

**UNIVERSITY OF KWAZULU-NATAL**

**The development of engineers into entrepreneurs and business leaders in  
South Africa.**

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degree of Master of Business Administration**

**Graduate School of Business & Leadership College of Law and Management  
Studies**

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## DECLARATION

I ..... declare that:

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## Key Words

Engineer

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Entrepreneurial Orientation

Entrepreneurial Intention

Entrepreneurial Engineering

## **Abstract**

Over the years there has been a great emphasis on the study of the transition of engineers to managers across business. The emphasis has resulted to the fact that a great number of engineers find the transition from engineers to managers a lot easier as structures in organizations have been put in place to allow this transition to be seamless. With a high-growth potential entrepreneurial ventures in terms of their creative ideas when it comes technology in various disciplines, engineers have not effectively been developed and have somewhat been neglected by the academia in general. The aim of the study was to investigate the development of engineers into entrepreneurs and business leaders in South Africa. The failure of South Africa to rapidly develop engineers into entrepreneurs and business leaders can be seen as one of the drivers of entrepreneurial activities being significantly low in the country. Understanding the importance of entrepreneurial activities in any emerging economy it therefore should become a priority for the government. A probability sample of 220 engineers was drawn from the database of the National Society of Black Engineers-South Africa (NSBE-SA). Data was collected using a web-based questionnaire developed specifically for this study by the researcher, the questionnaire was also emailed to other participants. A salient feature of this study is that 71.82% of participants were interested in becoming entrepreneurs and out of those 51% were male participants compared to female participants with 21.82%. The main driving forces for the participants wanting to be entrepreneurs was the ability to own their time and financial freedom which come with one being an entrepreneur. Over 60% of the respondents indicated that their engineering qualification did not prepare them to be entrepreneurs, further to that 90% of the participants indicated that the engineering curriculum should pay much more attention to entrepreneurship. The study went on further to recommend a long-term strategy of developing an Engineering Entrepreneurship Program in collaboration with the institutions of higher learning in order to develop engineers into entrepreneurs and business leaders. This recommendation is in line with the triple helix model of innovation which was greatly explored in both the literature and the findings.

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## **CHAPTER ONE:**

### **OVERVIEW OF STUDY GENERAL INTRODUCTION**

#### **1.1 Introduction**

The structure of this chapter is such that it provides a brief background and the motivation of the study as well as the problem statement of the study. This chapter also presents the aim/purpose, research objectives, rationale of the study, research questions and the significance of the study. Furthermore, presented in this chapter is the summary of the research methodology, chapter outline and summary of what has been discussed in the chapter.

#### **1.2 Background to Study**

Over the years there has been a great emphasis on the study of the transition of engineers to managers across business. These studies have resulted in a great number of engineers finding the transition from engineers to managers a lot easier as structures in organizations have been put in place to allow this transition to be seamless. The studies and the structures put in place have primarily dealt with assisting engineers move into management position mostly within their space of expertise and not necessarily into multi discipline spheres of the organisation or business.

With a high-growth potential entrepreneurial ventures in terms of their creative ideas when it comes to technology in various disciplines, engineers have not effectively been developed and have somewhat been neglected by the academia in general. The development of engineers into business entrepreneurs and leaders is an area that has not had much focus on and as a result many engineers even though they possess the required skills to become entrepreneurs and business leaders have been trumped by their counterparts as their development has not been geared to leading the business. The focus of this study will be on the development of technical specialist into entrepreneurs and business leader focusing on engineers. The background and focus the study is fleetingly undertaken as a directive to provide a foundation for the problem statement and research objectives. The description of key concepts and the identification of focus areas as well as their significance is dealt with in great detail in Chapter 2 of this dissertation. Entrepreneurship and Business leadership will be discussed with an emphasis on engineers and their development into entrepreneurs and business leadership.

### **1.3 Motivation of study**

The failure and success of any emerging economy such as South Africa is heavily dependent on the success or failure of entrepreneurs (Minniti and Levesque, 2008). The heart of entrepreneurship as stated by Wang (2013) is wealth creation, it then follows that wealth creation generally leads to the growth of the economy. Entrepreneurial ventures according to Aloulou and Fayolle (2014) are the engines of change and growth for any economy, it is therefore fueled by the entrepreneurial attitude. The understanding of the correlations between economic growth and entrepreneurship as argued by West, Bamford and Marsden (2015) is viewed by many governments as a means of achieving economic vitality. This economic vitality is said to enhance innovation and prospective growth which according to West et al. (2015) will yield qualitative social improvement of the country in general.

With the above emphasis on entrepreneurial ventures being able to vitalise the economy, the South African government has since identified the development of small enterprises as well as venture capitals as an important driver in job creation and sustainable economic growth. The South African government in 2009 established a ministry that would deal with small businesses with the hope of driving the economic growth and job creation through the development of small enterprises. With the prevailing negative economic outlook of the country and the state of the markets in general the entrepreneurial activities in South Africa have declined and are generally lower in comparison to other developing nations. The contribution by South African entrepreneurs has declined from 35% of gross domestic product (GDP) in 2010 to 30% in 2017, this when compared to our BRICS counterparts such as India and Brazil who at approximately 60% (GEM, 2018).

### **1.4 Problem Statement**

The failure of emerging economies such as South Africa to rapidly develop engineers into entrepreneurs and business leaders has been highlighted by West et al. (2015). Although many studies have been conducted on the development of engineers into managers within the engineers' areas of expertise, (Lucas and Cooper, 2004; Zhao, Seibert and Hills, 2005; Wilson, Kickul, and Marlino, 2007; Borchers and Park, 2010), not much research has gone into the development of engineers into entrepreneurial and business leadership. The dearth of research in this area has a pronounced impact on the development of engineers into entrepreneurs, especially in view of the

fact that the failure and success of any emerging economy such as South Africa is heavily dependent on the success or failure of entrepreneurs (Minniti and Levesque, 2008). It is therefore against this background that this study sets out to investigate the development of engineers into entrepreneurs and business leaders in South Africa.

### **1.5 Purpose/ aims of the study**

The aim of the study is to investigate the development of engineers into entrepreneurs and business leaders in South Africa.

### **1.6 Research Objectives**

The objectives of the study are as follows:

- To establish the characteristics required to develop an entrepreneur and a business leader.
- To examine the entrepreneurial orientation of engineers in South Africa;
- To determine the driving factors of engineers becoming entrepreneurs and business leaders in South Africa;
- To identify challenges faced by engineering entrepreneurs as business leaders in South Africa.
- To recommend strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa

### **1.7 Rationale of the Study**

Understanding of the critical role that can be played by entrepreneurship in revitalizing the economy, especially in the creation of jobs and a sustainable economy, it is therefore significant to involve your most creative thinking and analytic professionals such as engineers into the entrepreneurial space.

### **1.8 Research Question**

**The study answers the following question/s**

- What characteristics are required to develop an entrepreneur and a business leader?
- What is the entrepreneurial orientation of engineers in South Africa?
- What are the driving factors of engineers becoming entrepreneurs and business leaders in South Africa?

- What are the challenges faced by engineering entrepreneurs as business leaders in South Africa?
- What are the strategies that can be recommended on how engineers can be developed into entrepreneurs and business leaders in South Africa?

