through the Eco-Innovation project.

Eco-Innovation is a strategic approach supporting sustainable processes in a company's value chain (UNEP manual, 2014). Funded by the European Commission, it looks to implement projects to develop technical capacities to strengthen sustainable practices in SMEs at the local and national level. The project leverages on UNEPs experience in resource efficiency and cleaner production service network to assist SMEs in implementing Eco-Innovation.

South Africa as a country was selected to pilot a 4-year program to promote resource efficiency and eco-innovation. This research was independent of the structure of the UNEP pilot program; 20 companies were selected based on the UNEP pilot program for a workshop to discuss factors influencing sustainability of the companies. A quantitative and qualitative analysis was done to identify 5 companies that were finally selected for this research and further elaborated in the Methodology section.

The context of this research is focused on SMMEs in Western Cape, South Africa. South Africa, being the 3rd largest economy in Africa (World Bank, 2016) recognises the importance of SMMEs to an extent that a Ministry of Small Business Development was established in 2014. The aim of the ministry has been to promote and develop small businesses that contribute significantly to the national GDP and contribute towards job creation (The DTI, 2008). While SMMEs in South Africa contribute 39% of the country's GDP, which is lesser than the contribution to the developed nations, it employs 60%-70% of the total workforce (SEDA report, 2016). Therefore, it is in the interest of the national government to put policies, strategies and programs in place to create an enabling environment for SMMEs (SEDA report, 2016).

The challenges faced by SMMEs in South Africa range from the ones described in literature such as Access to Finance and Credit (Berry, 2002), poor infrastructure (GEM, 2014), low level of R&D (Booysens, 2011) to ones that are specific for South Africa such as labour laws (OECD, 2015), inadequately educated workforce (The DTI, 2008), inefficient government bureaucracy (GEM, 2014), crime (GEM, 2014) and access to market (Watson and Netswera, 2009). Therefore, risks faced by SMMEs, internal or external business sector threaten their existence highlighting the importance of the study of factors affecting their success. A critical understanding of them is essential for their continuity and growth that can in turn support the economic development of South Africa.

Over a one year period, CEOs of 5 participating companies were interviewed qualitative and quantitatively to understand the present position of their firm in the business ecosystem and

their internal structure. In the 1 hour interview session held in their respective firm premises, the CEOs discussed their understanding of what innovation is, its role in their sustainability, challenges faced, their current strategy of new product, process or service development. Given the temporal limitation of research, the focus of the interviews was to understand the current strategy and not to propose future intervention programs.

As illustrated by CEOs, innovation is crucial for their firm's survival given the extreme pressure from not just customers but also their competitors and technology. Despite the constraint and limitations of finance and skill, the firms were quite adept in their approach to acquiring new knowledge through various means and keeping their internal structure flexible enough to pivot their strategy quickly. This study embeds itself in between two systems (external and internal) to understand how the flow takes place and what the factors responsible for it are.

1.6. Chapter Summary

This section aims to introduce the importance of innovation for a SMME and the need to be proactive in their approach to adapt to the changing business environment. It highlights the meaning of innovation and its evolving nature that requires a constant flux between the firm at the centre and its external environment. The need of the firm to be able to change is paramount for its long-term existence and therefore they need to build internal frameworks that can help them adapt.

It highlights the difference between innovation and innovation system to set the background for the rest of this study as a concept and a unit of analysis. The firm at the centre of this study were aware of innovation as a concept that referred to development of a new product or process, adaptation to changes, imitation of a new technology and adoption of new technology but were not aware of the system of innovation (Based on Dosi G. 'The Nature of the Innovative Process'. In: Soete L. Technical Change and Economic Theory (Pinter Publishers, London, 1988, p222))

It introduces the segments of innovation system from and internal and external system and how firm at the centre leverages information and knowledge from the outside based on its internal structure. It touches upon the purpose of this research to combine both for a SMME by identifying factors of innovation and set the background for further research to understand how each factor relate with each other.

In the context of the manufacturing companies in Western Cape, South Africa, most of the companies researched for this study were into the service based manufacturing for their clients and were aware of the impact of innovative solutions such as automation and 3D printing taking away projects from them. At the same time, the SMMEs knew the importance of being innovative in either their products or process to remain competitive but were not clear in how to manage it.

The inductive qualitative data from cross case study analysis helped this study to highlight the current assessment of innovation in the SMME operating in the sector. While the SMMEs actively look beyond their system to bring in additional work, they are often limited by their internal infrastructure and capacity. This study looks to identify the factors that are positioned in the flux of those two systems.

The study combines the theoretical lens of external innovation system (national and regional), combines it with the internal system (firm level innovation and organizational structure) through diffusion of innovation and knowledge based view of the firm. The data analysed together with literature were clustered as first and second level data to identify the common factors of innovation.

CHAPTER 2: LITERATURE REVIEW

2.1 Chapter Introduction

Innovation is widely becoming a key driver of economic sustainability for firms, regions and nations (Frambach and Schilewaert, 2002). With the current research in business ecosystem focusing on resource scarcity, global warming and population growth, firms are being forced to shift their balance to more resource efficient and sustainable process systems (Lancker and Mondelaers, Wauters and Van Huylenbroeck, 2016). They are expected to be proactive in their approach of not only consolidating their current value but also looking for newer ones complementary to their own strength as well as the ecosystem in which they function (Chesbrough and Teece, 2002). These unique and systemic resource changes are forcing firms to change their practices and to adjust other factors of the business systems involved (Maula, Keil and Salmenkaita, 2005).

This review focuses on the concept of external factors of innovation and their relationship to the internal innovation structure of a firm and how the firm can look at both factors at the same time to become more innovative towards financial sustainability. It begins with the theoretical background of innovation as a concept and how innovation system gives rise to new knowledge for the benefit of the firm through the flow of this new information from external to internal system. The second half of the review then shifts focus to SMMEs and how they currently are placed within the innovation system and interact with the ecosystem for their need of new knowledge towards economic sustainability.

Traditionally, innovation originated from large enterprises who acted as a knowledge monopoly and therefore controlled the overall innovation process from idea creation to commercialization (Sağ, Sezen and Güzel, 2016). However, in today's world, it is impossible for a single firm to generate all the factors for a successful innovation based on their internal resource. As products and services become complex, firms are almost expected to integrate knowledge from multiple resources into their internal system. (Howells, James and Malik, 2003). Another reason for integrating new knowledge is due to the pace of innovation externally in the business ecosystem that pressurizes the firms to rely on new knowledge and technology to speed up their innovation process instead of building on their own (Sağ, Sezen and Güzel, 2016).

Firms are means of knowledge generation that is transferred and implemented from them to the business ecosystem for innovation (Grant, 1996). This perspective gave rise to the

concept of Resource Based View (RBV), reviewed further in detail, to explain a firm's capability to acquire new knowledge, renew and accumulate. This aspect is critical for firms working in highly dynamic industries where new knowledge is constantly emerging and forcing them to continuously source this new knowledge to gain and sustain competitive advantage (Yoo, Sawyerr and Tan, 2015). Therefore, firms need to make conscious decisions to facilitate or update knowledge internally and acquire knowledge from external sources or both (Chen and Lin, 2004).

Current literature highlights the knowledge sourcing strategies on internal factors through R&D and external factors through acquisition and imitation (Choi and Lee, 2012). Internal R&D is a recognized source of new knowledge for a firm to develop innovative capabilities, but in highly competitive ecosystems, knowledge is distributed more widely and therefore the internal R&D needs to be adapted to acquire knowledge more efficiently. (Katila and Ahuja, 2002). Therefore, as new knowledge emerges from outside the boundary of the firm, it is imperative for firms to source this from external sources (Leiponen and Helfat, 2011). As growing literature investigates the factors of innovation (Simao, Rodrigues and Madeira, 2016) much of the focus on these knowledge factors, whether internal or external has been in isolation and therefore the outline of this review is to look at the systems level innovation that exhibit not only the individual factors but also the relationship between them.

Firms differ in their knowledge sourcing strategies leading to variations in capabilities generated (Katila and Ahuja, 2002) and firm performance (Cassiman and Veugelers, 2006). Even though the bulk of innovation through knowledge sourcing strategies still comes from R&D of very large firms, recently disruptive breakthroughs have emerged from SMMEs (Baumol, 2005). SMMEs are an ideal research focus for their absolute dependence on agility, innovation and their state of flux that mimics the current business ecosystem. SMMEs overcome many of the constraints such as lack of manufacturing facility, marketing ability, limited financial and human resources, copying innovators, lack of intellectual property and distribution channel (Narula, 2004) by hyper collaborating and acquiring external knowledge, resources and complementary assets to develop and commercialize their product or processes (Nordman and Tolstoy, 2016).

SMMEs overcome size-dependant challenges by accessing resources in networks by creating, transferring and combining resources enabling them to discover new business opportunities (Crick and Spence, 2005). This literature review focuses on this characteristic of SMMEs to combine the external resourcing factor of knowledge with the internal structure within the

system of innovation to better understand the gap in theory emerging from this study of factors in isolation.

This review, takes the view of the firm through the theoretical lens of external system of innovation (National and Regional) and how new knowledge gets adopted within the firm through diffusion of innovation. The review further highlights the internal system of a firm through resource based view of the firm to highlight the flux of knowledge between the external and internal ecosystem. Below is a summary of the different literature referred to for this review. It lists the seminal work of the listed authors that has formed the foundation of the theoretical framework for this work. More recent research articles and sources are further presented in the part following Table 1.

Framework	Citation	Description
Firm level innovation	Musiolik, 2012	Firms looking beyond their internal system to acquire new knowledge
External innovation		
National Innovation System (NIS)	Nelson and Winter, 1982	Understanding of NIS and identification of actors
	Lundvall, 2002	Focus on actors as part of the innovation system and not individual
Regional Innovation System (RIS)	Malerba, 2005	Impact of geographic proximity on flow of knowledge between actors
Cluster theory	Porter, 1990	Effect of cluster on the improvement of a firm's product and organization towards competitive advantage.
Diffusion of Innovation	Rogers, 1995	Temporal adoption of innovation
Internal innovation		
Resource Based view	Wernerfelt, 1985	Tangible and intangible assets of a

of the firm		firm
Knowledge based view of the firm	Grant, 1996	Importance of knowledge as a resource for a firm
	Polanyi, 1966	Details KBV into explicit and tacit knowledge

Table 1: Theoretical Lens

2.2. Innovation

2.2.1. Definition

Schumpeter (1934) in pursuit of research data to find a change in the economic system which was defined as a circular flow proposed "innovation" as the factor that disrupts the system and introduces a new trajectory of growth. It is a whole process starting with a new idea, novelty or invention, and finishing with the end user through marketing and commercialization activities (Bessant and Tidd, 2009). While some research points to the need of innovation to add value to consumers in a systemic way through new ideas and different way of thinking (Adair, 2007), some state that it stems from pressures of competition from the external environment, liberalization, isomorphism, resource scarcity and customer demand, wherein adjustable behavioural changes in the organization need to be made to improve their performance (Damanpour, 2009).

The Oslo Manual describes innovation as the "the implementation of a new or significantly improved product (good and/or service), or process (manufacturing and supply methods), a new marketing method (packing, sales or distribution methods), or a new organisational method in business practice, workplace organisation or external relations" (OECD, 2005, p. 46). Innovation as a concept involves creation of effective products and processes with the application of new knowledge and in return contributing new information essential for innovation development (Drucker, 1994).

Innovation is fast becoming an important concept for policy makers as it allows countries through their industries to achieve competitive advantage, realise and sustain economic growth at the micro level and ultimately increase employment at the macro level (Hirsch-Kreinsen and Jacobson, 2008). The drivers of innovation such as availability of knowledge, technology fusion and shorter innovation cycles have become extremely important for

companies to develop and maintain their competitiveness and to improve their performance by seeking new opportunities for commercialization (Inauen and Schenker-Wicki, 2012).

Innovation can either be created internally or adopted from others (Pérez-Luño, Cabrera, and Wiklund, 2007), where it takes the form of a product, process and technical innovation which are generated using resources and research efforts of companies in response to needs of the market or customer (Ghoshal and Bartlett, 1988). This understanding of innovation is now being extended to the adoption of innovation to include more actors in the innovation process. Adoption is considered as an important component as the strategies designed around it, differs at the firm level and has a direct impact on the competitiveness of the firm (Pérez-Luñoa, Wiklund and Cabrera, 2011).

2.2.2. Firm Level Innovation

Innovation has long been considered as a key driver of economic growth, enhancing competitive advantage and stimulating the productivity of firms (Schumpeter, 1934). Firms being at the centre of this economic activity not only acquire new knowledge but also generate new information to manage their resource and capability (Srholec, 2011). This new resource helps firms to distinguish from their competitors and develop a competitive advantage (Barney, 1991).

There is an increasing importance in academic research to understand the innovation dynamics in complex system for firms to enhance their competitive advantage (Iansiti and Levien, 2004). Firms of today are required to be flexible in their business model, technological platform, marketing pitch amongst others to keep themselves sustainable. Focus of research on firms used to be on translating ideas emerging from their internal structure to implement them in the market to generate economic value. Due to the complexity of the business ecosystem and the dynamic environment they work in, companies must now look outward to gain knowledge to generate new ideas and integrate better with the external market and improvise their implementation strategy. Implementation of an innovation strategy requires not just an alteration to the existing socio-economic-technical system i.e. technology, user needs, market dynamics, infrastructure, policy etc. but also the linkages between these dimensions (Geels, 2005).

Firms are effective facilitators of generating and implementing knowledge emerging out of their value chain (Grant, 1996). Through the approach of the resource based view, firms are constantly looking to generate new value through a strategic action to update their

competitive knowledge. However, firms differ in the strategy of sourcing new knowledge, whether internal or external, leading to different capabilities and firm performance (Katila and Ahuja, 2002). In highly dynamic and competitive environments, knowledge in the ecosystem becomes widely distributed amongst firms leading to new combination of information. Therefore, it becomes necessary for firms to look beyond the boundary to acquire new knowledge from an external source (Yoo, Sawyerr and Tan, 2015).

Research on firm level innovation has described the need to accumulate, combine and exploit resources to generate commercial value (Grant, 1991). Large companies have dedicated R&D that are equipped to source this new information and generate value in the form of management and productivity of innovation activity (Eisenhardt and Martin, 2000). SMMEs which recently have been viewed as agents of change, employment and technological diversity, also contribute towards the stimulation of growth and innovation in the industry (McAdam, Moffett, Hazlett and Shevlin, 2010).

Innovation management and capability has been identified as a critical factor for the survival of an SMME (Hitt, Ireland and Camp, 2001). This capacity of innovation in SMME has been studied from the point of view of various factors such as organizational culture (Pohlmann, Gebhardt and Etzkowitz, 2005), access to funding (Freel, 2000), technology transfer and adaptation (Panizzolo, 1998), economic growth and policy implications (Oakey, 2007) or the role of entrepreneurs (Brendle, 2001). The research around these factors offers a fragmented body of literature and asks for a more holistic picture that is evident in the literature for large companies.

2.3. Innovation System

In the 1960's, the Organisation for Economic Co-operation and Development (OECD) started to look at the "systems approach" to study decisions and choices regarding science, technology, and innovation (Godin, 2009). The OECD were one of the first users of this systems approach in their policy making strategies amongst their member states (Godin, 2005).

The approach is a major change in the way creation of knowledge is viewed as it shifts from research and supply of knowledge to the process of innovation in which individual actors are just elements (Dantas, 2005). While the concept of innovation refers to development, adaption, imitation and adoption of new information, an innovation system is a network of institution/organisation in an economic system directly involved in the creation, diffusion and

implementation of new knowledge for the co-ordination and support of the innovation processes (Dosi, 1988). The systems approach is based on the premise that a wide range of organisations and practices are required for successful innovation to take place (Dantas, 2005).

The need for a systems approach to understand innovation came when researchers were trying to integrate value generation from universities and institutions with other sources such as engineers, customers and marketing (Lundvall, 2002). To integrate these wider contributions, a concept of innovation system emerged that was a holistic approach to identify not only the actors which were sources of knowledge but also the relationship between the actors to understand a multi-level approach to innovation (Lundvall, 2002). The research on the systemic view of Innovation was highlighted by B.A. Lundvall in 1985 who himself referred to the work of Friedrich List´s conception of "The National System of Political Economy" in the 19th century (List and Colwell, 1856). While Lundvall defined the term innovation system, David and Foray (1995) described the need for a systems approach through "a system of innovation cannot be assessed only by comparing some absolute input measures such as R&D expenditures, with output indicators, such as patents or high-tech products. Instead innovation systems must be assessed by reference to some measures of the use of that knowledge'' (p. 81).

The development of innovation systems has taken place in parallel with the economic theories to integrate knowledge and innovation into a neo-classical growth theory which is being widely referred as a new theory to overcome the linear perspective in policy analysis (Lundvall, 2001). Therefore, this approach to generate scientific and technological knowledge has been gaining ground in policy and academic research (Dantas, 2005).

Innovation System conceptualises the flow of information and knowledge among firms and institutions to be the key driver of innovation. It is a systemic spread of knowledge amongst actors (firms, institutions, customer) within an institutionalised framework to turn ideas into product or process. (Lundvall, 1985).

Although there is no consensus on the definition of the term 'Innovation System' , ones listed below by early researchers are widely accepted.

1. "*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies."* (Freeman, 1987. p. 6)

2. " .. *the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge ... and are either located within or rooted inside the borders of a nation state.*" (Lundvall, 1992. p. 2)
3. "*... a set of institutions whose interactions determine the innovative performance ... of national firms*." (Nelson, 1993. Pg. 4)

Innovation System (IS) is a framework to understand innovation from a policy and research point of view and to generate new insights into the relationship between innovation and economic progress. Innovation is the result of an interactive process between actors such as firms, universities and research institutes and while these actors do not possess all the knowledge, different sources need to be identified to provide this gap in knowledge. The other departure point from the earlier understanding of IS is that it is not a linear path from research to development to production to finally introducing new product or process, but involves a continuous feedback between different stages (Galli and Teubal, 1997). As the interactions between actors in an ecosystem grow, the traditional method of understanding innovation from just an input/output point of view gets transformed into a more systems approach of gathering knowledge (OECD, 1997).

Other benefit of IS as a theoretical concept is that it brings the different actors and factors of innovation in a single framework (Dantas, 2005). It provides valuable insight into the process of innovation by highlighting that the actors such as universities, research institutes, public research development organisations, government agencies and departments, patent offices, and both private and public funding organisations do not function in isolation but through a web of inter- relationship and therefore needs to be considered before making any strategic decisions (Viotti, 2002).

The aim of this theoretical lens in the review was to not only focus on the individual actors but also understand how they interact with each other and how that impacts the generation of new knowledge. The aim of systems thinking is to focus on the inter relationships between the actors as they work together to fulfil the purpose of the whole system. The whole system comprises of the stages of innovation that is production, diffusion and application of knowledge (Dantas, 2005). An understanding of how the information flows in the system, either in the form of soft knowledge or standard one, helps the firm develop approaches to enhance their innovative performance in this knowledge based economy (OECD, 1997).

Innovation system can be applied at different levels of economy based on the focus of national, regional, local or sectoral system of innovation. From a policy perspective, differences in the type of innovation and organization of innovation in different business sectors, gives rise to a more focused approach to innovation system in the form of national, regional, sector level (Dantas, 2005). This approach changes the focus of analysis from the more internal working system to the way the same system interacts with outside world to source new knowledge to remain economically competitive and sustainable in the long run.

2.3.1. National Innovation System

Metcalfe describes the purpose of a National Innovation System (NIS) as a successful economic development linked to a country's capacity to acquire, absorb, disseminate and apply new knowledge (Metcalfe, 1995). It further details the role of national institutions contributing to creation and diffusion of new knowledge which can then be used by the government to create policies influencing the innovation.

NIS was first conceptualised by Freeman (1982) drawing on the idea of List (1841), Nelson (Nelson and Winter, 1982), Schumpeter (1942) and Lundvall (1985) that neo classical growth theories ignored the contribution of innovation and therefore proposed a new model for growth through the role of institutions and collective activities around them to generate and diffuse knowledge in a national economy. In research done later, the role of feedback and exchange of knowledge between institutions was further highlighted to explain the conceptual mandate of NIS in the economy (Nelson, 1990).

Early work was set out to identify institutions and system interactions focused in the OECD member countries. The institutions identified were

1. Government and related agencies involved in regulation, standard setting, public-private partnerships, and funding of basic research,

2. Sectors and industries including firms which generate commercial innovations through experimentation, R&D, and product improvement,

3. Universities which conduct basic research and train a technical and scientific workforce, and

4. Other public and private organisations that engage in education oriented activities (Patel and Pavitt, 1994).

This further led to the study of interactions within and between institutions because of user-producer linkage that facilitates sharing of cumulative knowledge and collective learning (Lundvall, 1992).

NIS studies were centred on firms (both small and large) as an institution where innovation was developed and commercialised (Patel and Pavitt, 1994). Keeping the firm at the centre of activities, the theoretical framework identified other institutional actors as supporting roles which contributed collectively to the knowledge base (Watkins, Papaioannou, Mugwagwa and Kale, 2015). The research on NIS has now evolved into understanding the role of institutions other than having an "educational role" and how it interacts with the firm to make the firm more competitive and sustainable (Watkins, Papaioannou, Mugwagwa and Kale, 2015).

Firms within the NIS network constantly look for current and emerging knowledge to keep pace with the changes in the ecosystem and therefore make new relationships with other firms, universities, government bodies, funding agencies (Wolpert, 2002). This pursuit and sharing of new knowledge through new networks and partners creates a new learning that is fed back into the system for use by other firms and institutions to benefit from, therefore completing the systems loop in innovation. These new interactions have added to the literature of NIS and growth in understanding of creation, distribution and use of knowledge as well as the factors influencing these processes (Viotti, 2002).

Based on the economic and sociological perspective, NIS framework describes the difference in a firm's pattern of operating within the system and how the interaction is based on

(1) the extent that financial resources are available for such activities,

(2) the ability of the government to create a suitable environment fostering innovation,

(3) the level of generalized trust in society, and

(4) the formation and efficient allocation of human capital within the economy (Zanello and others, 2015).

In the current knowledge based economy, firms are almost expected to tap into the distribution of knowledge between institutions by collaborating to develop a new generation of innovation indicators (Godin, 2009). It is this need for new knowledge that the firm makes a choice on knowledge acquisition strategies to decide if they need to develop it partially or completely outside of their boundaries (Glückler, 2013).

This review supports the configurational approach to identifying factors of innovation that are common between the external and internal ecosystem. It departs from the conventional NIS theory to the one proposed by Lundvall where he suggested considering institutions not as individual actors but as part of the system (Lundvall, 1999). The approach deductively identifies the relevant institutions for firm innovation but inductively uncovers relationships these institutions forge to collectively foster innovation (Lundvall, 1999). This configuration method then shows its basis on the idea that factors of innovation are interwoven and complement each other to support an innovation based activity in the firm. Therefore, focusing on factors along with others in the system adds a higher value at the firm level innovation (Lundvall, 1999).

As studies on the relationship amongst the factors or institutions gathered pace, a new outlook to NIS emerged in terms of the influence of geographical distance amongst institutions and its influence on innovation.

2.3.1.1. South African innovation policy

The transition of economic focus since Apartheid has been fast paced and the country has quickly made strides to become competitive in the globalised economy. They focused on two main areas of economic transition-

1. Moving away from dependence on primary resource production
2. Moving away from dependence on associated commodity based industries (OECD, 2007)

The South African Innovation survey of 2012 looked to gauge the dynamic innovative ability of the firms to support them to remain productive and competitive on a global level. (Moses, 2012) The basis of their support was around the framework of generating jobs and being export oriented as it was understood that innovative companies more often look beyond borders for their market than the non-innovative ones (Geroski, 1995). The fundamental basis of this survey was defining innovation through- product, process, organizational and marketing which is part of the OECD definition and gives a glimpse of the institutional framework. Apart from the R&D activities, the non-R&D activities considered in the report were - acquisition of new knowledge, new equipment (or technology), new market activities and design which complemented some of the other studies undertaken by government organizations and independent bodies (Moses, 2012).

South Africa has a history of innovation-friendly policy corroborated by their recent 10-year innovation plan moving the country towards a knowledge based economy which focuses on life sciences, energy, science and technology, space science and improving social structures through job creation (Innovation, 2015). This gives a glimpse of the country's strength and motive in investing further on innovation driven and supportive economic policies.

According to the country specific report (OECD 2010), South Africa does well among the developing country where the firms collaboratively innovate in non-technological innovations. Its history of working in a regulated environment due to economic sanctions laid by the international community strengthened the local firms and their collaboration with other firms to introduce new products into the local market more effectively (Hamann, Khagram and Rohan, 2008). This gives an ideal baseline opportunity for this review to understand the indicators of such a unique collaboration more deeply and identify factors that were successful nodes of the network. This identification will potentially throw up the weak factors that can provide companies a quantifiable prospect to strategize towards innovation.

2.3.2. Regional Innovation System

Innovation needs to be adopted and diffused within an ecosystem and market space with the aim in mind to create an absorptive environment to support and sustain the generation and adoption of knowledge within the region. Regional Innovation system (RIS) as a concept was proposed by Asheim (Asheim and Isaksen, 1997) and Cooke (1997) to elucidate that innovation is best understood as a local and regional phenomenon. Where physical interactions, knowledge sharing and learning occur between geographically proximate actors and institutions that are bounded within a location.

RIS is a new concept that has captured the attention of management researchers and policy makers to help support the national and regional institutions to develop region specific innovation policy. It is based on an approach that regional competitive advantage is based on innovation activities where existing knowledge is continuously configured into new combination in the local context (Coenen, Asheim, Bugge and Herstad, 2016). It has partly come to prominence due to the imbalance of opportunity caused by globalization of the economy and the inability of firms to deliver value in a region (Doloreux, 2004). It is an important theoretical lens for this study as it has been widely accepted that firms develop competencies and learning processes in regions that can provide them resources in the form

of skills, institutional benefits, sharing of common social and cultural values that are essential ingredients of sustainability (Maskell, 1999).

RIS is the meta layer of the innovation system mediating the diffusion of knowledge and resources from the national to the firm level. This regional system has become an important component of the larger national innovation system to complement the understanding of firm level innovation in context of the following (i) knowledge and technologies, (ii) actors and networks and (iii) institutions. (Malerba, 2005). It draws upon a broader interest in the relationship between proximity of actors and innovation in shaping the rate and direction of innovation process (Gertler, 2003).

The system defined by Malerba (2005) is a set of 'actors' working in unison to provide a related product/service value based on common knowledge. It is a framework of knowledge, technology, input and demand as a set of actors that carry out market and non-market interactions to create and diffuse new knowledge within the system that is geographically contained. The part of interaction is an important function within the regional system as it allows them to share the knowledge and resource and collectively progress (Malerba, 2005). New firm level actors emerge from these interactions in pursuit of new value, as the firm looks to capacitate its internal resource by looking outside of the firm boundary for new resources (Musiolik, 2012).

This theoretical lens is an important part of this review due to the focus on SMMEs. SMMEs particularly benefit from RIS as they work within an ecosystem that comprises funding/venture capitalists, knowledge institutes; established businesses and service providers that helps them towards their growth potential (Napier, 2013). They are not dependent on the grid policy of global and national innovation system but on the successful networking and collaboration between the agents of their local business ecosystem (Napier, 2013). This linkage was further studied by Morris (2006) who described the relationship of firms with learning networks as a need of inter-organizational networking to develop a capacity within the firm and in competition within the ecosystem.

Firms need to create new value through their product or process to remain competitive and therefore, different types of knowledge creation and innovation support strategy needs to be contextualised within their local industry and sector of the economy (Asheim, Lawton, Smith and Oughton, 2011). In recent years, the process of knowledge creation and innovation process has become complex due to the diverse nature of knowledge sources and types

(Asheim, Lawton, Smith and Oughton, 2011) and therefore, requires a fluid interaction between different actors and people (Nonaka and Takeuchi, 1995) which is relevant to the firm. This is where RIS plays a key role in the conceptual configuration of IS to describe the importance of proximity in this exchange of information (Arundel, 2004).

Regions play an important role in supporting innovation and enabling firms to benefit from it. They provide the fundamental resources for the firms to build and improve their innovative capacity and competitiveness through tangible and intangible assets ((Coenen, Asheim, Bugge and Herstad, 2016). The fundamental driver for firms to be part of a network within a region can be pointed to complementing each other to bridge the gap between the supply and demand of the market and increasing it as a measure of growth. Through the motive of supplying products/service to users, it blends in regional resource strength through a unique relationship between social and cultural strength (Landry, 2002) and proximity of other firms and suppliers (Arundel, 2004). Actors in this network comprise of organizations and individuals where organizations are classified as firms (users, producers and suppliers) and non-firms (universities, associations, govt. Institutions, financial institutions, etc). The different actors are connected by market and/or non-market requirements. This relationship between actors to share knowledge, learning process, technologies and skills is specific to each sector in terms of the content but not the framework (Asheim, Lawton, Smith and Oughton, 2011).

As regions provide mechanism and condition for firms to function optimally through specific and non-specific interaction with other actors, the view allows for a more cluster based approach to understanding the position of the firm. Firms as part of a cluster gain advantage over other competitors through improved links, knowledge sharing and innovation (Kuah, 2002). As Porter (1990) highlighted the effect of a valuable value chain (firm, suppliers, buyers, channels) to the competitiveness of a firm, this review looks at the view of a SMME and its action to acquire new information. The view of cluster in RIS is defined by Porter (1990) as "*groups of interconnected firms, suppliers, related industries and specialised institutions in particular fields that are present in particular locations*". While RIS, focused on the horizontal relationship between firms and other actors in the system, cluster theory details the value chain and vertical integration in the regional system (Kuah, 2002).

SMMEs which are the focus of this review operate in a geographical concentration to benefit from the talent attracted to their cluster and the informal nature of their knowledge held within the cluster to give them competitive advantage (Swann, Prevezer and Stout, 1998).

Swan and others (1998) further elucidate the importance of the cluster from the cost point of view to show reduced affects in transportation, supply chain, customers searching and improving quality.

RIS is an important theoretical framework for the context of this research primarily due to the grounded scope of innovation in small firms that is highly dependent on the dynamic relationship with other actors and flexible boundary of the firms. And more so, firms benefit immensely from regional policy by improving their innovative capacity to remain competitive and sustainable in their business environment. As previous studies, have shown that apart from a firm's own innovation characteristic, local conditions are also a factor in stimulating the firm's innovation capacity (Khosropour, Feizi, Tabaeean and Taheri, 2015). SMMEs especially rely on regional resourcing strategies compared to their internal source as they are much more constrained in terms of managing resource (Rammer, Czarnitzki and Spielkamp, 2009) and therefore, external sources of knowledge are much more accessible offering lower associated costs and risks (Atuahene-Gima, 1993).

2.3.3. External system of innovation

Innovation is a complex process that is increasingly being influenced by the effectiveness of a firm's external sourcing strategies (Brown and Duguid, 2001), research opportunities, and public information sources, each of which has its own separate search channel that allows companies to tap into relevant market, operational, and technological information (Laursen and Salter, 2006). Literature of innovation often has stated the importance of creation and recombination of knowledge for new products as a fundamental factor of innovation (Katila, 2002) and external search for this knowledge can sustain innovation in several ways (Smith et al., 2005).

Firms look to access knowledge from diverse sources to promote variety through novel perspectives which contributes to the decision-making process of new product development (Grimpe and Kaiser, 2010). This process of looking externally for new knowledge in addition to what they already have provides the firm with a stimulus to engage in innovative thinking and adopt new problem-solving approaches (Laursen, 2012). It favours the introduction of new product or process that are different from the competitors and helps in increasing their knowledge base that will then allow them to come up with original knowledge combinations (Laursen, 2012).

Products or processes that are associated with high recombination capabilities are more likely to be launched by firms that rely on diverse search channels (Fleming, 2001). The other benefit of sourcing knowledge externally is that when the breadth of external knowledge grows, uncertainty arising from product innovation activities gets mitigated when it is sourced from multiple resource channels instead of a few (Leiponen, 2012). Therefore, having a more diverse knowledge sourcing strategy allows for both downstream and upstream complementary inputs (e.g., technological, market, manufacturing, distribution, and design knowledge) to recognise the wants and needs of the customers and market to help define a more successful product or process design (West and Bogers, 2014).