### **1.9 Significance of Study**

The failure of South Africa to rapidly develop engineers into entrepreneurs and business leaders can be seen as one of the drivers of entrepreneurial activities being significantly low in the country. Understanding the importance of entrepreneurial activities in any emerging economy it therefore should become a priority for the government. The significance of this study will not only be beneficial to government but also to engineers who are aspiring entrepreneurs as well as the private sector. Aspiring engineers will be able to get a better understand on some of the challenges that there are likely to encounter in their quest of becoming entrepreneurs as well as insight on organizations that can assist in their quest to becoming successful entrepreneurs.

### **1.10 Chapter Outlines**

In this study, chapters will be organised as follows:

**Chapter 1** - Introduction of the research topic and outlining what has to be expected from the research. The chapter will introduce the study by providing background to the study followed by problem statement, objectives, questions, aims, significance of the study and the overall study structure.

**Chapter 2** - Literature review which provides in depth analysis and evaluation of current knowledge regarding research problems that this study tends to examine. Key sections discussed in this chapter includes engineers as entrepreneurs and business leaders, the definition and discussion of an entrepreneur, definition and discussion of entrepreneurship, entrepreneurial orientation, entrepreneurial intention, transitional leadership and triple helix model of innovation.

**Chapter 3** - The research design and research methodology will be outlined. This chapter provides the research design for the study. Key sections discussed in this chapter includes the research design, methods, sampling and sampling strategy, research instrument, pilot study, validity and reliability and ethical considerations

**Chapter 4** – The research outcome, discussion and interpretation of findings will be outlined in this chapter.

**Chapter 5** – The research summary, recommendations and conclusions based on the outcome of the study will be outlined. This section will also discuss the limitations of the study as well as recommendations for future study.

### **1.11 Summary**

The chapter outlined the introduction to the study, background thereto, research problem against the objective and the significance of the study. The chapter ends by outlining the structure of this thesis. The next chapter focuses on review of literature relevant to this quantitative study.

**CHAPTER TWO:**  
**ENGINEERS AS ENTREPRENEURS AND BUSINESS LEADERS**  
**LITERATURE REVIEW**

**2.1 Introduction**

The South African economy since 2008 has been in a dire state and has never recovered from the global economic meltdown experienced by the markets in 2008. The economy has continued to shed jobs and the current unemployment is said to be around 27.2% (STATS SA, 2018). Understanding the significant role played Small, Medium and Micro Enterprises (SMMEs) in emerging markets in terms of growth and job creation it is therefore important to actively create conducive environment for SMME to be established. This statement is supported by Maas and Herrington (2006) by advocating for the urgent need of entrepreneurs to startup businesses thus combating unemployment and contributing to the country's economy.

In the ever-growing competitiveness and business pressures of the emerging markets, engineers with entrepreneurial knowledge and skills are critical to ensure sustainable growth. Unfortunately, in many of the institutions in the country the current curriculum does not seem to expose engineers into entrepreneurial education. Due to their technical and analytical ability engineers with entrepreneurial skills and training are able to provide valuable contribution to managing multi-interdisciplinary team, problem solving and comprehending basic business principles.

As stated by Drejer (2016) constantly developing new products, processes or services and providing customers with an improved offering in one of the key competitive success factors in any business. This therefore implies that achieving business success requires the implementation of entrepreneurial orientation by the business leader or entrepreneur. In this chapter the study will investigate the development of engineers into entrepreneurs and determine how the dimensions of entrepreneurial orientation influence the development of engineers into entrepreneurs and business leader. The literature review will have seven main components which are: the definition of entrepreneur and entrepreneurship; contemporary models of entrepreneurship; Teaching of Entrepreneurship; entrepreneurial orientation and dimensions; entrepreneurial intention; engineers as entrepreneurs and transformational leadership. Defining key concepts used in the

literature review is imperative as it provides the required context for the reader as similar concepts maybe used in other studies in a different context.

## **2.2 Engineers as entrepreneurs and business leaders**

Forbes Magazine (2014) estimates that a remarkable 20% of the Fortune 500 company Chief Executive Officers (CEO) hold an engineering degree. However, this has not always been the case as up until the 1940's engineers had been in the forefront when it comes to business leadership with the likes of John Frank Stevens, Karl Benz, Thomas Edison, Henry Ford and Herbert Hoover amongst the most notable engineers who became great entrepreneurs and business leaders. After World War 2 there was an apparent shift with big business running the economy this saw a shift from industrial driven careers into careers driven by business. This shift resulted in engineers being replaced by professional business managers in their leadership positions. This change saw the mentality of engineers change towards leadership as this limited their role in decision making.

With great emphasis on entrepreneurship as a vehicle to transform economies around the world, there has been a need to reintroduce engineers into the spotlight of business leadership (Hechavarria and Reynolds, 2009). This reintroduction of engineers has been through engineering entrepreneurship which has gained a lot of attention in the recent years (Hechavarria and Reynolds, 2009) particularly in the developed economies. According to Dabbagh and Menasce (2006) one of the motivating factors regarding engineering entrepreneurship is the high potential growth associated with technology ventures. This drive particularly in western world saw a number of universities introducing entrepreneurship courses in the engineering curricula (Bilen, Kisenwether, Rzasa, and Wise, 2005; Creed, Suuberg, and Crawford, 2002; Nichols and Armstrong, 2003; Ohland, Frillman, Zhang and Miller, 2004; Standish, Kuon and Rice, 2002). This change was based on the premise that entrepreneurship can be taught using traditional teaching approaches (Borchers and Park, 2010).

Many studies have been conducted on the development of engineers into managers within the engineers' areas of expertise, (Lucas and Cooper, 2004; Zhao, Seibert and Hills, 2005; Wilson, Kickul, and Marlino, 2007; Borchers and Park, 2010), not much research has gone into the development of engineers into entrepreneurial and business leadership. As has already been alluded to in the previous chapter that there has not been extensive research done on engineers as entrepreneurs particularly in the developing nations and this study aims to add to that body of knowledge. According to (Borchers and Park, 2010) engineers by virtue of having formal education and having specific skills in their application of engineering expertise and knowledge

form part of what term knowledge economy. The combination of existing and new knowledge is basically the driving factor of innovation in the knowledge economy. Engineers have the ability to utilize their technical knowledge to contribute to the innovation space. This contribution by engineers with entrepreneurial intention and a high entrepreneurial orientation will advance the economic growth through entrepreneurship. Zhou, Yim and Tse (2005) affirms this assertion with their theory which says that entrepreneurial orientation highlights the spirit of creating new business out of on-going practices.

In line with the findings of Baron (2007) which indicate that individuals identify opportunities that others may not perceive because of their situational factors such as better access to information for a particular market. This finding backs the idea that through entrepreneurship engineers have the exclusive ability to contribute to economic growth due to the opportunities presented to them by virtue of the environment they are exposed to. This does not in anyway suggest that people who are not from an engineering background cannot realise engineering opportunities but rather engineers are more likely to realise these opportunities as they would have a better understanding of the market and any opportunities that can be exploited due to the gaps in the market offering. Esbach (2009) also suggests that engineers add a great amount of value to products in the economy and market because of their innovation channeling skills.

### **2.3 Entrepreneur**

Derived from the French verb “entreprendre” which means to undertake an idea. Kuratko and Hodgetts (2014) defines an entrepreneur as an individual who seeks for an opportunity to fulfill their needs by being innovative and starting a new business. This definition is supported by the description of an entrepreneur by Shelton and Darling (2011) as an individual who is innovative, a developer and is able to recognize opportunities that can be converted into workable ideas to add value. The two types entrepreneurs described by the Becker- McKinney model (1957) are Craftsman-Entrepreneur and the Opportunistic-Entrepreneur. The former having specialized technical education with low levels of confidence and flexibility. Conversely the later having advanced level of education with high degrees of flexibility and orientation (Smith, 1967). From this model Boulton, Hoy and Carland (1984) defines an entrepreneur as an individual who establishes a new venture and manages it with the goal to be profitable and to be successful. For the sake of this study this definition of an entrepreneur will be deemed sufficient.