Growing literature investigating innovation in a firm identified the external relationships as a critical factor in introducing new products (Gronum, 2012). The external relationships are influenced by the market demands and the dynamics of the industrial ecosystem responding to it. The fluctuating expectation of the market changes the composition of the customer and their preferences (Kohli and Jaworski, 1990). During this high turbulence of fluctuating market demand, firms must respond to understand changes in customer preferences and design appropriate strategies (Grewal and Tansuhaj, 2001). Market advances in process, product and demands significantly shorten the product life-cycle and affect the competitiveness of the existing firms allowing incumbents to come to the forefront (Zhou, Yim and Tse, 2005).

Firms are therefore forced to diversify their learning orientation to increase the variety of ideas to broaden the capacity of firm to make useful and profitable action within the organisation (Moorman and Miner, 1997). This way, high market turbulence incentivises firms to acquire knowledge from an external source to reduce uncertainty and deliver in alignment with customer preferences (Yoo, Sawyerr and Tan. 2015).

In most of the situations, firms are unable to control or manipulate the external economic conditions. When dealing with uncertainty from competition and customer demand, diverse resources are required to develop a capacity to respond to such changes. Looking for external source of knowledge increases the firm's knowledge base allowing them to innovate and commercialise new products (Okamuro, 2007). Access to the external complementary knowledge therefore allows the firm to develop an internal capability to scope and scale new value and in turn respond to the new market demands.

The performance of the firm is directly dependent on the firm successfully determining the factors of value addition and integrating within (Mol and Birkinshaw, 2009). Most studies focus on the interaction between external source of knowledge with the internal R&D to stimulate innovation (Veugelers, 1997). Cohen and Levinthal (1989, 1990) however, also identified the importance of industrial ecosystem in the acquisition of new knowledge that gets assimilated and implemented within the firm. Purpose of sourcing external knowledge ranges from reducing the cost and time of existing internal processes to achieving technological and knowledge transformation (Tsai and Wang, 2009).

The innovation process in a firm involves acquiring of new knowledge from suppliers, customers, other industries to update the in-house knowledge (Knudsen, 2007). This external knowledge could either be complementary or substitute the existing one (Sofka and Grimpe, 2010). The key to a successful innovation management process in the firm would be to identify the right external knowledge and how well to integrate into the existing infrastructure (Tsai and Wang, 2009).

The knowledge points external to the firm are heterogeneous agents that are categorized as organizations (institutes, government bodies, financial institutions and other firms) and individuals (consumers, entrepreneurs, consultants). These heterogeneous actors relate to each other either directly or indirectly generating new information for the benefit of the firm. Therefore, from an external perspective of knowledge acquisition, an innovation process for the firm involves systemic interaction with such actors for generation of knowledge relevant to innovation and commercialisation (Malerba, 2005).

2.3.4. Internal system of innovation

2.3.4.1. Resource based view of the firm

Resource based view of the firm (RBV) explains that a firm's competitive advantage can be reached if the internal resources are adapted against competitors and external forces that can affect the firm performance negatively (Porter, 1980). These advantages can be achieved through factors such as social network (Nahapiet and Ghoshal, 1998), organizational process (Barney, 1991), innovation through products and process (entrepreneurial) for cost efficiency (Terziovski, 2010), and intellectual capital gained from employees (Bontis, 1998) among others. Barney (1991) further highlighted that for firms to acquire resources to become more innovative, they need to ensure that the resources are 1) valuable, 2) rare, 3) imperfectly imitable, and 4) hard to substitute.

RBV relies on two fundamental assumptions, 1) resource heterogeneity (firms differ in their resource capability) and 2) resource immobility (differences can be long lasting) (Mata, Fuerst and Barney, 1995). A firm for them to remain competitive must strategize to acquire resource that is not possessed by others and/or harder to obtain, develop and use it (Rivard, Raymond and Verreault, 2006).

This review focuses on the theory of RBV to understand how firms can restructure their internal resources in this resource limited business ecosystem (Greene, 2015) and what factors to acquire as new knowledge to become economically sustainable. The basis of this research being firm centric, it is necessary to understand the internal requirements and capacity of the firm and looks to identify the factors that will aid them to become more innovative.

The current research on RBV state that the firm's internal resources are the primary driver of defining firm level performance and competitive advantage (Newbert, 2007) but does not extend the boundary of definition to explain the true value of "resource". It is still being defined as a singular theory which does not consider the interlinkages between actors within the company or outside that influences the pursuit of resources (Barney, 2011).

The RBV model allows for a clear differentiating factor for the firm belonging to an industry may be different from other firms in terms of the resources they acquire and manage (Porter, 1981). These resources form an asset for the firm which helps them to achieve their target and performance (Bryson and others, 2007). This understanding of resource per the seminal work of Wernerfelt was anything that "*could be thought of as a strength or weakness of a given firm*" (Wernerfelt, 1984) which further explained the tangible and intangible assets (Caves, 1980). The resource that a firm looks to create and manage could either be basic or higher order form of tangible or intangible asset (Madhavaram and Hunt, 2008). The basic resources such as finance, human resource, methodologies, specialized knowledge, trust and reputation are assets of the company that would need to be upgraded for the firm to match its value creation with the moving needs of the business system (Bryson, 2007).

Firms develop and strategize their profit-making business model around the resources available and its translation through a process into a product. Early proponents of this theory proposed that firms to become competitive looked at internal capacity of sources for competitive advantage rather than a competitive environment for it (Wernerfelt, 1984). It is a

unique shift in mindset that firms need to plan for exploiting external markets using existing resources rather than acquiring new resources (Barney, 1991).

Much of the old literature on RBV has looked at the inward approach of creating and managing resource to achieve competitive advantage (Wernerfelt, 1984) while the new work looks at the dynamic relationship of the firm with their partners (other firms, govt. institutions) representing relational resources and their outcome on the firm (Arya and Lin, 2007). This relational view emphasizes on the common resources that the partners cannot generate independently and stems from the firm's network tie that are heterogeneously distributed (Lavie, 2006). This relational view of the RBV allows for a complex routine that is more difficult to imitate and therefore providing a competitive advantage to the firm (Gulati, 1999). Therefore, a study on relational resources has the potential to create exclusive value for interconnected firms with either similar or dissimilar resources (Shan, 1994).

The external pressures on firms are multiple but like most of the companies in a cluster, the competitive edge can be gained by re-assessing the resources available to each firm. Much of the literature shows that it is the internal resource and not the external environment that plays the pivotal role in the success of the company (Tokuda, 2005). The tangible and intangible resources available to the firm need to be organized to leverage the most competitive output. It is these internal resources determining the performance that could potentially contribute to the sustainable advantage of the firm.

Resources support the competence of the firm by providing the catalytic factor for the product which leads to a value in the market (Prahalad, 1990). Therefore, an important strategic decision of delivering the value of the product to the market relies on the relationship of identifying to acquiring the resource which is a differentiator in the homogeneity of the industry.

2.3.4.2. Knowledge based view of the firm (KBV)

The knowledge based theory of the firm considers knowledge as the most important resource of the firm (Grant, 1996). While resource based view of the firm does recognise the importance of knowledge, some researchers argue that it treats KBV the generic component and does not detail the specific role of knowledge (Wernerfelt 1984). It highlights the importance of firm as a provider of an ideal platform for creation, transfer and application of knowledge (Spender and Grant, 1996). This knowledge allows for the creation of capability for the firm which determines the ability to do things (Henderson and Clark, 1990) and

therefore, the strategy of constantly knowing and learning is as important as what should be known (Spender and Grant, 1996).

Theories of firms attempt to conceptualize, explain, model and predict firms structures and behaviour (Grant, 1996b). They are approaches that help to understand the heterogeneity between firms and a strategy on how the firms can differentiate form competitors to gain sustainable competitive advantage. While evolutionary theory views firms as repositories of standard and path-dependent routines (Nelson and Winter, 1982), organization theory focuses on the internal structure of the firm and relationship between its units and departments (Grant, 1996b). KBV highlights the existence, boundaries and internal organization of a multi-person firm where knowledge is the key explanatory factor and nature of knowledge is an important factor in understanding firm organization and behaviour (Foss, 2005).

KBV further classifies as explicit and tacit, where explicit knowledge is one which can be quantified and expressed without any problems, whereas tacit knowledge is personal, context driven and based on practice and experience (Polanyi, 1966). The two differ in terms of their transferability, appropriability and potential for aggregation and storage (Brown and Duguid, 2001). This research reviews tacit knowledge from the experience of the CEO of a SMME to lead and manage the information in hand as they attempt to keep this knowledge hard to share and transfer.

Tacit knowledge is embedded in specific practices and experiences which is hard to understand and transmit outside of the firm which is opposite to explicit knowledge which can easily be adopted and translated outside of the firm (Szulanski, 2002). Nonaka and Takeuchi (1995) further differentiate tacit knowledge into cognitive and technical. The cognitive facet of tacit knowledge lies in the mental models, conceptions, schemas and perspectives of an individual, while the technical facet includes the operational process, skills which are comparably tangible (Nonaka and Takeuchi 1995). This intangible form of knowledge which remains subconscious to individual and is difficult to articulate provides an advantage to the firm by providing the individual a unique skill and judgement which is different from the activity of the firm (Kirsimarja, and Aino, 2015).

Knowledge is the new fundamental basis of competition and the most important factor in the creation of economic value and competitive advantage (Drucker, 1993). The theory recommends firms to align their strategy to understand current knowledge resource and capabilities in the firm and to address gaps in relation to what knowledge resource is needed

from an internal strategic viewpoint and in comparison, to competitors (Zack, 1999). KBV is an important theoretical lens for this review as it highlights the distinctive characteristic that sets it apart from other resources and thereby providing a complementary support to the innovation system. It is of benefit to the smaller firms who cannot afford to invest in creating new knowledge other than what comes out of adoption and implementation existing knowledge (Shapiro and Varian, 1998). Thus, the process by which firm uses and implements knowledge within is at the heart of their performance and value creation.

2.4. Chapter Summary

Firms in developing countries are being forced to become more adoptable and responsive to the rapid changes in market needs, national policies and technological transformations (Henderson and Clark, 1990). These changes force the firms to learn not only new components but also links between them to reconfigure their existing linkages (Kale and Little, 2005). Internal and external resources (tangible and intangible) affect the economic sustainability strategy of a firm based on the path driven process of innovation (Antonelli, Crespi and Scellato, 2013). The strategy to acquire new knowledge and to adapt the internal structure for this new knowledge is at the helm of many management strategists from both a theoretical and practical viewpoint.

Literature on innovation has evolved from a linear model to a more systems based approach (Ortt and van der Duin, 2008) to understand linkages between different actors which in this review is the firm and its relationship with the actors of the external ecosystem. Firms being at the centre of this system, organize themselves to gain excess to external knowledge to gain competitive advantage (OECD, 2014) and therefore must manage or add internal factors (Tidd, 2007). This review looks at the internal analysis of innovation to highlight the tangible and intangible assets of a firm contributing to the competitive advantage (Galende and Fuente, 2003).

While there is abundant literature on external and internal factors of innovation, the aim of this review was to position the needs of a SMME in between external and internal factors of innovation and to extend the theoretical understanding of innovation in the flux region between the two domains. The review focused on the summary of existing theories around the source and transfer of knowledge acquisition and innovation management leading to a requirement to identify the common framework between both the factors. The theoretical framework of the review is shown below.

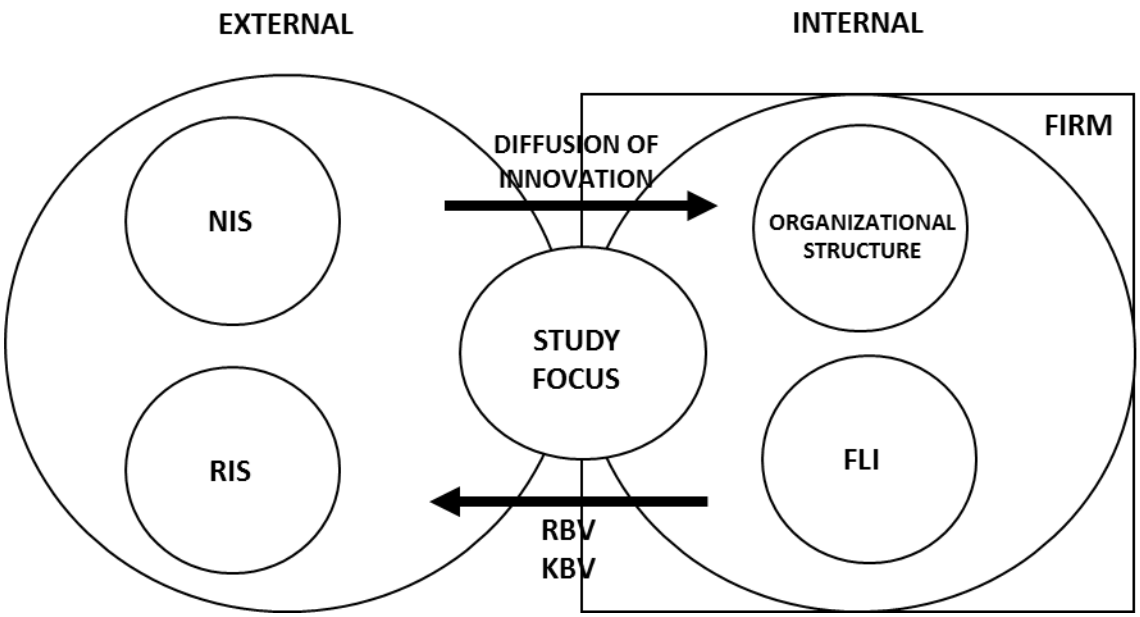

Figure 1: Theoretical framework (Nikhil Rautela)

NIS: National Innovation System

RIS: Regional Innovation System

FLI: Firm Level Innovation

RBV: Resource Based View of the firm

KBV: Knowledge Based view of the firm

The focus of the study lies in the flux of the two system that allows the firm to adapt and prepare itself to the external acquisition of new knowledge or information. The question that researchers often ask is what should the focal point of analysis be- firm to look at external knowledge and then adapt accordingly or bring in external knowledge based on their current capacity? This study aims to look at the impartial view of this balance based on the participating SMMEs current conditions.

The main focus of the study lies in between the flux of the two innovation systems and how it flows into the company and gets adopted within. There is an element of the firm looking at the external system to bring in new knowledge and therefore modify the internal structure accordingly. The framework in Figure 1 above looks at identifying factors in each system (internal and external) that are dependent and influencing on the factors from the other system. The common ones between the two forms in the space identified as “study focus” is the main departure point of this study and to conclude the factors of innovation for a SMME.

CHAPTER 3: METHODOLOGY

3.1. Introduction

This research was a qualitative inductive process to understand the factors of innovation in a SMME from an internal and external viewpoint. Based on the guiding research question, the interviewees were asked about the current position and understanding of their firm within the theoretical context of innovation. The context of the research question and interview was to explore the position of the SMME in the current innovation system of Western Cape and South Africa and how they relate to the factors of innovation for their strategy towards sustainability.

The research methodology was grounded on the cross-case study methodology where the approach was taken to explore the phenomenon of innovation in SMME using variety of data sources that allows for the multiple facets of phenomenon to be elucidated. It follows the methodological approach based on (Yin, 2003) philosophy of constructivist paradigm. According to Yin, one of the three multiple case study approaches is the explanatory one which is the causal case study in which the information from the cases is related to a theoretical position (Yin, 2003). This approach of multiple case study allows for the data to be organised in a comprehensive description that is a unique and holistic entity (Yin, 2003).

The constructivist view underpins the perceptual nature of innovation as seen by an SMME without having the objective information around the phenomenon. The CEOs interviewed for this interview needed to be given the freedom of their experience to construct the relationship of what they thought was innovation with that of the theoretical construct of the phenomenon. My position in this interview was that of a facilitator based on the participatory approach of (Crabtree and Miller, 1999). The approach allowed for the interviewee to describe their views of the phenomenon (Lather, 1992) and to help me to better understand their action in their company that related to innovation.