## 2.4 Contemporary Models of Entrepreneurship

There have been a number of contemporary models of entrepreneurship. In one of the first efforts to explain what makes up an entrepreneur, Blake and Saleh (Clifford and Shaukry, 1992) combine personality factors, knowledge, managerial mechanisms and environmental forces in a schematic that traces out the entrepreneurial process. In this model, the entrepreneur begins a venture by coping with environmental change through three critical responses: 1) uncertainty management 2) knowledge filtering and 3) the exploitation of environmental change. What the individual does in this process is helped or hindered by personality characteristics that play a role in guiding the use of mechanisms to perform successfully. The idea is that a person's characteristics will encourage risk-taking or networking and co-ordination to bring about a successful launch. This process is initiated by certain occurrences or issues that exist in the environment. An opportunity is seen by the entrepreneur, perhaps as a result of environmental change, who then, through efforts of personality, uses a number of mechanisms such as innovations, or market attraction, to make things happen.

In the Entrepreneurial Model propounded by Ford, Churchill and Walker (1985) there are three classifications that reveal the entrepreneur: These include the historical roots of an individual which are said to be important in bringing him or her to the point of creating the new venture - this Historical Background which includes family, culture physiology, demographics, etc. establishes the values that guide individuals in life and make an important contribution to the entrepreneur. The Personal Elements of the individual (Motivation, Personality, Abilities, Skills) are critical in setting out to understand the entrepreneur and the effect organizational abilities might have on the process. Finally, there is the Outcome, which in fact becomes the process itself: entrepreneurship. In this model, Motivation is the operant condition that initiates the entrepreneurial process. It is the individual desire to build something, to gain recognition or to reach a particular end-state that kick-starts the push to a self-determined future. The new venture creator with a need for recognition and who is confident of his ability to perform will be very motivated. Fry (2002) has suggested that these variables do come together in an equation:

$$M = A_i \times T_i$$

Where M= Motivation

Ai = Antecedent variables (e.g. background, creativity, personality, experience, and education)

Ti = Triggering factors such as job loss, opportunity, idea, environmental change, etc.)

Fry incorporates a “Triggering event” as a component of motivation. The Antecedent Variables emphasize the roles that historical and personal variables play in defining the entrepreneur.

In examining technically-oriented entrepreneurs, Edwards (1991) lists three primary causes (a) independence, (b) challenge and (c) monetary reasons. Monetary causes tend to be low on the list as being critical to the high-tech entrepreneur. Freeser and Dugan (1989) have determined that four factors, distilled from eleven motivational elements, are able to set out the parameters that make up the motivation to become entrepreneurial: (a) feeling of frustration with the employer (b) desire to avoid working for others and be properly rewarded for one’s own efforts (c) drive for challenge and advancement (d) intense drive to do one’s own thing, to develop one’s own ideas.

## **2.5 Entrepreneurship**

Even though over the years there has been a great amount of interest in the subject of entrepreneurship it has been difficult to find one single definition due to the different definitions or descriptions coined by various authors over the years (Drucker, 1999), cited in Esbach (2014). Wood, Gadd and Falkenburg, (2014) defined entrepreneurship as the ability to channel creative innovations into ventures that have value, as well as the ability to create and sell new ideas and build new business ventures. Entrepreneurship as defined by Spinelli and Adams (2012) is the way thinking and acting that is opportunity based as well as holistic in approach and balancing it with leadership. This definition links with that one of Coulter (2013) who defines entrepreneurship as the process of pursuing an opportunity to create or add value through innovativeness and uniqueness. In layman’s term entrepreneurship is defined as the ability to start a business leading to self-employment (Joubert, 2017). With the many definitions advanced by various authors however to put it into the context of economic growth entrepreneurship is essentially about innovativeness and wealth creation.

## **2.6 Teaching of Entrepreneurship**

The field of “Teaching of Entrepreneurship” has been divided as to whether entrepreneurship can be taught or not (Gibb, 1986). Those who favor it as an independent academic discipline see it as

a distinctive, if not unique component of the free enterprise system. In this respect, it creates wealth, improves the productivity of a region, adds to employment, and offers a more exciting dimension to society. A second consideration is that entrepreneurship contains specific knowledge, concepts and theories that apply in a reasonable and consistent manner across the discipline. The search for an opportunity, the verification or viability of the opportunity and the language of financing are distinct and particular to entrepreneurship in its own right (Gibb, 1986). Those who do not favor an entrepreneurship discipline are becoming less vocal in their opposition than in the past. Entrepreneurship courses and programs are sprouting up in business and engineering colleges of esteemed universities. What does remain is the lingering argument that much of what is applied in the process of entrepreneurship includes material that overlaps in other courses. In the early days, a number of large universities claimed that the functions of management, planning, organizing, controlling are very much evident in entrepreneurship and need not be treated as a uniquely different discipline (Gibb, 1986). The debate did not recognize two critically important features of an entrepreneur: The role of creativity in entrepreneurship, whereby the new concept, invention and innovation that literally takes charge of the entrepreneur. Second, there is the vision that goes along with the new concept (Coulter, 2013). A final argument that the more conservative academics pursued was that, since a new venture cannot really be created in the classroom, the concept of entrepreneurship cannot be taught and that the “concept of starting one’s own business” does not require academic treatment (Gibb, 1986). However, teaching entrepreneurship offers the advantage of avoiding those errors and misjudgments made by individuals who ventured before (Dawson, 2012).

According to Kriewall and Mekems (2010) the academic propositions in teaching business to young people also apply in the teaching of entrepreneurship. The number of businesses created and the economic impact of entrepreneurship courses and programs at Stanford, MIT, University of Texas-Austin and other leading universities is testimony to the fact that entrepreneurship skills and know-how can be taught, and entrepreneurs can be nurtured through supporting programs in university-based incubators, entrepreneur associations and local business networks (Crawford, 2012)

## **2.7 Entrepreneurial Orientation and Dimensions**

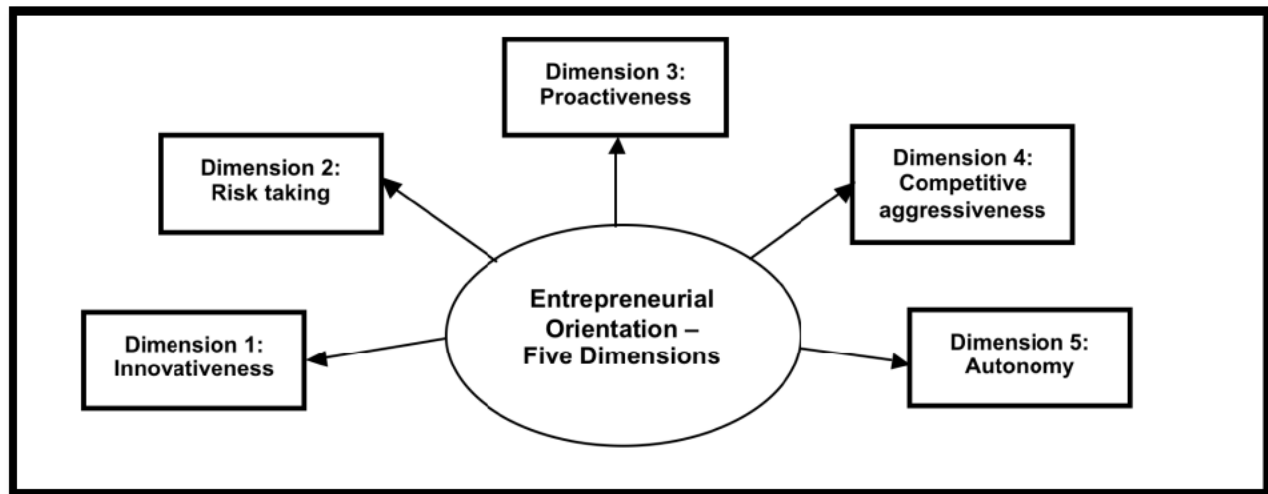
### **2.7.1 Entrepreneurial Orientation**