In this research, 5 cases were examined based on the interview of the CEO of a SMME at their workplace and desktop research to collate their understanding of their company's current and future strategy on innovation towards sustainability. In each case, the perspective of the CEO was developed and examined independently and then across stakeholders for a cross-case analysis based on the study done by Mills and Huberman (Miles and Huberman, 1994).

Following the methodology, the method of gathering data is presented in this chapter to outline the strategy of selecting the companies and interviews. The chapter further explains the need for a quantitative approach to collecting data for the interviewee to confirm their understanding of the question and relate their current thinking within the context of the question being asked.

3.2. Case study methodology

Case studies are described as an exploration of a "bounded system" (Bloor and Wood, 2011). It is a strategy of research aiming to understand a phenomenon within a single or small number of naturally occurring system (Yin (2003). The purpose of using the methodology in this research was to provide a description of the multiple stakeholder influence of the understanding of innovation to generate a theoretical framework. However, it was not just descriptive but itself suggested a critical exercise for the examination of a phenomenon with a view towards giving recommendation.

Stake (1995) and Yin (2003) based their approach of case study analysis on the paradigm of constructivism which describes that truth is relative and dependent on one's perspective. While constructivism "recognises the importance of the subjective human creation of meaning, but doesn't reject outright some notion of objectivity, pluralism, not relativism, is stressed with focus on the circular dynamic tension of subject and object" (Miller and Crabtree, 1999), it is built upon the understanding of social construction of reality (Searle, 1995). One of the advantages described in the early methodology literature was the close collaboration between the researcher and the interviewee which enabled the interviewee to narrate their stories to describe their views of reality and therefore enable the researcher to understand the action better (Lather, 1992). In this research, the subject which is the CEO of a SMME was interviewed to understand their perception of innovation and the company's view and relationship with the ecosystem it functions in. The subject might have different views on innovation based on the needs of the company, but still have objective view in relation to the theoretical perspective of innovation. Therefore, my research position was to extract this understanding of innovation from the CEO and analyse the perceptual boundary between company and innovation system from the CEOs point of view.

Yin in his work recommends case study as a research methodology to be considered when 1) aim of the study is to answer how and why, 2) researcher cannot manipulate the behaviour of the participants, 3) researcher wants to consider contextual conditions relevant to the

phenomenon and 4) boundaries are unclear between phenomenon and context (Yin, 2003). This formed the basis of the structure of research planning, interview questions and framework proposal for this study to ensure that the perception of innovation of the CEO is documented. The position of the research method followed in this study was to consider the context of the current innovation system and its influence on the firm level activities to highlight the factors of innovation.

Case studies are valuable where the research context is too complex for experiment or survey research to generate theories before they are tested in the main study or to help researchers to expand on quantitative findings (Bloor and Wood, 2011) as is the case in this research. Purpose of the case study is to gain a detailed understanding of the process involved in the research setting whether studying a single or multiple case and the numerous levels of analysis (Yin, 1994).

The size of the case can vary from single individual (as in the case of this research) to groups of people, organisation and cultures. It is important to consider the right case(s) for the development of a theory based on sampling for the researcher to generate insights from each one of them towards a polar perception of data analysis. This research used 5 cases of different levels of business within one industry to estimate the generalized position of a company within the ecosystem and its relationship.

Once the case was determined, it was important to set the boundaries of study to ensure that the focus of study does not become too broad or set too many objectives for one study. Some of the suggestions on how to bind cases are: 1) by time and place (Creswell, 2003); 2) time and activity (Stake, 1995); and 3) by definition and context (Miles and Huberman, 1994), to make sure that the study remains reasonable in scope. The boundary for this research was based on the qualitative and quantitative context of the company within the ecosystem to better understand the diversity in their business activities and to extrapolate their relationship with the ecosystem uniformly to other companies as a recommendation through the proposed framework.

According to the research question stated in previous chapter and the determination of the qualitative nature of the case and its boundary, multiple case study analysis as a case study design was chosen per the guidelines recommended by Yin (Yin, 2003). Based on the purpose of this study which is to determine the factors of innovation common to external and internal structure within the innovation ecosystem, multiple case study analysis allows me as

a researcher to explore subtle differences between different SMMES (cases) towards the general theory being recommended here.

3.2.1. Multiple case study methodology

A multiple case study as described by Yin enables the researcher to study the differences within and between cases. Due to the nature of the research, comparisons will be drawn between cases and therefore, it is important that the cases are chosen such that the researcher can predict similar cases across different cases (Yin, 2003).

The multiple case study approach of sampling 5 companies was to allow for two or more observations of the same phenomenon. While the variant enables replication to independently confirm the emerging constructs and propositions, it also enables extension which is essential to reveal complementary aspects of the phenomenon (Santos and Eisenhart, 2011). In this research, the phenomenon of innovation system was used as a unit of analysis to understand the SMMEs position in the innovation system and how they currently function within it. The study of 5 cases allowed for a more robust, generalizable and developed theoretical framework being proposed here.

Multiple case study analysis allows for the researcher to analyse similarities and differences within each setting and across setting. Based on the purpose of this research, multiple case study analysis was most suited to analyse the perceptual understanding of innovation within the SMME and how that understanding shaped their relationship with the outside business ecosystem. Based on the assumption that the participating SMMEs have different business models compared to others, interviewing these diverse companies within the industry allowed for a tighter response to the questions and their understanding of external factors of innovation. Therefore, analysing these multiple cases improves the analysis of data to predict similar results (Yin, 2003) as is the case in this research to identify the unique factors of innovation for one case which can then be generalized to other cases.

A collective approach to the case study was used for this research with 5 CEOs from SMMEs in the Western Cape region of South Africa chosen for data collection. The firms were selected as per the process described in the next section of this chapter. Motive of choosing these 5 firms was to have more diverse concept of CEOs understanding of innovation and to know the diverse nature of the firms existing relationship with the business ecosystem.

The interviews which were qualitative and quantitative in nature lasted from 30 min to 60 min. The structure of the interview was such to start with their perception on innovation and the need for their company to embrace it. This laid the foundation of the qualitative assessment of the research question allowing the participant to explore ideas and thoughts and allow for the emergence of new links with the innovation system. Based on the multiple case analysis theory building by Eisenhart (1989), it is important to avoid starting with a theory in mind, but rather allow for the emergence of meta-analytical data.

3.3. Method

The research design summarized below in the table gives an outline on the approach to data collection over the period of this research.

Period	Phase of research	Description
Mar – June 2015	Literature review	Background research work towards theory building
May – Oct 2015	Sample selection	Part of the UNEP Eco-Innovation intervention program: Selection of 5 companies
Oct – Dec 2015	Interviews	Interviews with CEOs of selected companies
Jan – Mar 2016	Literature review	Further background research work after change of research question

Table 2: Research Design

3.3.1. Context of study

The 5 companies selected for this research were shortlisted from the United Nations Environment program (UNEP) Eco-Innovation Pilot project which studied the need of new business models for companies to become sustainable. This research was done to study the proposed framework in the context of sustainability and how Innovation could be one of the ways to achieve it.

Eco-Innovation project run in South Africa since 2015 is part of UNEP efforts in 9 countries focuses on 3 industry segments- Agri-food, Chemicals and Metals. Aim of the project is to help companies become economically competitive by identifying alternate business model and strategy to achieve this. Operationally, "It works through a new business strategy that incorporates sustainability throughout all business operations, based on life cycle thinking and involves partners across the value chain. By implementing a set of coordinated modifications to products (goods / services), processes, market approaches and organizational structures, eco-innovation enables the creation of novel solutions leading to enhanced sustainability performance and competitiveness." (http://www.unep.org/ecoinnovationproject/) The participation of companies was completely voluntary and was funded by UNEP.

3.3.1.1 Sector and Firm selection

UNEP, through the Eco-Innovation manual recommends using their tools as a guiding construct (UNEP, 2015). Target Identification Tool of UNEP was used as a guide to structure the desktop research to select the relevant sector for South Africa. Although the metals sector was pre-selected for South Africa, it quickly became clear through desktop research and interviews that there was not only a great need for eco-innovation in the sector, but also room for innovation in the sector.

The initial sector analysis was conducted through desk-top research, but also through industry, academia and government expert interviews and meetings. Considerable information was gathered in assessing the metals and engineering sector/cluster, which is summarized in the next chapter. Please see in Appendix A1, the list of desk-top materials, reports and well as consultations with experts. The metals sector was briefly compared to other industries in the Western Cape, South Africa.

Once the sector was selected, a sub-sector was to be identified for implementation. The most promising sub-sectors were identified, utilizing the Target Identification tool and the PESTEL tool as a guide. Sub-sectors were filtered based on recommendations from the government bodies and that some sub-sectors were not ready or suitably organized to take on the eco-innovation project.

In addition to a basic desktop study of each sub-sector, expert interviews and consultations allowed for the sub-sectors to be chosen, as well as understanding the market. This was very useful in gaining insights into the market, as the desktop research was quite general, and the

implementation team was interested in more specific information. The short list of sub-sectors included: the tooling or precision engineering sub-sector; the stainless steel sub-sector, the foundry industry, the green cape cluster (renewable energy) and the general metals and engineering sub-sector.

The sub-sector bodies were approached to begin identifying potential companies that would be appropriate for the implementation of the pilot eco-innovation project. One of the conditions was for companies to have previously participated in some form of improvement practices or intervention programs to ensure better response, open mindedness to change and better implementation. The reason being, the sub-sector management were not willing to implement what they called an 'intervention' programme unless the companies had gone through basic benchmarking and improvement programmes. The eco-innovation programme was a 'reward' for those companies that had gone through their initial programmes for improvement.

Each sub-sector in South Africa has an industry association or cluster management group to represent them. To better understand the sub-sector, managers of each cluster body were approached for recommendation on the sub-sector to be the most relevant for the eco-innovation implementation project.

Through further investigation into the South African context, additional insights were gained into the sectors, markets and companies operating in the nation that could be targeted for the eco-innovation pilot programme. This portion of the "Prepare Phase" (UNEP manual, 2014) process focused on identifying trending challenges faced by companies, and thus assisted in detecting the potential gaps for eco-innovative solutions.

The strategy framework for the research procedure utilised the provided UNEP PESTEL tool from the Eco-Innovation Manual Instructions guide. The tool examines country, sector and market trends such as political, economic, social, technological, environmental and legal factors that may influence a company's strategy and success. Furthermore, the tool provided a comprehensive foundation for identifying sustainability risks and opportunities that may be used by the service providers for background research and justification while engaging with companies. This is elaborated more in the next chapter.

The methods applied in the data gathering process included:

- **Desktop Research:** Most the research undertaken for understanding the market phase was completed through desktop research. Government officials, industry heads and sector experts supplied documentation in the form of reports, articles and websites etc.
- **Open-ended Interviews:** Several interviews with industry association heads, government departments (e.g. environmental affairs and the green economy) and other experts were conducted to understand the market. (Refer to Appendix A1 for list of consulted experts).
- **Survey:** At the Eco-innovation information session and introductory workshop, attended by approximately twenty companies from the metals industry, two surveys were distributed. The first survey offered several qualitative questions and the second quantitative survey administrated was tailored towards the PESTEL tool.

The following PESTEL tool table provides a snapshot of examples and sources showing current trends affecting the Metals and Manufacturing industry in the Western Cape, South Africa. Further documentation and relevant resources will be listed in the appendix if additional resources are needed for reference.

Heading	**Description of issue/trend**	**Source of example**	**Time scale***	**Impact (High/ Medium/ Low)**
Political	National climate change policy to cap emissions growth. Include regulatory, fiscal and legislative standards to make tracking and reporting of emissions mandatory.	(Steiner, 2009, p. 8)	36+ months	High
	Given metals sector strong links with fixed investment cycle, it is a highly cyclical sector. Notably, the sharp slowdown during the 2008/9 recession. While rest of economy has begun to recover, slow recovery of	(Laubscher, 2011)	36+ months	High

Economic	metals sector is worrisome.			
Social	Lack of skilled labour joining and being recruited to the metals sector. Losing and lack of managers in the metals sector. Since 2012, 90,000 jobs lost in the metals sector. Broad Based Black Economic Empowerment (BBBEE) regulations BBBEE goal posts continually moving	Industry head interviews, surveys and documentation.	36+ months	High
Technological	Technological pitfalls are one of the primary components holding the metals sector back. Opportunities in the development of the Atlantis Green Technology Industrial Park. A hub to provide the best of facilities for knowledge, trainings etc for setting up renewable energy producing compnay	Interview with John McEwan. (Pwc, 2013)	36+ months	High
	Energy scarcity are pressuring companies to come up with more innovative ways to source power and increase efficiencies. As emissions increase globally and in South Africa, the environmental risks associated are becoming increasingly evident. This is forcing industries to address their emissions.	Interview with industry head of SASSD A Michel Basson.	36+ months	High

Environmental		(Report and Province, 2013)		
Legal	Labour laws continuously changing. New wage law, increasing minimum wage and conditions for workers in the metals industry. The need for companies to keep up with BBEE regulations.	(Gazette. Department of Labour, 2014)	36+ months	Medium-high

Table 3: PESTEL Analysis

*The time scales for all the issues being raised are estimated to affect the sector for over a 36-month period. This is supported by the qualitative survey distributed during the 27th May, 2015 Eco-Innovation workshop, in which all questions used a 3-year time scale as the team identified the issues as being medium-term (i.e. 3-5 years).

An Eco-Innovation workshop was held to introduce the project. There were over 120 industry CEO's and senior managers at the event, where we gave a presentation, and engaged with company CEO's who were interested in the programme. This event also allowed the team to select and invite twenty companies to the half-day eco-innovation workshop and information session which we planned to use to gain deeper insights into each company to select a final seven. The process was to follow the recommendations of the sub-sector managers, and be introduced to the CEO's before being engaged with them directly. The sub-sector managers had engaged with several CEO's on our behalf, and subsequently introduced us to 'promising companies' for the project – which we then also met individually.

Overall, 15% of the companies showed interest in knowing more about it and how they could integrate this model into their process. The networking event generated enough interest for the 15% of them to commit to the UNEP workshop to be held on 27th May, 2015.

A half-day workshop on Eco-Innovation was held on 27th May, 2015, Cape Town, South Africa. This was the first organized meeting of the twenty selected companies as part of the

selection process for the Prep phase of Eco-Innovation phase. It also provided the CEOs with an opportunity to understand the programme more in-depth, and understand the value of eco-innovation to their business. Most of the CEO's and CFO's of the companies were present, as well as the industry association managers.

After gaining an overview of the Eco-innovation implementation plan through presentation and brief note, company representatives from the metals sector of Western Cape were encouraged to provide insights during the workshop. This was used in the study to identify the opportunistic factors of innovation that the companies could use for their innovation strategy.

3.3.2. Survey

A real-time online survey tool was used at the Eco-Innovation workshop. The primary purpose of the tool was to gain an understanding of the perception of metals industry attendees pertaining to the political, economic, social, environmental and legal trends that may be affecting their business strategy and success. The secondary purpose was to provide a mirror for the CEO's to see how other company CEOs felt about the issues being raised.

With the target identification and understanding the market components being fulfilled, the team had already presented the eco-innovation process at two events. The first was a metals industry association gathering and the second was a service provider's organized event. Valuable and company specific information was gained from the workshop, as well as brief engagement with the CEO's. From this information and engagement of twenty companies, the team had a relatively good grasp on which five companies would be most suitable to implement the eco-innovation strategy.

3.4. Data collection

The five companies selected, embarked on the Eco-Innovation pilot program through several phases during the 12-month period. The program commenced with one-on-one meeting with CEOs and managers to understand their current business strategy and model. This phase in the Eco-Innovation project was to understand their perceived sustainability risks and opportunities. The next phase of the program was to develop and apply business model modelled after the eco-innovation strategy.

At this stage of the project, interviews were conducted based on the assumption that the CEOs selected for this interview would be more receptive to the questions and the new topic

of focus. During the 2 months of the project introduction, the cohort of companies that was used to choose from had a better cognisance of concepts such as “innovation”, “eco-innovation” and “sustainability” which enabled for an open-minded response to the interview questions.

The SMMEs that were selected for this research interview ranged from micro (1-5 employees) to the biggest (75-100) which were involved in different levels of innovation as described in the previous chapter. This diversity as described by Eisenhardt (1989), brings its own unique results and insights presenting new emergent theory that would be unbiased from the researcher’s point of view (Eisenhardt, 1989).