Entrepreneurial Orientation as defined by Lumpkin and Dess (2011) is the processes, practices, and decision-making activities which lead to the establishment of new start-ups. The intentions and actions of key players functioning in a dynamic process with the aim of creating new ventures is according to Domke-Damonte, Faulstich and Woodsen (2015) what describes entrepreneurial orientation. The policies and practices which provide the basis for entrepreneurship according to Rauch, Wiklund, Lumpkin and Frese (2013) is what entrepreneurial orientation. According to these authors the body of knowledge on the strategy-making process is where entrepreneurial orientation has its roots. Business leaders generally use entrepreneurial orientation as a strategy making process to implement and sustain the vision of their business or organization as well as to create a competitive advantage.

### **2.7.2 Entrepreneurial Orientation Dimensions**

The understanding of entrepreneurial orientation provides an indicator of the tendencies one may carry into the business environment. It further provides a greater understanding of the required behavioral ingenuities in the development of a new venture (West, Bamford and Marsden, 2012). Innovativeness, risk-taking and pro-activeness are the original three dimensions which are said to characterize entrepreneurial orientation (Miller, 1983). Rauch et al (2013) citing Lumpkin and Dess (2011), added two more dimensions to the original three which are autonomy and competitive aggressiveness. In this section these dimensions as illustrated in Figure 2.1 will be further elaborated on in the context of entrepreneurial orientation.

**Figure 2.1: Entrepreneurial Orientation Dimensions**



### **2.7.2.1 Innovativeness**

Innovativeness is described as the ability to develop creative solutions to mutual challenges arising in a particular business sector or environment (Darling, Gabrielsson and Seristö, 2007). Supporting creative processes that bring about new ideas and allowing the experimentation which may result in the formulation of new products, services or technologies is the reflection of the innovativeness by the business leader or entrepreneur (Lumpkin and Dess, 2011). Problem solving and creating solutions to needs of business describe innovativeness which is the core value of entrepreneurial behavior Caruana, Ewing and Ramaseshan (2012). The importance of innovativeness in business is that it allows the business to be ahead of the pack and be the first mover into that market space and allowing you to dominate that space provided there is a market for that product or service created. It is therefore imperative for one to be innovative in the entrepreneurial space and have innovativeness in one's entrepreneurial orientation dimension (Kuratko and Audretsch, 2012).

### **2.7.2.2 Risk-taking**

According to Dewett (2014), when there is uncertainty about the extent of a particular decision is the simple definition of the term risk. In terms of the conventional definition risk-taking refers to instantaneous explicit actions taken in moments of uncertainty (Tulloch and Lupton, 2013). In the world of business, the entrepreneur or the business leader must take into consideration a number of risks when making a decision such as financial implications and marketing implications. It is

safe to say that these decisions always have a risk element to them. From the above it can be said that business leaders are risk takers as they are faced with the task of decision making on a daily basis and these decisions have a great impact on the success of the company or the business venture.

Risk taking is inherently part of the life of any entrepreneur or business leader as if one is not willing to take risks then they would not be able to realise the opportunities emanating from the innovativeness of the business (Caruana, Ewing and Ramaseshan, 2012). Further to this Caruana et al. (2012) defines risk as an opportunity awaiting to be realised. In relation to entrepreneurial orientation dimensions' risk taking is the most imperative dimension based on its impact on the success of the business in comparison to other dimensions such as pro-activeness and innovativeness (Sharma and Dave, 2011). Although business leaders or entrepreneurs are expected to take risks on a daily basis often these are calculated risk as a result of a framework set out by the organization to assess these risks. These decisions taking frameworks must consider the reward available and identify the opportunities that can lead to greater success of the business. Often this can be achieved by proper market research as well as other entrepreneurial strategies and tools such as mathematical methods. In the words of Peter Drucker "Whenever you see a successful business, someone once made a courageous decision." These words by Peter Drucker epitomizes risk taking for any entrepreneur and business leader.

### **2.7.2.3 Pro-activeness**

The ability to anticipate and act on the markets future requirement is what Madsen (2012) refers to as pro-activeness. Being the first mover into a particular market allows one to be able to dominate all entry channels thus creating barriers to entry for new comers. Sharma and Dave (2011) emphasise on the point that businesses should strive to be leaders and not followers which is explained as pro-activeness. Sustainable businesses are those businesses that are pro-active and have innovative entrepreneurs who are risk takers (Madsen, 2012). Pro-activeness is further defined by Lumpkin and Dess (2011) as the implementation of change whilst analysing the future implication to ensure that the business is prepared for what awaits in the future. It is important for entrepreneurs to be pro-active as this enable them to identify and predict future trends and expectations of the market. This will better prepare them and thus enable them to reap maximum benefits from the anticipated changes in the market. Rauch et al. (2013) affirms that

innovativeness, risk-taking and pro-activeness as dimensions of entrepreneurial orientations must be applied concurrently in order for the entrepreneur to achieve the desired results

#### **2.7.2.4 Competitive aggressiveness**

Chang, Lin and Chen (2015) defines competitive aggressiveness as the measure and the ability of the entrepreneur to relate to competitors and respond to market demands. Competitive aggressiveness can be further explained as the competition for demand in the market space (Chang et al., 2015). This definition is very similar to that of pro-activeness and it is therefore imperative for one to clarify the fundamental differences between the two dimensions. Competitive aggressiveness is the ability to outperform the competition and being prepared for any eventual competition whereas pro-activeness is the ability to meet the future demands (Antonic and Hisrich, 2013). The entrepreneur's ability to think and act in unconventional way rather than relying on traditional methods of business reflects the competitive aggressiveness of the entrepreneur (Lumpkin and Dess, 2011). Competitive aggressiveness is utilized as a guide for the entrepreneur to achieve and maintain competitive advantage of the market share.

#### **2.7.2.5 Autonomy**

In the context of entrepreneurial orientation dimensions autonomy is defined by Lumpkin and Dess (2011) as the ability and willingness of an entrepreneur to work independently on an opportunity. Autonomy is further described as the pursuit of an opportunity with great determination by an individual creating new ideas, new ventures, visions and carrying it out to completion (Casillas and Morena, 2010). Autonomy as a dimension is regarded as the bases for innovation and entrepreneurial orientation and this creates autonomous leaders and generally creates better-quality decision making (Casillas and Morena, 2010). According to Dawson (2012) for an entrepreneur to be effective one needs to enjoy a high level of flexibility and autonomy in order for them to realise their full potential. Whilst the entrepreneur requires a high level of autonomy to be effective, it is equally important for the entrepreneur or business leader to be able delegate authority to their subordinates in order to give effect to autonomous decision making throughout the business. Allowing or giving subordinates or employees the autonomy to make decisions is likely to improve business success as well as employee's satisfaction, of course there must be checks and balances for this autonomy to eliminate undesired results (Dawson, 2012).

In conclusion on his research on the five dimensions of entrepreneurial orientation Knight (1997) indicates they should utilize as a guide to entrepreneurial and organisational success. When utilized effectively these dimensions are an imperative guide to the entrepreneurial business as they will ensure the business is firstly able to enter the market and secondly the business will be able to retain its competitive advantage in the market space. These dimensions should therefore be utilized as the fundamental bases when creating or improving business strategies to achieve business goals.

### **2.7.3 Entrepreneurial Intention**

Entrepreneurial intention is defined by Domke-Damonte et al (2015) as the precursor to entrepreneurial activity as without entrepreneurial interest one would have no drive to start a business. It is for this reason that Pownall and Lawson (2005) argues new venture creation or development is possible only when both the desirability and feasibility have been recognised by an individual and this leads to them being entrepreneurial. Following on the findings above in the interest of this study one can therefore deduce that no matter how high their entrepreneurial orientation, engineers without entrepreneurial intention will not become entrepreneurs.

Entrepreneurial orientation is a combination of individual and situational factors (Pownall and Lawson, 2005) and Baron and Ward (2004) added that entrepreneurial intention is derived from an intellectual point of view. This therefore means that entrepreneurs by their nature tend to view things differently from ordinary people and it is for this reason that they are able to identify the opportunities that others ordinarily wouldn't. This assertion is supported by Pownall and Lawson (2005) in saying that there is a relationship between conception of the desirability and the ventures feasibility in relation to the environment within which the entrepreneur finds themselves. Essential this suggests if one were to put two engineers with different cognitive point of views, they will most definitely act differently towards a similar opportunity presented to them. It is this cognitive ability that separates the two engineers where one will enter into the entrepreneurial space whilst the other does not, and this can be credited to situational factors. The author can therefore conclude by saying that this reasoning is supported by the literature above that identified entrepreneurial orientation as a situational factor that derives its influence from the environment in which the engineer is active in.

## **2.8 Environmental Factors Impacting New Venture Creation**

Gartner (2015) is of the view that given a satisfactory market opportunity, there are a number of environmental elements that must be in place to support a successful start-up. Gartner (2015) further lists five ingredients that are most important to successful venture creation. These five factors are: 1) Suitable financing, 2) Accessibility to helpful suppliers, 3) Government support, or at least the absence of obstacles, 4) Support of local population, 5) Low entry barriers. Each of the above factors is important, some of them may be more critical to one venture and not another, but all of them have a considerable role in ensuring new venture success.

Mokry (2013) suggests that in order to create a more receptive environment for entrepreneurship, a number of fundamental societal changes must occur. He supports the major truism that “local communities are the breeding ground of entrepreneurship” and are capable of creating an environment favorable to it. Mokry (2013) has added two factors to Gartner’s 5 factors that affect entrepreneurial success: 1) Existence of an entrepreneurial sub-culture. The tremendous success of Silicon Valley, Boston, Austin and San Diego very much support the notion that entrepreneurs feed off each other in a synergistic fashion and create their own dynamic environment. 2) Incubator organizations, many of which are initiated by local universities and governments as enterprise centers.

Studies by Wolfe, Adkins and Sherman (2010) have shown that universities serve as sources of new technologies that might be commercialized by incubator client firms and other regional start-ups. Universities can also provide other valuable services and unique resources to both the incubator, its clients and other regional start-ups such as (1) Faculty / technologist managerial or technical consulting on a pro bono or fee basis (2) Student interns and employees (3) Access to technical labs, facilities and equipment (4) Access to databases and researchers (5) Access to research and development financing through programs. Wolfe et al indicated that federal grant funding is greatly enhanced when incubator clients submit a joint proposal with a university or federal laboratory (6) Additional services and resources including patent knowledge, alumni who may act as advisors, business contacts and strategic alliance facilitators or investors, access to a far-flung network of laboratories and technical expertise, and access to investment by university foundations.

## **2.9 Transformational Leadership**

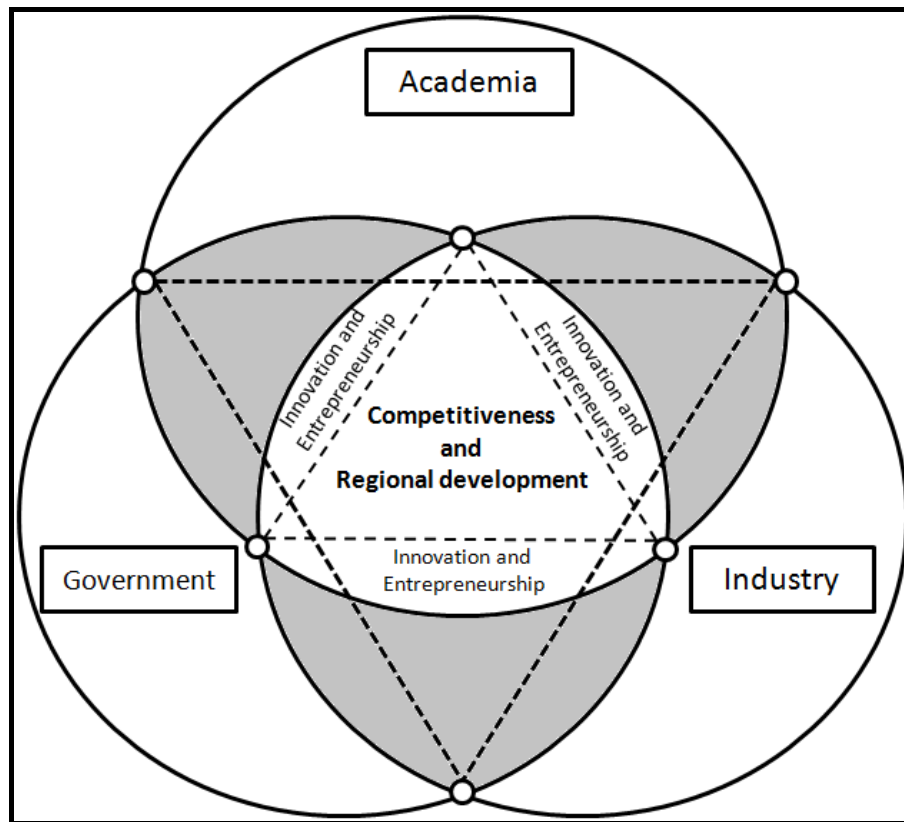
Leadership is the cornerstone of the success of any entrepreneur, leadership determines whether the entrepreneur succeeds or fails. The significance of business leadership is well expressed by the following reflection: “A good leader can make a success of a weak business plan, but a poor leader can ruin even the best plan.” For several years, there has always been an argument as to whether leaders are born or made. It is a widely-accepted phenomenon that leaders are made and shaped by varying various circumstances and experiences. The development of a leader can be attributed to continuous progression as an individual through education (both formal and informal), training, and the accretion of appropriate experience over the years (Bass and Bass, 2008). It is further argued by Jenkins (2013) that the fundamental basis of a greater leader is for one to possess strong character and selfless devotion to the organisation one is leading.