The questionnaire to collect data was designed in 2 phases to first set the construct for understanding the theme of the topic and then to introduce the concept based on experiential learning of the interviewee during the interview

3.4.1. Qualitative interview

The 5 companies selected from the UNEP program were requested for a one-one to further understand the business model and strategy. CEOs were then requested to give an additional time of 30 minutes for this research to deep dive into their current innovation capacity towards sustainability. This form of data collection was done through a one-one interview at their respective offices under the only condition that the CEO be the interviewee.

The first phase focused on understanding the challenges faced by the interviewee as a change maker on specific categories such as economic, environmental and social and then in general towards innovation. The discussion was open ended for the interviewee to understand the context better through reflective and exploratory approach. The assessment started off qualitatively as the subject of discussion was more suited to open ended answers to encourage thinking and to slowly align the conversation to the next phase of the specific to innovation factors.

The qualitative discussion was designed to follow an epistemological approach of the methodology through a mix of authoritative, logical and empirical knowledge as described by (Cohen, Manion and Morrison, 2007). The firms in the middle of the two innovation systems were involved in either generation or diffusion of innovation between the two systems and therefore, the empirical nature of the discussion was based on a positivistic interpretation. For this study, literature provided with the authoritative knowledge of innovation system while

the discussion with CEOs provided with an empirical data that allowed for a logical interpretation of the data and research question.

This phase was complemented with literature study and desktop research analysis from the previous survey to identify the factors of innovation which was then assessed further in the next phase of the interview. The qualitative approach was needed to help the interviewee contextualise the phenomenon of innovation as a subjective approach rather than making it objective and introducing bias to the research interview. As the existence of the firm became a part of the system of innovation even the CEO and firm were not aware of how the flux of knowledge between the systems was flowing. This allowed for an unbiased approach to data gathering in the context of subjectiveness that is innovation.

The focus of this phase was to help the interviewee differentiate between current conditions of innovation in their company from the opportunistic relationships already existing towards innovation. Questions were designed to probe discussion on a realistic approach of what they have been doing in terms of bringing a new project and leading to what they would like to do in the future in order to bring in a new project. While the focus of the CEO was on what they did not have to bring in a project, they were also encouraged to look at the opportunities available to them. An approach of a growth mind-set was encouraged in the discussion to not be blocked by problems they face but think open to what all they can do. This brought in a shift in discussion on possible outcomes of their existing or new relationship with the external environment to further add value to this research in terms of new untapped channels for innovation.

3.5 Reliability and Validity

Measuring reliability and validity is a contextual and multifaceted process depending on the methodology used in the research. Although, it is almost impossible to indicate complete reliability and validity (Cohen and Manion, 2011) in a qualitative form of research, attempt has been made to illustrate the purpose of it in this section.

The purpose of this research through the qualitative and quantitative approach was to understand a subjective phenomenon within a specific context and to help the interview elaborate on the identified points. The structure of the interview was two-phased to aid the interviewee into the subject through a hierarchical, reflective and unbiased approach to improve the response type. As the process of reliability in qualitative research suggests that the role of the researcher is not to determine causality, prediction or generalisation

(Golafshani, 2003), aim was to highlight the phenomenon of innovation and the dual nature of internal and external factors to extrapolate the findings to similar contexts.

As qualitative research has varying perspective on the field or context of study, the constraint of applying reliability and validity concepts to legitimize this study was acknowledged. Some researchers argue for reliability in qualitative research to be judged based on the ability to generate understanding by the reader (Stenbacka, 2001) and for this reason attempt was made to elaborate on the phenomena from a theoretical point in addition to the emergent analysis.

To maintain the consistency in the interview structure and open-ended responses, the interviewee was allowed to respond without any interference from the interviewer towards the requirement of the research question. A natural flow of conversation in phase 1 was allowed versus a more structured procedure in phase 2. The natures of the questions asked were categorical allowing for the classification of answers from the CEOs. Given the static context of the current scenario in the Metals and manufacturing industry in Western Cape, South Africa, the questions if asked to other non-participating companies, would have similar response. Therefore, the questions were carefully conceptualised and the companies chosen covered the spectrum of the industry to ensure an equal sample of companies in the industry.

Golafshani (2003) mentioned the need for unbiased approach from the researcher during interview and minimalistic interference, which was managed through the second phase of quantitative interview. To replicate the focus of research with other participants, a structured and quantitative interview pattern was established to help in the data interpretation detailed in the next chapter which would help in the consistency of responses. The CEOs were ensured that the data was anonymous to avoid the conflict of perfection in the self-assessment responses.

Validity in qualitative research has been argued to the point that there is no one definition to describe it but rather an understanding that details the process and intention of the research methodology (Winter, 2000). As Creswell and Miller note that validity is constructed by a researcher's contextual and subjective understanding of validity (Creswell and Miller, 2000), own method was developed to achieve validity through the rigour of data analysis process, discussed in the next chapter.

Keeping in line with the research methodology of multiple case study analysis described by Yin, it provided with a valid rigour to the analysis of data and the study as whole. Allowing the interviewee to elaborate on his understanding of innovation and the current relationship

with the outside ecosystem without interference allowed for the authentic response expected for this research. There was an epistemological approach to understanding the data that was analysed through interpretivism. The subjective nature of innovation and the understanding of it can vary among individuals especially for SMME's who are much more informal than the big companies. The purpose of the interviews was to gather tangible insights into their current methods of innovating and then engaged them to a discussion that challenged them to reflect broadly and deeply into their practice of innovation.

The purpose of the interview was to get a broader understanding of how the CEOs think and operate in their current situation to bring in new knowledge in the form of new work or knowledge (Davenport and Bibby, 1999) or process (Laforet and Tann, 2006) as it is known that SMMEs access new knowledge from different domains. The discussion was broadened to extract their understanding in other aspects of innovation that have been highlighted in literature such as marketing, supply chain, knowledge acquisition.

Further support of validity comes from my process of capturing data through audio recording and transcribing all interviews personally. This, in addition to the desktop research creates a better link between the theoretical background of the phenomena and the emergent data.

Bryman and Bell (2011) further added credibility, transferability, dependability and confirmability as different criteria to ascertain the "trustworthiness" of qualitative research especially in the case of data that stems from interviews which is the case in this study. Combinations of the 4 criteria form the conventional pillars for trustworthiness for qualitative methodology (Phillimore and Goodson, 2004).

The theoretical lens for this study was triangulated based on framework stemming from national and regional innovation system for external factors and firm level innovation, resource and knowledge based view of the firm for internal factors together with diffusion of innovation to understand the relation between the two as summarised in Table 1. The credibility of these seminal theoretical frameworks has been well established in their respective research areas.

In terms of dependability, the questions put forward to the CEO's were specific and at the same time allowed them the freedom to give a subjective viewpoint. Considering the context and research setting being around metals and manufacturing companies based in the Western Cape, South Africa, questions asked were categorical that would allow for relatively easy analysis of the answers. Only if the conditions in the business environment change, the same

questions might add further insight into the innovation factor which can then be analysed further. The same questions if asked within other industry domain would elicit specific answers that could be easily analysed and then categorised, therefore conceptualising the purpose of having a common framework of innovation for SMMEs being easily replicable in respective context.

To confirm the authenticity of the data gathered, 5 companies were shortlisted from 20 through a workshop on sustainability and which volunteered to be part of this research. This allowed for a random sampling; as suggested by Phillimore and Goodson, 2004, of the 20 companies who wanted to be part of this research. Mixed and cross-case study method was used to remove bias from one company and data from the 5 companies analysed together to identify common themes. The methodology was thoroughly reported in this study including the specific questions asked (Appendix B) to the CEOs and the quoted and relevant replies in Appendix C and D. The analysis was a single level interpretation of the quoted replies of the CEOs which was contextualised within the theoretical framework to give a unbiased conclusion.

3.6. Chapter Summary

The 5 companies selected through the preliminary research and interview were qualitatively assessed during the interview to not just highlight their current understanding of innovation but also to extract other points that have been highlighted in literature. During the 30-45 min interview, CEOs of the 5 companies were all asked the same question as a starting point, but were also allowed to elaborate their own understanding of the subject. Innovation being a subjective phenomenon with different elements associated, it was important to allow their own narrative of what they thought of innovation for their company. Working in the same industry of metals and engineering, the different narrative would be a balance of similar operations combined with diversity of marketing or supply chain that the company could exploit to gain competitive advantage.

The epistemological approach behind the interview was to allow for this broad thinking perceived in the field of innovation which can either be influenced by external pressure or emanate from internal capacity. The qualitative nature of the interview helped the study in diversifying the process of innovation across the 5 companies. This allowed the CEO to elaborate on their limited internal system and the much-detailed external system of their business.

The analysis of the data was through a cross-case study methodology to identify the unique factors from each company and then cluster them for a first level analysis. These factors together with literature formed the second level analysis to finally conclude the factors of innovation.

CHAPTER 4: RESULTS AND FINDINGS

4.1. Introduction

This study aims to identify the common factors of innovation between external and internal innovation system in which a SMME functions. The CEOs of the 5 firms that were interviewed for this research primarily operated in the business ecosystem in Western Cape and South Africa. The purpose and structure of the interview was to scope their understanding of innovation, its need for their firm strategy and the firm's position within the innovation system. This was then further directed to help CEOs extract how they interact with their external system of business to bring in new knowledge and to explain their current internal capacity. This was then further analysed together with literature and then translated to summarise the data for the key indicators of innovation. Key indicators identified in the internal and external system were further analysed to conclude the common factors that existed between the two systems.

As described in the previous chapter, the selection of the 5 firms was based on the data obtained from their involvement in the UNEP Eco-Innovation project. The CEOs were clear on the need for innovation and a sustainable strategy, but were unsure about the method of innovation and how to mitigate the risks before starting a new product or service development. The primary insight that emerged through the course of the interview was their understanding of innovation to be associated with only new product development, isolated thinking about innovation that it is generated internally and their fractured method of acquisition of new knowledge from outside of their firm. They however did acknowledge the importance of various factors identified and summarised in literature, how their firm interacted with the external factors on a need by need basis and the role of holistic approach on their internal structure towards product development. Although, they were unconsciously involved in all the factors that are identified through this research, they were not structured in their approach towards innovation and only ever used them in a case or project specific context.

The SMMEs participating in this research were well connected with the external ecosystem and aware of the changes in the business environment to make a strategic pivot for their business, but were not equipped to structure the internal system for this for various reasons. While the data analysis for this part was based on the open-ended discussion, literature and theoretical contextualisation was added to structure the analysis. Although the data emerging

from the interview were qualitative in nature, they were consistently connected with the current literature to identify factors of innovation for SMMEs.

The first phase focused on understanding the challenges faced by the interviewee as a change maker on specific categories such as economic, environmental and social and then in general for innovating themselves. The discussion was oriented to understand their current situation with respect to competition and steps taken to generate a new value through innovation. The interviewee was encouraged to assess his answers both quantitatively and qualitatively. The assessment started off qualitatively as the subject of discussion was more suited to open ended answers to encourage thinking and to slowly align the conversation to the next phase of the assessment specific to innovation. Wherever clarification was required, the interviewee was guided to answer as accurately as possible. References were used to explain the question succinctly.

To analyse their first-hand understanding of innovation and sustainability, the phase was structured to focus on the challenges their firm faced in the current ecosystem and how it interacts with it. This complemented the actual findings through supportive cases from literature wherein the change maker identified the need of innovation and sustainability. This helped in organising the discussion for the next phase to emphasize the need for innovation to become sustainable and how do they currently operate towards it. The data from the two phases of the interview was analysed to understand the various factors that firm can utilise for its future business to produce new products or services.

The multiple and cross case analysis was based on consistent questions with open ended answers. While some of the answers were consistent with literature, the qualitative assessment helped in extracting the niche factors that are effective for SMMEs. As described in the previous chapter, first and second order insights were generated to identify common themes emerging from analysis.

The data collated from the two phases and literature formed the first order of data that had the salient points from interviews with CEOs, sector heads and literature. The first order data then helped in identifying themes that had a common thread amongst the first order data. These themes were then further elaborated to identify the factors of innovation for SMMEs.

4.2. Data

4.2.1. Preliminary data

As described earlier, the pool of 20 firms that participated in the workshop went through a quantitative survey to understand their current issues impacting their business

- When asked, which political or legal factors had the biggest impact on their businesses success:
    - Labour laws (82%)
    - Environmental laws (9%)
    - Health and safety (0%)
    - Consumer laws (9%)
- When asked on a sliding scale from 1 (not likely)-10 (most likely) if they believed economic factors**,** such as exchange rate, interest rate and economic growth will have an impact on your businesses success:
    - 36% rated the issue as a ten and over 80% of the ratings were above a six on the scale.
- When asked which, social factors have the biggest impact on their businesses success, the metals industry heads rated:
    - Lack of skilled workers (45%)
    - Labour laws (36%)
    - Management issues (18%)
- When asked if they believed the metals sector in South Africa is technologically competitive in the global market
    - 45% reported yes they are.
    - 27% reported they were not sure.
    - 27% reported not they are not.
- When asked which, environmental factors have the biggest impact on their businesses success, the metals industry heads rated:
    - Raw materials (55%)
    - Energy cost (36%)
    - Water costs (0%)
    - Waste management (9%)

From this information and engagement of twenty companies, 5 companies were conclusively identified most suitable for this research. The selection was voluntary and there was no

financial or consulting benefit to the companies from this research. The participating companies were clearly explained the difference between this research and the UNEP project, and thereafter took their approval for interview.

4.2.2. Challenges on Innovation

As mentioned previously, the focus of this phase was to understand the current position of the firm within the ecosystem and get a first-hand analysis of the association of the firm with the ecosystem. The data on how the firm look at sustainability yielded diverse challenges and opportunities amongst the 5 companies but can be clustered as economic, social and environmental sustainable solutions. Innovation was commonly considered as a driver of economic sustainability while being complementary for social and environmental sustainable strategies.

Being an SMME, the CEOs of the firms acknowledged the constraint of finance as the biggest challenge to their future strategy and Innovation was widely understood as an expensive concept to introduce new products or processes within the firm. The ability to take risks although acknowledged to be necessary, was far greater for their small firm to experiment with on a new product or process, unless requested by the customer. However, the firms had introduced innovative changes in operations and management of personal to become leaner and efficient for delivering of service and product.

The preliminary data for the various challenges faced the firms is in the table below. The names of the companies are kept anonymous as per the agreement at the time of interview.

1. Rate your biggest challenge to innovation:

	Company 1	Company 2	Company 3	Company 4	Company 5
Economic	✔	✔			✔
Social			✔	✔	
Environmental					
Others					

Table 4: Challenges to Innovation

The above question was further detailed in the discussion to understand the factors that inhibit them from becoming innovative

Company 1	Company 2	Company 3	Company 4	Company 5
Economic challenges: *"being a small company, we only have access to projects that no one wants to do and which pays less. Access to funds from private and public is very difficult"*	Economic challenges: *"policies hit us hard as we sit between big and small size category. Don't have enough funds, bad debt and not enough customers. Lack of better machinery. No support from govt."*	Economic challenges: *"Cash flow is an issue for a growing company. No support from banks and IDC"*	Economic challenges: *"Cheap imports have made us almost redundant. Investing in new projects is expensive"*	Economic challenges: *"Operational cost is increasing every year. External Funding support is almost non-existent"*
Social challenges: *"training costs time and money. Cannot afford to train on new skills. Apprentices are hard to find and the good ones get poached"*	Social challenges: "*pool of employees is limited. Bright people don't want to join this kind of business"*	Social challenges: "*BBBEE. Unavailability of young skilled labour"*	Social challenges: *"No trained personal available. Workers take no pride and have no passion"*	Social challenges: *"Training new skills is hard. No one wants to get their hands dirty anymore"*
Challenges to innovation: *"Time and cash flow"*	Challenges to innovation: *"Limited access to funds for new product development.*	Challenges to innovation: *"No marketing team for searching new customers. Customers do*	Challenges to innovation: *"Limited finance and skilled personal"*	Challenges to innovation: *"No customer demand for new products"*

	No sure about customer needs"	*not like change, so no incentive to be innovative"*		

Table 5: Detailed challenges to Innovation

Key observations of this phase were as follows:

1. Finance was by far the biggest challenge for all the interviewees.
2. Funding of a new project was extremely difficult due to limited finances and prioritisation given to existing projects.
3. Tapping into a limited pool of skilled labour was a big social challenge. This affected the planning for product development and therefore discouraged firms from trying something new.
4. There was a clear desire to be innovative to become sustainable.
5. Innovation was however thought to be more of an isolated phenomenon than a systemic one.