Often entrepreneurs are transforming an existing situation through their innovative idea and it is for this reason that the author is of the view that the leadership style that best suits entrepreneurs and business leaders is transformational leadership style as they are often disrupting the market and thus transforming it. Transformation leadership is defined by Lamb (2013) as a leader with qualities such as extroversion, confidence and values that are clearly stated and are able to motivate their followers. Charry (2012) concurs with this definition by indicating that transformational leaders motivate and inspire people, they focus on ensuring that each person is able to fulfil their potential. One of the traits associated with this style of leadership having high ethical and moral standards which are essential for any business leader (Charry, 2012).

## **2.10 Triple Helix Model of Innovation**

The interaction between government, academia and industry which fosters both social and economic development is referred to as the triple helix model of innovation (Etzkowitz and Leydesdorff, 2000). According to Etzkowitz and Leydesdorff (2000) the triple helix model of innovation has three components which are academia-industry interaction, government-academia interaction and government-academia interaction. This interaction is based on the fundamental roles that are to be played by each of the elements which are, academia is engaged in basic knowledge production and research, industries produce commercial goods and government playing the regulatory role of both academia and industry (Etzkowitz and Leydesdorff, 2000).

**Figure 2.2: Triple Helix Triangulation Model (Huahai, L., Xuping, Z., and Feng, Z., 2011).**



The triple helix model posits three spheres, overlapping and interacting freely, with each “taking the role of the other,” producing hybrid organizations such as the science park, spin-offs, university-run enterprises and the incubator from these interactions (Huahai et al. 2011). However, this model lacks precise indicators and measurement techniques. Field theory from physics has been used to develop a method for triple helix analysis that may serve as a base for future research on triple helix interactions (Zhou, 2001). Triple helix field theory depicts helices with an internal core and external field space (Figure 2.2). The model helps explain why the three spheres keep a relatively independent and distinct status, shows where interactions take place and explains why a dynamic triple helix can be formed with gradations between independence and interdependence; conflict and confluence of interest (Leydesdorff, 2011).

Cai (2013) criticizes the triple helix model contending that it is based on developed economies as the model takes for granted that knowledge intensive activities are linked to economic growth, that intellectual property rights will be protected, and that the state has a democratic and market-

oriented culture. Cai (2013) further contends that the model is not a relevant policy making tool for developing economies where at least one of these conditions is missing.

## **2.11 Summary**

To conclude, from the above literature review, it has provided insight on some of the key concept that are imperative to this study as well as provide the interpretation that will be adopted by this study given the fact that some concepts can often be interpreted differently based on the context of that particular study. The literature review started with the basic definition of an entrepreneur as this in the view of the author forms the basis of this study. Based on this study the basic definition of an entrepreneur advanced by the author is that of an individual who establishes a new venture and manages it with the goal to be profitable and to be successful. Once entrepreneur has been defined of course it became imperative to define the space in which that entrepreneur operates in which is entrepreneurship. The most widely accepted definition of entrepreneurship is the ability to start a business leading to self-employment through innovation and ultimately creating wealth.

Entrepreneurial orientation was identified as one of the key fundamental concepts in an entrepreneur being able to see of his or her idea. Entrepreneurial orientation has dimensions which are said to be independent variables that are interdependent in order for the success of the business. The literature indicates that these dimensions should be utilized when creating or improving a business strategy to achieve the business goals. Despite one having a high entrepreneurial orientation however without entrepreneurial intention the business venture will never see the day of light as entrepreneurial intention is described as the precursor into any entrepreneurial activity.

The literature suggests that engineers have all the attribute of becoming entrepreneurs due to their exposure into the knowledge economy. Since entrepreneurial orientation is a situational factor that influences the entrepreneurial intention, engineers have the ability to utilize their technical knowledge to contribute to the innovation space. Viewed by the author as the cornerstone of success for any entrepreneur, leadership can simply determine whether the entrepreneur succeeds or fails. Transformational leadership is the styled viewed by the author as one that is most fitting for an entrepreneur as they disrupt and transform the environment through their innovativeness. A leader with this style of leadership is said to have the ability to motivate their follower and

ensure that each individual fulfils their potential for the greater good of the collective. In conclusion it is the view of the author that the literature review conducted provided the kind of base required for the study. The literature review does provide an in-depth analysis of the key concepts and there for fulfils its primary objective of provide the context required for the study.

## **CHAPTER THREE:**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.1 Introduction**

Research design in this study implies the logical methodologies utilised in searching actualities and answers to questions to achieve legitimate, solid and reliable conclusions. Research can be viewed as a journey of revelation (Remenyi, 1996). This disclosure looks to discover clarifications for unexplained wonders and to clear up uncertain facts. An all-around defined research problem is an essential for any study and from there on an intelligent advancement of a research design pursues. Mouton (2001) characterizes research design as an arrangement or an outline of how one intends to conduct the research. Not at all like research methodology, research design centers around the rationale of research. Each research project requires a custom-made research design that will help address the research problem. Babbie and Mouton (2003) contend that a research design, from one viewpoint, is a structure framework of how one expects to conduct the research process to solve the research problem.

The quality of research is measured by the legitimacy and unwavering quality of results. Legitimacy alludes to how much an investigation estimates what it implies to quantify while unwavering quality is a gauge of the accuracy and inner consistency of an estimation instrument. Legitimacy and unwavering quality frequently endure when a researcher chooses perspectives and contentions that support individual perspectives, give deficient supporting proof and purposes for final conclusion and are prejudiced (Bless, Higson-Smith and Kagee, 2006). The researcher endeavoured to accomplish high legitimacy and unwavering quality by guaranteeing that the perspectives and contentions advanced by the respondents are precise in that the selected respondents comprised of randomly selected engineers around the country.

#### **3.2 The Research Design**

Research design as defined by (Sekaran and Bougie, 2013) is the strategy for the assimilation, measurement, and analysis of data, based on the research questions of the study. According to Babbie (2011) exploratory research design, explanatory research design and descriptive research design are the three dominant types of research designs which are used to conduct a research study.

Exploratory research design is explained by Barnham (2010) as a research design utilized for a research problem where there are few to no earlier studies to refer to in predicting a particular outcome. The emphasis of exploratory research is on gaining insights into, and familiarity of research problem. The main focus of exploratory research is intended to produce insights on the basic details, settings, and concerns of the research problem under study (Kothari & Gaurav, 2014). On the contrary analytical study which is also referred to as explanatory research as explained by Van Wyk (2012) is the identification of links between variables pertaining to a particular research problem.

### **3.3 Research Methodology**

The rationale for a research design is to plot and construct the research study so that the legitimacy of the research findings is enhanced through either limiting or where conceivable eliminate any potential errors. Legitimacy and dependability should complement each other as it is no use to utilise a dependable instrument with no legitimacy. Equally, an instrument with high legitimacy is pointless except if it can also be proved to be dependable. All through the whole research process including the data collection stage, the researcher endeavoured to limit errors and predisposition by assuring that the research sample is widely representative and that the views of the respondents were not influenced by the researcher.

For the purpose of this research project both qualitative and quantitative research methods detailed below have been utilised. As argued by Mouton (2006) using a mixed research method is not only possible and desirable but is regarded as one of the best ways to improve the quality of the research. The use of multiple data collection techniques will often ensure that the research obtains the required legitimacy and unwavering dependability. The legitimacy and dependability of the results is augmented by the use of multiple data collection methods.