The CEOs acknowledged that the above reasons were challenging but also an opportunity where innovation could help the company get around them. There was a unanimous agreement on the understanding of innovation and its need for new products for the market. While market was the key driver for their product/service development, they were all aware of companies such as Apple, Facebook, AirBnB, Uber to name a few that started from similar backgrounds but scaled exponentially on the back of a disruptive product coming out of innovation. It was clear from the analysis, that their understanding of innovation stemmed from a disruptive product and came from an internal R&D effort. This understanding of innovation inhibited them from trying out something new as they saw themselves incapable of such a big disruptive process.

One of the CEOs highlighted the hesitance in starting something new within the company without any market need. The same CEO quoted *"We do not have the cash flow of a large company where we can test new things and fail. We need to focus on short term revenue streams."*

The firms were inadvertently innovating in their internal process and their marketing approaches which although unstructured, were sustaining their business in the short term. The CEOs however agreed in principal that their innovative work would directly contribute to the knowledge base of their ecosystem which would not only help them in future but also other firms. This was more of an outward thinking without realising the benefits of new knowledge they could themselves acquire from different stakeholders.

Their institutional understanding of innovation was firmly rooted to developing new products which provided them with a disruptive strategy to introduce in the market. All the CEOs considered innovation as an important strategic driver for their company and related it to two intentions: enhance cash flow or reduce cost. Based on the two intentions, they widely accepted the need for innovation as a resource to remain competitive but were not clear on "how" to achieve it. Statements like *"We have lots of ideas but not sure how to implement them"," we have innovative products but not sure about market response"* indicated a clear need for a strategy on innovation for these firms.

It was concluded from the first phase that the firms had the "intention" but not the knowhow of either the process or factors of innovation to help them in the strategy for innovation. The firm and CEOs had the basic insights into the process with the right channels of engagement with the outside ecosystem but were hindered by the limitations of making internal changes to accommodate innovative processes. Internally all the employees were artisans with basic education and their lack of formalised education hindered their capacity to understand and work on innovative projects.

Other crucial insight from this phase was on their understanding of innovation. They understood the high level meaning of innovation, the need for it to become sustainable, while one firm even had the roadmap and budget allocation but did not know the process or framework to help them with. They were aware of the disruptive forces of innovation in other countries and industries but were fixated in the idea that innovation means new product which restricted their action on innovation and its various forms.

Due to this fixated idea of innovation, the following limitations of executing innovation driven proposals were listed by them:

1. Lack of funds:

They were all young companies in which their entire focus was on short term sustainability and to fulfil current orders they had. Due to this, they are unable to fund anything new as they found it cash intensive to buy new technology, train current employees or hire new ones and thus the reason for them not innovating.

2. Lack of time:

   For the reasons mentioned before, the limited overheads and their existing organisational structure did not allow them time to think and act on innovation. The only innovative action the firms undertook was in lean and procedural improvements to their current projects. They further explained that exploring new products, markets would require a major internal organisational restructuring based on the industry trends Their work schedule and internal work required high skilled and time consuming process that in its current form would not give them flexible time to explore other options.

   The other aspect of time constraint came from the customers who gave very conservative time targets and together with the limited human resource compounded the tight work schedule and leading to the cyclic work.

3. Lack of Skilled Labour:

   The industry cluster of tools manufacturing is a mix of product and service based industry and is heavily dependent on the artisan skill resource of the firm to manufacture standardized products and services. There was an inherent lack of skilled labour and apprentices to consolidate their firm's current product flow let alone developing new products. This affected their:

   a. Work time, resources and loss of workable revenue due to time spent on training.

   b. Attrition rate associated with training and employees moving elsewhere.

   c. Lack of formalised training limited the company to only take up projects in which the workers are trained for as current expertise was experiential and not platform or technology based.

4. Lack of customers:

Based on cross case analysis from the 5 firms, this was due to a lack of their marketing capacity and the limited size of their overheads. The company owners repeatedly mentioned their difficulties in finding new customers and new market. With market being one of the main anchor points of innovation, the gap in understanding the new requirements of the customer hindered them to translate it into action in their process. This is again linked to be a small company focusing on establishing its foundation by first fulfilling immediate job requirements from clients rather than actively go out seeking for new ones.

The challenges were integral for the CEO to understand the importance of innovation to solve them for the company to grow. Although the 5 companies all had similar challenges, it varied in impact on the business based on the external business environment i.e. market, customers and regulations.

Finance was by far the biggest challenge for all of them as being an SMME in which cash flow was of utmost priority affecting the growth of the company. This challenge had the biggest impact on their innovative work as it required majority of their time to be spent on looking for funds and managing the current project work of their clients.

4.2.3 Factors of Innovation

The second phase of the research interview was focused on the qualitative assessment to understand the factors of innovation that the firms were dependent on. As evident from the this phase, CEOs associated innovation with new product or process development and was the basis of discussion for this second phase to understand how they used the different factors available in the context to help them with starting on a new project.

This phase started with questions around their understanding of innovation and their current capacity in innovation as highlighted in the table below.

1. What does Innovation mean to you:

Company 1	**Company 2**	**Company 3**	**Company 4**	**Company 5**
"Something new and different"	"A new product sold in the market"	"New product or process"	"process to develop new products"	"New product"

Table 6: What does Innovation mean to you

CEOs were then asked about their understanding of innovation and in the context of how they innovated. One CEO said that "while they went out looking for work, the staff worked with them to identify problems and find solutions". Another CEO said "the marketing and delivery team worked with the field workers to design the product"

The table below highlights the understanding of the CEO on how they indulged in innovative activities.

Company 1	**Company 2**	**Company 3**	**Company 4**	**Company 5**
How do you innovate: *"Workers identify problem, I come up with solution"*	How do you innovate: *"I suggest ideas to client for approval. Once approved, I along with workers we implement it"*	How do you innovate: *"Can only innovate in process, so we get together in weekly meetings to brainstorm and identify pain points. Management then takes action accordingly"*	How do you innovate: *"We have a monthly meeting with supervisors of various departments to understand problem, solutions that can be generated internally or if urgent, we bring from outside"*	How do you innovate: *"I meet customers to understand their requirements and the changing field. We then discuss with the process engineers and design teams to understand how best to re-design or reduce costs"*

Table 7: Management of Innovation

Four of the five CEOs were primarily responsible for bringing in work while the one had a marketing team. Therefore, they were much more involved in building relationships with the external ecosystem to bring in new work and the subsequent knowledge (tangible and intangible) associated with it. One CEO travelled 80% of his working day to meet different customers and stakeholders to create new channels for his company"

All the CEOs were clear on the role of external and internal ecosystem to help their firm become innovative. As CEOs explained in their pursuit for work, they looked at creating new

network channels for acquisition of new knowledge that they did not have. When asked about their current strategy of being innovative through new projects, one CEO replied "*I am responsible for most of the new job, but my staff identify most of the problems and then we solve it together*" This showed the flexibility and team involvement at the firm level to have a better understanding of what the CEOs could bring in and their internal capacity.

Although, the CEOs were primarily tasked with finding new projects, as one CEO said "*We have to actively go out and meet other companies to see how we can service them. We need to be proactive in finding work*", they worked with their internal staff to work within their limits. The SMMEs already had a system of looking at their internal capacity to decide on the new knowledge to be acquired. While one CEO said, "*the new knowledge for us is in the form of new technologically advanced machinery*", most of the CEOs identified funding as the main driver of innovation to work on something new.

The factors concluded from this study indicate the reliance on external ecosystem for new knowledge and opportunities but indicates a limitation of the internal structure that is dominant in small firms. This limitation however inhibits the progress to innovative strategies and therefore corroborates the need for literature to pursue this angle of research on innovation.

4.2.4. External factors of Innovation

The SMMEs interviewed for this research were all motivated to develop an engineering ecosystem in Cape Town to help others gain from their knowledge, products and experience. One CEO was part of the industry trade association and worked actively to bring all of them together periodically to share ideas and strategies. They believed that to keep up with the global changes in technology and subsequent customer demands, the firms must rally together to share information generated in each firm with others to collectively grow as an industry and become sustainable. The firms in this research had an informal list of stakeholders they had previously interacted with at different times of their past work but was not formalised and structured enough to form a stable innovation based strategy but instead an ad hoc work dependent.

The CEOs highlighted several stakeholders and each of the purpose for their interaction. The discussion was around the question of how they interact with the external ecosystem and the reason for the relationship. This has been summarised in the table below:

Company 1	**Company 2**	**Company 3**	**Company 4**	**Company 5**
Who are your stakeholders for innovation?				
Other companies, government bodies, industry associations, universities	Licensing companies, government and suppliers	Client companies and suppliers	Customers, government clusters and suppliers	Wine industry, farmers and government
Why do you interact?				
For business, funding, raw material or anything they don't have internally	For funding, raw material and technology	For customers, new machines, funding and research	For customers, trained artisans, funding and	For customers, trained people and raw material
"I look for new customers constantly", "other companies to partner with", "New efficient machines"," Funding from government"	"We need consistent supply of raw material", "New efficient systems to manage machines and workers"	"We are constantly looking for customers and new materials", "We need research partnership with universities", "	"Our company needs funding from government", "Diversify customer base", "Skilled artisans", and "new machines"	"Need funding", "consistent supplies", "skilled people"
How do you get new projects?				
Tender, Marketing	Existing clients, word of mouth	Marketing, Trade shows, recommendations	Existing clients	Marketing
Where do you get trained workers for new projects?				
University	Other companies	University	University	Other companies, Recruiters
What is your source of new information or knowledge?				

Customers, cluster meetings and supplier	New customer request	Customers, Trade shows, Research articles	Other companies, customer, govt. regulations	Customers, Conference and cluster association
How can technology help you towards innovation?				
Ease process of manufacturing, save time, reduce manual error	Assist in manufacturing, bring in new projects, make employees more efficient	Make efficient design, new material and data analysis	Reduce time and manual error	Improve design and reduce time
What is your current use of technology?				
Machinery	Software	Software	Machine	Machine

Table 8: Background of Innovation understanding

Therefore, the extent of how they interacted with each other, with industry, government and market was key in keeping pace with the latest trends and changes in industry and market. One CEO said, “he reads an engineering tech magazine or article for 30 min every day to learn of new engineering technologies around the world to remain competitive”. Their relationship with the external ecosystem was built on their own internal family based value system, where customers were acquired through personal networking. Even though the SMMEs did not have a big enough budget for marketing, the CEOs primary role were to go and look for new customers which required them to interact with other companies, industry clusters, sector heads, government bodies, universities each with a need.

While interactions with clusters, sector head and government were for financial aid and collaborations, universities were for new knowledge and to leverage on their research potential. 3 of the 5 companies looked at universities as a source of skilled employees and were actively looking to work with the geographically nearest one. All the 5 companies were in collaboration with other firms to complement each other’s expertise to execute certain projects of complexity.

The firms had similar requirements from external interaction in terms of customers, finance, legal and labour; they were however diversified in the nature and level of interaction of their requirements. Their dependence on raw material highlighted an interesting relationship

mechanism with the external suppliers which although was influenced by the client needs, also allowed them the flexibility on the criteria of choosing the supplier. This flexibility allowed them to think innovative in the use of material, delivery, cost of the raw material to help them in reducing the cost of the product and increasing their profit margin. The impact was immense on the internal functioning of the firm and influenced the undertaking of any new project. Firms had to strategize on a new product development based on their existing, limited resources and supplies (tangible and intangible) which restricted their innovative advantage they could potentially have had.

The firms were highly dependent on technology for their daily work ranging from product design, project and operation management, market research and data analysis but were lacking in upgrading to a more efficient system or acquiring new technology due to reasons associated with cost, labour and space. While all the CEOs acknowledged the importance of technology and their dependence on it, they were in perpetual need of new information on latest technology and trends in their industry or others in different countries to be aware of any disruptive forces that could affect them. While they were under threat from cheaper imports, their strategy was inclining towards technologically advanced products which would be more difficult to replicate. The management of all the companies were strategic in their investment on new technology and favoured it to lean their operations and make the process more efficient. While the technology was available in the country, the firms in focus felt they were ill equipped to adopt it efficiently due to lack of skilled labour and the cost associated with training them. CEOs were constantly on the lookout for affordable technology and ways to integrate it within the company based on customer requirements.

The CEOs were self-motivated and driven to succeed in the business environment and had their own way of updating their knowledge and keeping up to date with the latest industry trends ranging from reading engineering articles, newsletters to formally training themselves through courses to attending workshops organised by industry cluster. All the 5 company CEOs exhibited a strong case of “wanting” to be innovative and contributing to the knowledge base of their industry to make it competitive internationally. They would interact closely with sector and government bodies for information on finance and regulation to help them in their strategic decisions for the future of the company and safeguard against unexpected failures and market fluctuations.

All the 5 CEOs were unanimous in their intention of interacting with the external ecosystem but were informal in most of the relationships that showed a clear need of structured approach before taking on a new project. Although, they had wide ranging list of stakeholders to tap into for their business needs, there was a lack of integration with their internal structure on how to adopt changes internally.

Based on the data obtained from the interviews, the various "reasons" of interacting with the external system for new project has been clustered in the table below. Based on the segmented response of each CEO, the clusters were further sub categorized to show a sampling of the answers from various interviews.

Factors	**Sub- factors**
Market	Customers Database of businesses
Technology	Machine, software and manufacturing material Process Technological transformation
Regulation	Business and labour laws Taxation
Network	Other companies (domestic and international) Government clusters Universities
Knowledge	Skills development Process development

Table 9: External Factors of Innovation

4.2.5. Internal factors of innovation

The firms, to introduce new process within the company had to make changes in the organisational structure to seamlessly adopt these external inputs. External inputs such as new process, technology, market or customer data and knowledge were relatively easy to acquire from their efficient relationship with the external agents of innovation, but the firms were left with a need for this integration and diffusion into the company to translate into a resource that enhanced the value of the firm's product or service. Although efficient with their current internal structure, the CEOs acknowledged that it was a more reactive approach based on customer request rather than a proactive one.

The table below summarises the internal capacity of each of the participating firms and what they most needed to adapt for their external input.

Company 1	**Company 2**	**Company 3**	**Company 4**	**Company 5**
What is your current internal capacity?				
"We have good artisans", "Good design skills"	"excellent facility but", "Good suppliers",	"Processes are in place", "Efficient design team", "Collaboration with other companies and Universities for research"	"Set client base", "Family business", "flexible operation"	"Good design skills", "Excellent relationship with customers"
What internal changes will you need to make your company more innovative?				
"Limited artisans in number if we get more work", "we will need to reskill existing or hire new ones", "market and technology demands are changing and we need to as well"	"Collaboration with other companies and universities on R&D", "Re-training of staff", "Constantly upgrading new advancements in the field"	"Training of staff on new tech", "managing customer feedback"	"Technological help for efficiency and design", "wider base of suppliers"	"Lean management and operations", "Diversify customer industry"
Who identifies and solves a problem?				
Floor workers and CEO together	Supervisors and Managers	Floor workers, managers and management team	Managers and Management	Managers and CEO
What are the biggest influencers for internal system of work?				

Market, other companies and suppliers	Customer, stakeholders, market and technology	Market and technology	Client and competitors	Customer and other companies
How do you keep your team updated with new information/knowledge?				
Customer, courses and workshops	Customer feedback and workshops	Certificate courses, customer meetings, conferences and team discussions	Reading and management workshops	Meeting customers and other companies
What internal factor do you have most control on?				
Raw material and process	Manufacturing process	Product design, raw material and process	Process and raw material	Process

Table 10: Internal capacity of SMME

The nature of the risk of business and unstable industrial ecosystem, firms were focusing on working on a service based model of manufacturing products based on customer request. All the 5 companies had migrated from their retail to a more safer service model. This was a direct effect of the unstable economic environment, cheaper imports and the future technological advancements of 3D printers. The CEOs acknowledged that they had to adapt to such changes and be more fluid in their approach with the external ecosystem but were unsure about the process. One CEO said, *"We have the internal knowhow of services machine parts, so can take advantage of this capacity for the service model of business".*

The CEOs were themselves the change makers in terms of strategic direction of the company which is the typical case for an SMME, and were often quick in their decision making for any changes required within the company. The entrepreneurial natures of the CEOs allowed them to be bold and take risks but were often held back due to the lack of finance to try things out and the uncertainty of the market to accept it. As repeatedly mentioned by them, they have lots of idea they would like to pursue, but their internal structure was ill-equipped both in terms of process and soft skills to support the testing of ideas. One CEO mentioned "I have

800 different ideas but do not have the financial and internal capacity to execute even 10 of them".

The current organizational culture of their firm was set up based on their limited offering adapted around customer needs. Being small and therefore a flat hierarchy theoretically helps in adoption of new knowledge, but a more systemic view of the change was often needed for a seamless integration especially for a SMME due to their limited funds and overheads. To create the right commercial value for the firm, the CEOs were proactive and flexible in re-organizing their firm structure through discussion meetings, training of employees, adapting operation system to accommodate new customer requirement which were the right foundation of doing innovation related work. While one CEO said, "*being in the service industry we are completely dependent on the needs of the customer",* another one said *"we are flexible and can take up number of projects based on our capacity"* But it was limited in the type of work they could offer and often were restricted from doing anything of their own other than customer related projects.

The CEOs interviewed for this research were all efficient in allowing for a conducive environment for their employees to learn new facets of the business, product or industry through courses or training, but it was considered as a static requirement of the company and not enough proactive efforts were put in place to encourage individual motivated approach to learning. The new learnings were often from the customer feedback and what their limited staff could understand. This limitation was emphasized by a CEO who said, *"Our workers have limited capacity so we can only afford to do a job around them"*. The CEO would often allocate funds and time for their employees to learn something new, but it was more of a training exercise than a self-motivated one for the employees.

CEOs of SMMEs were more hands on in their approach to work and would often work on the floor with their employees and train them based on their skill and experience. But this method of training was more reactive and imparted only when the client product or service needed it that could not be managed by the employees only. Therefore, the CEO was constantly sharing his knowledge with the employees to bring them up to the requirement for any new project. This gave an impression that it was sole responsibility of the CEO to keep updating his knowledge and then training his employees on a need basis.

One of the major inputs from the external system was the customer feedback that firms paid attention to. Their internal structure was all designed to cater to these customer requirements

and adapt accordingly. Again, this was a reactive course of action for the firm to only change their internal structure based on customer requirement. All the CEOs agreed that this course of action was primarily driven by the short term thinking and the cash flow and acknowledged to change it through innovation but were unclear on a right method of doing so.

The other major flux from the internal structure was on networking that influenced the level and purpose of it. The CEOs said that they always kept their internal capacity in mind when they went out to network with customers, government or universities. While each stakeholder had its own purpose for the firm, one CEO said, "*I only look to the university and government for new research*". Another CEO used university and government cluster bodies for training of their staff. This was also the case before the start of any new project which required an additional capacitation to their staff member. The CEOs were mindful of their internal capacity before networking.

While 3 firms interviewed for this research had less than 20 employees, their organogram was lot flatter than the other two, therefore could not involve employees much in the planning and execution of customer driven projects. The other 2 being much bigger had formalised a structure to discuss, plan and execute the projects emerging out of customer feedback. This execution was again through the same framework that the company were following for their other projects and did not involve exploration of new factors due to the risk and unverified nature of them. The CEOs admitted that exploration of new link and factors were important to keep up with the pace of industry and competition but were not sure about the approach to achieving it and relied on other firms to take lead on it.

Some of the CEOs emphasised on the knowledge of raw material and process of their operation as one of their main internal capacity as they felt it gave a competitive advantage over other firms. One of the CEOs said, *"our process of annealing metal structure is a unique method taught to our employees"* while other said, *"our raw material and process is a trade secret"*. This unique capacity had a direct impact on their service to customers and an innovative advantage.

All 5 CEOs were actively looking to make their internal operation more efficient and considered the digital transformation in many of their processes as the way to go ahead. While one CEO said, *"we want to digitize our payroll system to make it more transparent",*

while other said, *"we are monitoring the downtime of the machine using licensed software to make our worktime and workforce more efficient".*

The main findings of this section of the study was a lack of focus on internal structure to adoption of new changes but were instead dependent on the external factors to dictate it. All the firms were modelling themselves for short term growths by restraining themselves from retailing new products but instead working on service model. The internal infrastructure and training was moulded around the service based work that the CEOs could get through their network.

Factors	**Sub- factors**
Innovation Team	Floor workers Supervisors/Managers Management team
Market	Trends Different areas
Value Chain	Raw material Process
Technology	Digital transformation
Network	Other companies Government University
Knowledge	Staff capacity Customer feedback

Table 11: Internal Factors of Innovation

4.3. Findings

As mentioned earlier, 5 interviews were conducted to develop a case for each one of them. Through a cross case study analysis, I developed concepts, themes and dimensions from the data that stemmed from both interview as well as literature. The multiple cases were analysed to give common themes across all the cases that were combined with literature data to form a more condensed theme and cluster which were later proposed as factors of innovation.

The data from each case was configured with literature in a method that not only complemented the existing theories, but also gave a unique perspective of the same from an SMME point of view. This part of the analysis was crucial to create a right balance of using

literature based theories from big companies and complement with the insights from small firms.

The 1st order data emerged from the qualitative and quantitative assessment of CEO's interview and literature.

The qualitative data generated from the above information was analysed along with literature on innovation system (Musiolik, 2012, Lundvall, 2002, Malerba, 2005), how knowledge is diffused within the organisation (Rogers, 1995) and the view of the firm towards knowledge as a resource (Grant, 1996). Based on the analysis of 1st order data, themes were extracted from across different cases and clustered together based on similar outcomes.

2nd order data

- Barriers to business
    - Finance
    - Social
    - Environment
- Finance being the biggest barrier to innovation strategy.
    - The firm wants to innovate but are constrained by resources associated with finance.
- Social was their second biggest barrier
    - Availability of trained personal was a constraint
- Time is the next biggest barrier
    - CEOs and employees would like to spend time on new ideas, products, processes, but being a small company, most of their time is spent on fulfilling existing orders and looking for new business to maintain cash flow
- Innovation
    - Networking for new customers and knowledge
    - Supply chain management
    - Technology
    - Stakeholders for strong relationship to complement their requirement
    - Updating own and employee's knowledge base
    - Marketing through new channels

Galende and de Fuente identified information as an important differentiator for firms to remain competitive and the firms interviewed in this research corroborate the same.

The structure of the data is summarised as below:

Discussion + Literature	**Themes**
Intent to Innovate	Internal Structure
Training of employees	
Flat hierarchy	
Strategic flexibility	
Infrastructure	
Organizational resource	
Intent to innovate	New knowledge
Innovation elsewhere (other firm or country)	
Skills	
Funding	
Inadequate funding	Barriers to innovation
Restrictive culture	
Risk avoidance	
Time	
Financial constraint	
Interact with other firms	Networking
Interact with govt. bodies	
Universities for new tech research	
Suppliers	Supply chain
Raw material	
Supply chain	
Industry trend	Market
Customers	
Improve process	Technology
Reduce time	

Table 12: Data themes

4.3.1. Context of Findings

As described in the previous chapter, the 5 firms were selected from the UNEP Eco-Innovation pilot project where the purpose of integrating this research work with the UNEP project was to understand how Innovation could be one of the ways to achieve sustainability. 20 firms voluntarily participated in a Quantitative survey to understand the various factors affecting their current strategy and future success. This preliminary phase of the selective data collection helped in understanding the problems associated with the firms and the industry in general. This helped the research study to structure the research interview and focus on the current strategy of becoming sustainable while dissuading the CEO from falling into the trap of focusing on constraints of the firm as a catalyst for innovation.

The interviews were held in two phases for specific purpose:

Phase 1: The data obtained form this was qualitative in nature to get the open interview started and gather a thorough understanding of the CEOs knowledge on innovation, sustainability and the comparative study of the factors of innovation with literature. Although the data identified the reasons of innovation for the firm, it became apparent that it was built on the problems faced by the company from a finance point of view rather than the need to be sustainable. This phase was important to merge the emergent data with that of literature.

Phase 2: The data was more quantitative in nature to extract the understanding of their firm's relationship with the external ecosystem and how the internal structure is augmented to support existing or new product or service development. It gave a CEOs perspective on the different factors that they interact with for the firm's growth. The CEOs were asked about their past strategies on developing products/services and what the ideal strategy would be to grow their business without any constraints.

The data from both the phases of each firm was critically analysed to identify common themes which were then classified under 6 factors of innovation common between the external and internal factors. The identification of these 6 factors has the potential to help SMMEs structure their future sustainability strategy around innovation.

4.4. Conclusion

The findings of this study highlighting the understanding of innovation in 5 CEOs of SMMEs based in Western Cape. The SMMEs involved in labour intensive and dependent work were facing an increasing threat from cheaper imports and technology, and therefore needed a

more innovative approach to help them become sustainable. Although fragmented, their interactions with external factors of innovation were more structured than the adaptive ability of their internal structure, therefore forcing them to move towards a service based model of activity.

The firms were well established and reputed for their artisan tool making and were constantly looking out for new market opportunities but were hesitant in committing to anything new due to the cash intensive investment required for such novel work. Their main reason of being a service based company was a lack of understanding of innovation apart from a disruptive product that they considered as a unicorn approach.

Although the CEOs were quite clear on the need for innovation, their biggest concern was not knowing the correct method of innovation. They focused on isolated factors of innovation one at a time such as:

- Bringing in new technology or
- Identifying new market or
- Reducing time in process or
- Reducing costs with suppliers

Looking at the above points to innovate, they would often not look at other anchoring mechanisms to acquire and adapt within the company. Their inability to see the systems based innovation thinking made it more difficult for them to strategize long term as the isolated points were only a stop-go method. The fear of failure and constraints of cash flow and trained personal did not allow them to develop a core platform focus to build future products or services on.

While they were excellent in networking within South Africa, their network overseas wasn't very effective leading to a severe handicap in terms of learning from changing customer trends elsewhere. This boxed thinking did not prepare them to structure their internal system for any future changes coming from the external ecosystem. They were waiting for their customers to drive this internal change based on the work being inherited from them.

All the CEOs interviewed for this research spent 80% of their time on networking to bring in new work and were only looking for customers that their internal structure could support. Being limited in their offering had a huge effect on their long-term sustainability as they

could never drive their own product line which would allow them to display their innovation potential.

These reasons restrained the CEOs for being more innovative as they were unsure about having a standard framework of innovation that would work for a SMME like theirs as most of the innovation strategies are based on a larger budget and a dedicated R&D being present in the firm. Therefore, a distinct need for a unified framework of innovation for SMMEs was needed that would help them to structure their internal system based on an external stimulus to support them in their drive towards sustainability.

CHAPTER 5: CONCLUSION

5.1. Chapter Introduction

The chapter summarizes the findings from this study and recommends a framework of innovation for SMMEs that contributes to the current literature of innovation by focusing on the SMMEs.

Based on the research question driving this study of what are the factors of innovation common between external and internal system of innovation for an SMME, this study focused on 5 manufacturing companies based in Western Cape, South Africa. I interviewed the CEOs of the companies through an open discussion which was qualitative and quantitative in nature to understand their perspective of innovation.

The analysis of data was done to identify key points from qualitative approach, comparative analysis with literature and was then extrapolated further to pick out the common themes. Together with literature from innovation system, diffusion of innovation and knowledge based view of the firm, the data was analysed to identify unique factors of innovation for an SMME that has both a theoretical and practical implication for them.

5.2. Innovation

All the 5 CEOs interviewed for this research had an isolated understanding of what innovation is and saw it as a unicorn concept achieved only through technology, big budget and performed by R&D departments in firms. This disruptive concept of innovation was one of the main reason it inhibited them from getting into retail model and therefore continued in the service model to sustain their short-term future. They identified finance and social as their biggest barriers to innovation and were looking to increase cash flows to secure their firm's immediate future.

On further analysis of the discussion and comparative analysis of literature, it was deduced that all the firms were involved in some form of innovation in their internal process; whether to reduce time or reduce waste or just become more efficient. This was one of the main findings of this research that they had a very fragmented view of innovation and looked at it as a single phenomenon and not a system view. Their process of innovation was isolated in nature and was task oriented i.e. innovated only within the domain of customer project.

Although the CEO interacted well with the external ecosystem and was involved with different stakeholders, however it was only on a need basis driven by customer requirements.

Their actions were not pro-active in terms of bringing in new technology or knowledge due to the constraints of time and cash flow. The main reason for this was the inability of their internal system to adapt to any new changes that would be brought in from the outside.

5.2.1. External factors of Innovation

The firms interviewed for this study were based in Western Cape, were well connected in their business ecosystem and had a mutually benefiting relationship with their respective trade associations. This was mostly oriented towards the marketing side and such relationships were leveraged for bringing in work for the SMMEs. This type of work established a service model for the firms and therefore was unidirectional where the firms looked at the external ecosystem as a resource for potential project work.

All 5 firms had built working relationships with other firms (customer and suppliers), government, financial institutions and universities for their purpose but never had a systemic relationship working simultaneously. Literature from innovation system (Lundvall, 2002 and Malerba, 2005) theorise that innovation is based on factors such as above functioning together at the same time to create a new value. This was a key differentiator between literature and the firms interviewed here, primarily due to the nature of literature being based on big firms. This analysis was an important corroborative data that came up in this research as the aim was to devise a unique framework of innovation for SMMEs and not big firms.

The firms had a static relationship with universities for training purpose and looked at them for recruitment of potential employees. Although they acknowledged other factors of interaction such as joint research, outsourcing of product design, the firms did not see it as a viable concept. Their interaction with government and other firms was mostly oriented towards finance support and further business respectively. They saw other firms as direct competitors and did not have any collaboration or partnership with them to work on new products together.

New knowledge for firms in the form of new technology, new process and new market was acquired by the CEOs from their interactions with the external ecosystem and were constrained by their internal system not being able to support much of the new changes being brought in. This showed that although the access to new knowledge was not a problem, how to acquire, assimilate and create a value out it was their primary concern as they did not have a full view of the product development to market route.

The firms saw technology as a direct threat to their existence instead of an opportunity, as most of their work was dependent on human artistic approach and therefore saw any tech reducing time, replicate design and even manufacture the product as a competition. This showed their inability to look at new opportunities to get around this threat which can be related to a gap in their understanding of innovation and its various forms.

The analysis of the SMMEs interaction with the external ecosystem highlighted their inability to look at the external system as an opportunity to acquire new knowledge other than marketing. It was clear that this was due to their internal structure not being in place to support the adoption of new knowledge or product development request. It however justifies the purpose of this research to identify factors specific for SMMEs that they can use as an anchor for strategic decision making towards innovation. The framework has the potential to allow firms to consider the proposed factors in organising their internal system before introducing a new product or process.

5.2.2. Internal Factors of Innovation

The firms interviewed for this study ranged in size from 9 to 26 for four of them and 96 for another. The small size had a flat hierarchy system with all the employees reporting directly to the CEO who had a hands-on approach in their day to day working. This was possible only due to the nature of work being brought in by the CEO himself and not based on the internal capacity of the firm.

The internal structure had a distinct advantage over some of the bigger firms that they could quickly make changes to a product or process and not get caught in the administrative procedures. Working on a service based model, the companies were often given freedom to experiment with their own design and development unless recommended by the customer. This theoretically allowed for the firms to establish an innovation led culture but was not possible due to the cost dependence nature of experimentation and failures.

The CEOs were the only employee from their firms to learn innovative approaches in product development and process that hindered the adoption and diffusion of innovation within the company. Again, attributed to the restrictive time and cash flow that did not allow them to encourage employees to acquire new knowledge, it inhibited the firm from trying anything new as the employees would not be technically skilled and trained to carry out the project. The CEOs relied on government aided skills development program to bail them out with this

regard to help them remain technically skilled in comparison to their international competitors.