#### **3.3.1 Quantitative approach**

Quantitative research includes the utilization of structured questions with predetermined response options, this research method involves a large number of respondents. Basically, quantitative research considers measurements, symbols, numbers and statistics in delineating key variables the data collection, its analysis as well data interpretation. As mentioned by Babooa (2008) measurements that are applied ought to be objective, quantitative and also statistically valid. A quantitative research approach can be separated into two classifications, to be specific, (a) studying

human beings and their behaviour by means of but not limited to survey and interviews (b) indirectly using computer simulated studies, statistics and secondary data (Mouton, 2006). It could be firmly contended that a quantitative research approach depends to a great extent on application of strict measurable techniques and also applications.

### **3.3.2 Qualitative approach**

Babooa, (2008) refers to qualitative research approach as one that involves the in depth understanding and analysis of the reasons which govern the participant's behaviour towards that particular subject. The fundamental difference to quantitative research is that qualitative research relies on the reasons that result into certain behaviours and certain experiences of the participants. This research method endeavours to explore the why and how when contrasted with what, where and when of the quantitative research method. A qualitative research approach additionally investigates the methods for social procedures, establishments, talks or connections and the centrality of implications that they create. Similarly, to quantitative research method, qualitative research method according to Mouton (2001) can be divided into two categories which are (a) the study of products of human behaviour, and (b) the study of human beings and their behaviour by means of interviews, case studies, field studies and as well as direct observation.

**Table 3.1: Advantages and Disadvantages of Qualitative and Quantitative Approach (Babooa, 2008)**

Approach	Quantitative approach	Qualitative approach
Advantages	<ul style="list-style-type: none"> <li>• Risks are sorted by their financial impact, assets by their financial value</li> <li>• The results can be expressed in a specific management terminology</li> <li>• The evaluation and the results are based on objective methods</li> <li>• Security level is better determined based on the three elements: availability, integrity and confidentiality</li> <li>• A cost-analysis can be implemented for choosing the best suited measures</li> <li>• Management performance can be closely watched</li> <li>• Data accuracy improves as the organization gains experience</li> </ul>	<ul style="list-style-type: none"> <li>• This approach makes easier to understand and observe the level of risk</li> <li>• Methods of calculation are simple to understand and implement</li> <li>• It is not necessary to quantify frequency occurrence of the threats</li> <li>• It is not necessary to determine the financial value of the assets</li> <li>• Monetary value of information is not determined, which makes the analysis process easier</li> <li>• Quantitative calculation of frequency and impact are not necessary</li> <li>• Estimated cost of the measure that should be implemented are not calculated</li> <li>• The most important areas of risk are evaluated</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>• The methods of calculation are complex</li> <li>• Without an automatic tool the process can be really difficult to implement</li> <li>• There are no standards and universally accepted information for implementing this method</li> <li>• The values of risk impacts are based on subjective opinions of people involved</li> <li>• The process handles a long time</li> <li>• The results are presented only in monetary values and are hard to understand by persons without experience</li> <li>• The process is very complex</li> </ul>	<ul style="list-style-type: none"> <li>• The evaluation of risk and its result are subjective</li> <li>• It is possible that the reality is not defined correctly because of the subjective perspective of the author</li> <li>• The performance of risk management are hard to follow because of their subjectivity</li> <li>• A cost benefit analysis is not implemented, only a subjective approach of the author and that makes difficult the implementation of controls</li> <li>• Insufficient differentiation between major risks</li> <li>• Results depend on the quality of risk management team</li> </ul>

Given the advantages and disadvantages the researcher as mentioned above for the purpose of this study a mixed research method has been utilised in a form of structured questions with predetermined response options as well as open ended questions which allow the researcher to understand in depth the reasons behind their behaviour towards entrepreneurship.

### **3.4 Target population**

According to Sekaran and Bougie (2013) an entire group of people and things that may be of interest to the researcher for investigation is referred to the population. In the case of this study the targeted population were engineers who are at different levels of their career. The database of the National Society of Black Engineers-South Africa (NSBE-SA) which the researcher utilized, has a membership which is approximately 500 members. Given the fact that the database of NSBE-SA is a representative of a variety of engineers and therefore the targeted population will produce credible and reliable results.

### **3.5 Sampling**

Random selection of a sample size is referred to as probability sampling and the sampling technique by which the selected sample is based on the researcher's subjective biasness is referred to as non-probability sampling. For the purpose of this study probability sampling technique 'Stratified technique' was utilized for the research. Rossi, Wright and Anderson (2013) state that "stratified sampling technique permits the researcher to subdivide the population into mutually exclusive and exhaustive subpopulations or strata. Within these strata, separate samples are selected, and sample estimates of stratum specific parameters calculated." In order to ensure all engineers are represented in the data collection process, the researcher used the Stratified Sampling Technique.

### **3.6 Sample Size**

The identification of this sample size further enabled the researcher to assign more time on the data analysis by looking at the contextual and theoretical perspectives. The sample size was selected after making use of the Sekaran and Bougie's list for selecting a sample size from a given population size (Sekaran and Bougie, 2014). Therefore, when using the Stratified Sampling Technique, the sample size was 220, thus achieving a 95% confidence level with a 5% error.

Research text has suggested that this confidence level is acceptable for the purpose of this study. Therefore 220 out of the target population of 500 members was selected as the sample size for the quantitative and qualitative study.

### **3.7 Data Collection**

An announcement to various engineering associations was made as a way of making fellow engineers aware of the intended research. The recruitment strategy itself was embedded on the selection of possible participants from the database of the National Society of Black Engineers-South Africa (NSBE-SA).

#### **3.7.1 Data Collection Instrument**

In the quest of collecting data for research purposes there is a plethora of data collection instruments which one can utilize. In relation to this study the researcher utilized a questionnaire as a data collection instrument. A questionnaire comprises of a list of research questions which are designed to extract specific information from the respondents based on the research objectives (Cooper and Schindler, 2014). The main advantage of in utilising a questionnaire is that it is reduces the variability, cost effective, easily administered and easy to analyse (Soobramoney, 2008).

Kothari (2014) asserts that dishonesty from the respondents in answering the questions in the questionnaire is the main disadvantage when utilizing this data collection instrument. This can happen for a variety of reasons, including social desirability bias and attempting to protect privacy. However, this dishonesty was negated by assuring the respondents that their confidentiality and anonymity will be valued and upheld at all times. Saunders (2009) also alludes to that another disadvantage with a questionnaire is that a person who is not the targeted respondent can complete questionnaires. This in turn poses the threat of misinterpretation as explanation would have been given only to the intended responded trouble with not presenting questions to users face-to-face is that each may have different interpretations of your questions (Saunders, 2009).

The research made use of a structured questionnaire containing both closed-ended and open-ended questions. Each of the closed ended question contained a set of answers that each participant was able to select their perceived response. As contended by Struwig and Stead (2013) that the construction of these questions allowed for each of the participants to make rapid

decisions. The open-ended questions were constructed such that they gave the participants the ability to elaborate on their response to provide the reasoning behind their behavior to the subject matter.

### **3.7.2 Questionnaire Construction**

The objectives of the study were arranged into categories and it follows that the questions were also arranged in the order of these categories. Dichotomous and Likert response scale type of questions were used. Dichotomous type of questions as defined by Cooper and Schindler (2014) are those with two possible responses, these types of questions are preferred as they provide a clear distinction of experiences, qualities and the opinion of the participants. The psychometric response scale referred to as Likert scale was used to obtain the participant's interval of agreeing with certain predetermined set of statements. The main advantage of this type of question is that they are easy to interpret as Saunders et al. (2014) conforms that they only measure a particular trait in nature.