The infrastructure of the firms was basic with run down equipment that had to be serviced by themselves. This was their biggest challenge internally to try anything innovative as the current infrastructure was not efficient enough to give them a competitive edge in the international market. Therefore, all of them followed the service model to focus on their short-term existence. Again, their interaction with the external agents such as government and other firms was to help them with leasing, renting or buying them in subsidy. Although, this was a clear example of the firm adapting their internal structure to accommodate new equipment, it was not a process adopted by them but rather an isolated event.

CEOs acknowledged that they did not have the know-how of the process of innovation and what changes to introduce internally for them to acquire new product or process from the outside. Their organisational structure had the flexibility of trying new things but was very fragmented in terms of a structure that is required to manage the process of innovation from design to market.

The factors identified here would allow them to plan their process before hand and make the crucial adjustments internally in terms of employee training, equipment and process development to accommodate a new product request.

What you present above is a continuation of the previous chapter more ‘discussion’ without the evidence or the benefits of links to literature. That should have been presented in the previous chapter; this chapter is about what this means for your study and what you conclude from having conducted the actual research.

5.3. Implications of study

The purpose of this study was to identify the common factors of innovation specific to an SMME that they could use for their strategic decision making around innovation. The factors would be common to both internal and external factors that the firm needs to focus on before starting on a new project. Given the financial constraints of a small firm, this framework would save time and effort for a small firm and provide them with a process that is specific to a small firm.

The factors identified in literature are mostly based on the study carried out on big firms under the assumption of having a larger budget, more time to develop and a higher appetite to

failure. The literature focused on specific factors of the external and the internal ecosystem as separate focal points. This research aims to fill this gap in literature to see the common factors between the two.

While each factor identified here has been highlighted as individual focal points in literature, this study aims to propose them as a systemic one. The study takes into consideration the internal system and how it can be adapted through these factors to acquire new knowledge (soft or technology) from the external ecosystem.

The following graphic shows the various factors that were identified during this research:

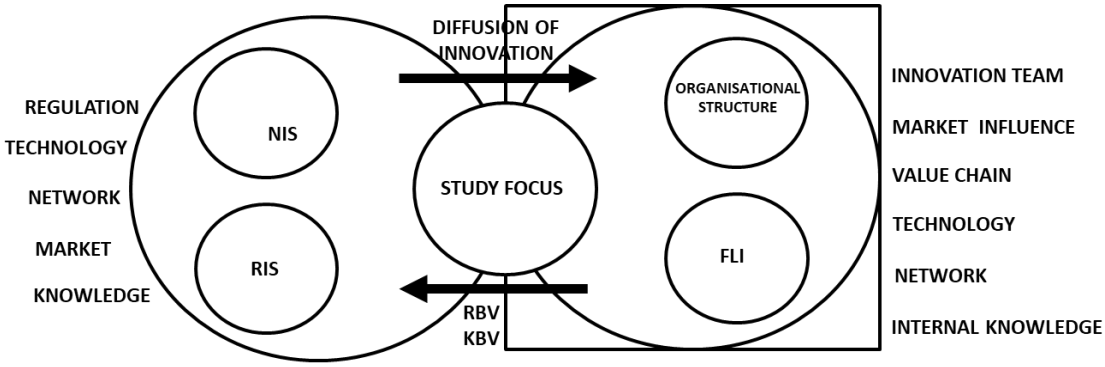

Figure 2: Factors of Innovation for a SMME

The following 6 factors emerged from these studies which are further used as recommendation. These factors emerged to be the common factors between the two systems. Factors that a firm form their internal point of view require in order bringing in new knowledge as well as the external system that influences the internal structure through diffusion of innovation.

- Innovation Team

  Given the constraints of the SMME in hiring employees and training them, the CEO was the only source of new knowledge for the company. Therefore, a team comprising of bench level workers, mid-level managers, management representative from the firm and a mentor from the external ecosystem to guide the strategy and project should be considered.
- Market

  One of the main factors for innovation is the market and customer needs. As the external business environment changes rapidly, firms need to adapt quicker and in

some way, even predict the next change. This requires a complete study of the past trends along with changes in other industry to be able to accurately predict the future. Therefore, they need to have a more global approach to market needs and be able to make quick changes within to adapt efficiently.

- Value chain

  Manufacturing industries contribute a high percent of GDP in any country and therefore their supply chain and sales need to be managed efficiently. This is an important factor for the internal system, as this is the only process that the manufacturer has an influence on by reducing cost, buying new materials having similar outcomes and delivering efficiently to their customer.

- Knowledge

  In this era of big data, learning and unlearning is an important asset for companies and none more so for service based firms such as the ones interviewed here. New information in the form of customer feedback, government regulations and business trends are crucial for a firm to acquire and diffuse internally. This soft skill does not require much capital and can easily be assimilated within firms to create economic value.

- Technology

  None of the firms in this study were efficient in technological transformation and saw it as a threat to their existence. Opportunities in digital transformation, data analysis, process operations, recycling and even raw material generation can add new value to them. Therefore, firms need to constantly look at acquiring new technology from other firms, industries and even universities to remain competitive.

- Network

  The firms interviewed here were very well networked with all the stakeholders, but it was fragmented and only utilised when needed. To take up innovative product or service development, firms needs to have a system based approach by considering the value of all the stakeholders simultaneously to provide the best possible solution.

The above 6 factors can be segmented as below

Factor of Innovation	**Segments**
Innovation team	• Bench workers • Mentors

	• Managers • C-executives
Market	• Trend • New market database • Marketing • Service • Exaptation
Value chain	• Raw materials • Process management • Supply chain • Sales
Technology	• Digital transformation • Process • Raw material • Analysis • Recycling
Network	• Other firms • Universities • Government bodies • Cluster
Knowledge	• Customer feedback • Business trends • Govt. regulations • Legal structure • Cross border interaction

Table 13: Factors of Innovation

5.4. Recommendations for future research

The study was carried out over a year with interviews scheduled with CEOs of 5 companies. Given the limitation of time and scope of the study, this research would need to be extended to more firms of different categories such as size and product or service development to give a more accurate estimation of the factors.

A research design including assessing the impact of the proposed factors over a project in each of the firm participating would provide a conceptual proof of the framework. It would also allow for a more deductive approach to the research work to identify further details of the factors.

An important extension of this research would be to study the interaction between each factor to highlight the importance of each and how it influences action within the firms. As firms have variable strength in each factor, how their factors relate with each other would provide a quantitative assessment leading to a more practical framework.

Further research on innovation in SMMEs independently has the potential of identifying a new category of innovation that is unique to small sized firms and therefore, research such as this would add value. As changes in external ecosystem prompt a reaction within firms, a temporal analysis of the interaction is required to understand the rate of diffusion of innovation within small firms. This would add tremendous value to policy makers at the national level to provide the right mechanisms for small firms and a more accurate provision of their needs.

A more accurate framework would provide practitioners with a tool to advise on innovation strategies for small firms irrespective of the financial constraint and thereby complementing policy makers with new strategic points. This kind of a framework can allow for flexibility of qualitative and quantitative approach of assessment to a firm's current operations as well as recommendations for future.

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APPENDIX

Appendix A: List of information sources for Desktop study

1. Desktop Study (National/ Regional Western Cape)
    a. National Development Plan
    b. National Framework for Sustainable Development (NFSD)
    c. National Grand Challenges (Find latest info on that)
    d. 10 Year Innovation Plan
    e. IPAP4
    f. National Innovation Survey
    g. OECD country reports on Innovation
    h. NCPC Framework
    i. ISTMA World Report
    j. Fridge Study
    k. OECD Metals Industry
    l. WTO
    m. World Bank
2. Regional Study
    a. Kholisa McKinsey Report
    b. Pwc – Metals and Engineering Sector Report
    c. Metals Sector reports
    d. Green Economy Report
    e. Growth Prospects DEDAT Report
    f. Economic Development Metals Sector Benchmarking Report
3. Expert Interviews & Sector Heads
    a. CEO, Green Cape (Evan Rice)
    b. Chief Director, Department Economic Development and Tourism (DEDAT) Nigel Gwynne-Evans
    c. Director, Metals and Engineering Sector, Marthinus van Schalkwyk
    d. CEO, John McEwan (WCTI)
    e. CEO, Michel Basson

Appendix B: Questions for interview

The data emerged from discussions to points such as:

1. First phase
    a. What are your challenges in?
        i. Finance
        ii. Social
        iii. Environment
    b. What are the different challenges in finance
    c. What are the different challenges in social
    d. What are the different challenges in environment
    e. Current understanding of Innovation
    f. How do you approach new product or process development?
    g. How can you become more innovative?
2. Phase 2:
    a. General questions
        i. What are your current challenges to become innovative?
        ii. How do you rate your firm in terms of innovation?
        iii. How do you rate yourself in innovation?
        iv. How does you firm adopt new changes?
        v. How do you innovate
        vi. How do they plan for new product or new process?
        vii. Duration of product ideation to product launch
        viii. Current capacity of product development
        ix. Current efforts towards innovation product, process or change
        x. Appetite for risk of new product or process
        xi. Innovation as a first level or second level management strategy?
        xii. Who are your stakeholders?

    b. External ecosystem
        i. What does external ecosystem mean to you?
        ii. What do you look for in the external ecosystem to help your firm?
        iii. What are the different factors that you currently use?
        iv. What are the factors you would like to use?

v. What is the benefit of each factor currently and for new product/process development?
vi. What are the main factors?
vii. Why do you interact with government bodies, other companies, universities for?
viii. How do you look for new project?
ix. How does your current internal structure affect your pursuit of innovative changes from the external system?

c. Internal Ecosystem
i. What does internal ecosystem mean to you?
ii. What are the different factors that you currently use?
iii. What are the factors you would like to use?
iv. What is the benefit of each factor currently and for new product/process development?
v. Which are the main factors?
vi. How do you restructure your internal system for new project or process?
vii. How do they adopt internally to changes in process?
viii. How do you adopt new information?

Appendix C: Challenges

Company 1	Company 2	Company 3	Company 4	Company 5
Economic challenges: *"being a small company, we only have access to projects that no wants to do which pays less. Access to funds from private and public is*	Economic challenges: *"policies hit us hard as we sit between big and small size category. Don't have enough funds, bad debt and not enough customers. Lack of better*	Economic challenges: *"Cash flow is an issue for a growing company. No support from banks and IDC"*	Economic challenges: *"Cheap imports have made us almost redundant. Investing in new projects is expensive"*	Economic challenges: *"Operational cost is increasing every year. External Funding support is almost non-existent"*

very difficult"	*machinery. No support from govt."*			
Social challenges: *"training costs time and money. Cannot afford to train on new skills. Apprentices are hard to find and the good ones get poached"*	Social challenges: "*pool of employees is limited. Bright people don't want to join this kind of business"*	Social challenges: "*BBBEE. Unavailability of young skilled labour"*	Social challenges: *"No trained personal available. Workers take no pride and have no passion"*	Social challenges: *"Training new skills is hard. No one wants to get their hands dirty anymore"*
Environmental challenges: *"Metal waste and oil discard is a big worry for us"*	Environmental challenges: *"Some of the chemicals we use is hazardous and we sometime are not sure about the risk"*	Environmental challenges: *"metal shavings and electricity consumption is our biggest worry. A lot of metal gets wasted during cutting. Also, contributes to the cost"*	Environmental challenges: *"any metal work will have waste but shortage of water and electricity is our big concern."*	Environmental challenges: *"shortage of water and electricity is our biggest concern. Chemicals used for metal cutters pose a big threat."*
Understanding of Innovation: *"Very important to keep growing. New products will open up*	Understanding of Innovation: *"New design of products, reducing process time"*	Understanding of Innovation: *"New products that improve efficiency and reduce work time"*	Understanding of Innovation: *"Essential for our survival. Need to be proactive in understanding*	Understanding of Innovation: *"New product development or improving the way we do things*

new market"			*customer needs, technological trends not just local but also international"*	*currently"*
How do you innovate: *"by reducing cost and using short-cut methods to reduce time"*	How do you innovate: *"by designing new internal operational process. as we are a service based company we are not allowed to change designs of products."*	How do you innovate: *"constantly changing design of components to make the machine system more efficient. Recycling waste metal"*	How do you innovate: *"digitizing operational process that reduced administrative time. New product experiments that are an improvement over customer specs."*	How do you innovate: *"New design for new products. Reducing time and cost"*
Challenges to innovation: *"Time and cash flow"*	Challenges to innovation: *"Limited access to funds for new product development. No sure about customer needs"*	Challenges to innovation: *"No marketing team for searching new customers. Customers do not like change, so no incentive to be innovative"*	Challenges to innovation: *"Limited finance and skilled personal"*	Challenges to innovation: *"No customer demand for new products"*

Appendix D: Data from each company towards factors of innovation

Company 1	**Company 2**	**Company 3**	**Company 4**	**Company 5**

How do you innovate: *"Workers identify problem, I come up with solution"*	How do you innovate: *"I suggest ideas to client for approval. Once approved, I along with workers we implement it"*	How do you innovate: *"Can only innovate in process, so we get together in weekly meetings to brainstorm and identify pain points. Management then takes action accordingly"*	How do you innovate: *"We have a monthly meeting with supervisors of various departments to understand problem, solutions that can be generated internally or if urgent, we bring from outside"*	How do you innovate: *"I meet customers to understand their requirements and the changing field. We then discuss with the process engineers and design teams to understand how best to re-design or reduce costs"*
What is external ecosystem to you: *"Customers, market opportunities, government bodies and banks"*	What is external ecosystem to you: *"Universities, customers and government agencies for funding"*	What is external ecosystem to you: *"Client, other companies and suppliers"*	What is external ecosystem to you: *"Market, suppliers and other companies"*	What is external ecosystem to you: *"Existing customers, potential customers and government funding agencies"*
Your requirements from external ecosystem? *"funding is the most*	Your requirements from external ecosystem? *"Financing options from government or*	Your requirements from external ecosystem? *"Other companies for*	Your requirements from external ecosystem? *"Market for new*	Your requirements from external ecosystem? *"Clients for business,*

important. Then customers and skilled apprentices"	*bank. Sector bodies for training and equipment and market for sales"*	*collaboration and supplies. Universities for research, technology and training"*	*opportunities, other companies for new technology government for funding and suppliers"*	*suppliers for raw materials and sector bodies for artisan training"*
Rate your need from external ecosystem: *"1. Customers, 2. Other companies and government bodies, 3. New tech or knowledge and 4. Suppliers"*	Rate your need from external ecosystem: *"1. Quality supplies, 2. Market for new business, 3. New technology for efficient process, 4. Other companies, government and universities for knowledge and finance"*	Rate your need from external ecosystem: *"1. New market for business sustainability, 2. New technology for diversifying business, 3. Quality suppliers, 4. New knowledge from different resources"*	Rate your need from external ecosystem: *"1. Other companies, 2. New technology, 3. Suppliers for raw material, 4. New knowledge and 5. New market"*	Rate your need from external ecosystem: *"1. Consistent supplier, 2. New technology for manufacturing, 3. New clients, 4. Industry trends and 5. Network"*
What is Internal ecosystem for you: *"My staff and equipment"*	What is Internal ecosystem for you: *"Employees, working conditions/culture, machine maintenance"*	What is Internal ecosystem for you: *"Employee morale and infrastructure"*	What is Internal ecosystem for you: *"Team dynamics, operations management and health and safety"*	What is Internal ecosystem for you: *"Equipment, employees and operations"*
Most important internal	Most important internal factors?	Most important internal	Most important internal	Most important internal factors?

factors? *"1. employees, 2. equipment"*	*"1. Employee performance, Machinery"*	factors? *"1. Employee conditions, 2. Infrastructure maintenance"*	factors? *"1. Employees, 2. Process, 3. Safety"*	*"1. Process, 2. Trained employees, 3. Management"*
How do you align internal structure for new product? *"Train employees, rent or buy equipment"*	How do you align internal structure for new product? *"change process, train staff and partner with other companies"*	How do you align internal structure for new product? *"Hire new employees, change processes, collaborate with companies"*	How do you align internal structure for new product? *"Retrain staff, partner with relevant organisations for training or process and buying new software"*	How do you align internal structure for new product? *"managing process and partnering with other companies"*