### **3.7.3 Primary Data**

For this study, a questionnaire was used with randomly selected engineers from various sectors using the database of the NSBE-SA. It is asserted by Cooper and Schindler (2014) that a questionnaire must comprise of a list of questions which the researcher uses to ask participants, these questions are designed to extract specific information from the participant based on the main research questions. It is further highlighted by the Cooper and Schindler (2014) that the questionnaires are used for data collection, to ensure that the data is comparable and amenable for analysis, to ensure that questions are varied and engaging as well as to minimise an possible biasness during the formulation of the questions. The questionnaire was preferred as suitable for this study because it allows the researcher to conveniently conduct the data collection at a minimal cost and it is time saving. As stated by Soobramoney (2008) one of the main advantages of utilizing a questionnaire for data collection is that it will reduce the variability of responses and is easy to administer and analyze the data.

An online survey of the questionnaire was created using "eSurvey Creator", the link to the survey was emailed to all participants using the internal emailing system of NSBE-SA. The link for the online survey was also distributed via WhatsApp based on the cellphone numbers provided by NSBE-SA. In order to allow for maximum participation three weeks was provided for participants

to answer the questionnaire. To ensure that participants did not lose interest in the questionnaire, the survey was designed such that it does not consume the participants time and thus it was designed to be no longer than 15 minutes for the participant to complete. Upon completion of the survey, the results were automatically collated on to the 'eSurvey Creator' where the results were exported for analysis.

#### **3.7.4 Secondary Data**

Secondary data refers to work that has already been published. The source of secondary data includes journal publications, books, thesis, government documents and websites.

#### **3.8 Data Analysis**

Merriam and Tidsell (2015) argues that, "data analysis is a process of making sense out of the collected data." In analysing the collected data, the researcher used the decoding system. Once the data had been completed the results were exported from "eSurvey Creator" into both excel and Comma Separated Values (CSV) format. This format allowed for the data to be cleaned by removing any outliers found and some of the data that was incomplete. The researcher used the Statistical Package for the Social Science (SPSS) and NVIVO 12 data analysis tools with intent of ensuring accurate data for all the separate programs in terms of the information. SPSS was used to analyze the quantitative questions of the survey and NVIVO 12 was used to analyze qualitative questions of the survey.

#### **3.9 Validity**

The extent to which the research design and the instruments utilized effectively measure the research area is referred to as the validity of the research. For one to consider a particular research or study to be valid, the methodology and the instruments utilized to conduct the research ought to accompaniment the objectives being tested. In order for the research to produce high quality results, the researcher ensured that the research is valid. According to Creswell (2014) a research must achieve three types of validity for it to be valid which are: Criterion, Content and Construct validity.

The ability of the questionnaire to answer the research questions is referred to as Content validity, this was achieved by adapting the questionnaire from previous research with results that were

deemed reliable and valid. In order for the research to be valid, the constructs of the research must represent the research topic, and this is referred to Construct validity. Utilizing literature review findings to develop the questionnaire is the way in which this research achieved Construct validity. The research did make use of questions by other researchers with similar topics however these questions were adapted to be specific to the research topic of this study.

### 3.10 Reliability

According to Blumer, Cooper and Schindler (2005) there are three types of reliability: Equivalence, stability and internal consistency. However, the most common type is internal consistency which is the one that was utilised for this research, which according to Saunder, Lewis and Thornhill (2013) is the ability even under different circumstances for a questionnaire used for the research to produce the same results. This definition according Saunders, et al (2013) also includes the interpretation and analysis of the findings as well as some various circumstances which the survey was under taken.

By comparing the responses of questions in the questionnaire to each other allowed the researcher to reach internal consistency. The internal consistency of the questions was tested by using Cronbach’s Alpha test. For the internal consistency to be deemed highly reliable the Cronbach Alpha’s test must achieve a score of at least 0.7, for this questionnaire a score of 0.805 was achieved hence the questionnaire was deemed to have Cronbach’s alpha was used to test internal consistency of the questions. According to the Cronbach Alpha’s test for internal consistency, a score above 0.7 is considered highly reliable. The Cronbach Alpha score for this questionnaire was 0.805. Hence the questions are considered highly reliable.

**Table 3.2: Cronbach Alpha Test**

<b>Reliability Statistics</b>		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.805	0.685	150

### **3.11 Ethical Consideration**

In any type of research ethical consideration is paramount, this as ethics are the standards or guidelines for conduct that differentiates between right and wrong. In essence ethics assist in the determination of the contrast between behaviors that are acceptable and those that are unacceptable. Ethical benchmarks avoid against the manufacture or adulterating of information and hence, advance the quest for knowledge and truth which is the essential objective of research. Ethical conduct fosters an environment of mutual respect, trust and accountability amongst researchers. When conducting any research public sentiment is of paramount and therefore it is important for the researcher to uphold high ethical standards as this will allow for the public to actually believe in their research. The general population needs to be assured that the researcher complied with the required guidelines and conducted the research within the ambient of the law.

The integrity of the research project is greatly affected by how ethical issues are handled hence why the researcher obtained the required ethical clearance from the Ethics Committee of the University of KwaZulu Natal prior to undertaking any data collection from the randomly selected participants. The ethical clearance serves as proof of the researchers undertaking to ensuring that the research was conducted in an ethical manner and is of high quality and integrity. The researcher was given consent by the participants and the anonymity and confidentiality of each participant was respected at all times.

### **3.12 Chapter Summary**

The purpose of this chapter was to set out the research methodology utilized to conduct the research from its expansive plan to methodologies and strategies. The procedure of instrument selection, the data collection and the data analysis were extensively discussed. The research methodology utilized for the research ensured that the research yielded accurate, reliable and valid results to meet the requirements as set out by the program. The chapter went on to further discuss the ethical consideration considered for the research so as to ensure the integrity of the research. In the following chapter the results and analysis of the data will be presented in line with the research objectives that were set out in Chapter 1.

## CHAPTER FOUR

### PRESENTATION OF RESULTS ANALYSIS AND DISCUSSION

#### 4.1 Introduction

The purpose of this Chapter is to articulate and present the results of the survey conducted, these results will be used to present the key findings of the research to NSBE-SA and other stakeholders in the fraternity to assist in their effort to develop entrepreneurs. A broad description of the sample will be provided which will include the population size, demographic statistics such as age, gender, race, qualification, management level and location. This raw data and primary information are presented in the form of tables, pie graphs, bar graphs and histograms. The descriptively analysed data for the standard deviation, variance and mean were subjected to the Cronbach Alpha test to confirm the reliability of the study. The results will be presented in respect of each of the five research objectives and discussion in relation to the implications of the results to each objective will also be presented.

#### 4.2 Results Presentation and Analysis

The results will initially be presented in and accordance to the Section of the questionnaire and thereafter the discussion will be done according to each objective. The questionnaire was separated into five section that seek to address each of the research objectives. The sections are **Section A:** is the personal data and demographics of the respondent. **Section B:** Seeks to establish the development of engineers into a business leader. **Section C:** Seeks to establish the characteristics required to develop an entrepreneur and examine the entrepreneurial orientation of engineers. **Section D:** Seeks to determine the driving factors of engineers becoming entrepreneurs and business leaders in South Africa. **Section E:** Recommendations and Strategies. As mentioned previously the quantitative (close ended questions) and the qualitative (open ended questions) data were analysed using SPSS v25 and NVIVO 12 Pro respectively.

##### 4.2.1 Section A: Personal data and demographics of the respondent

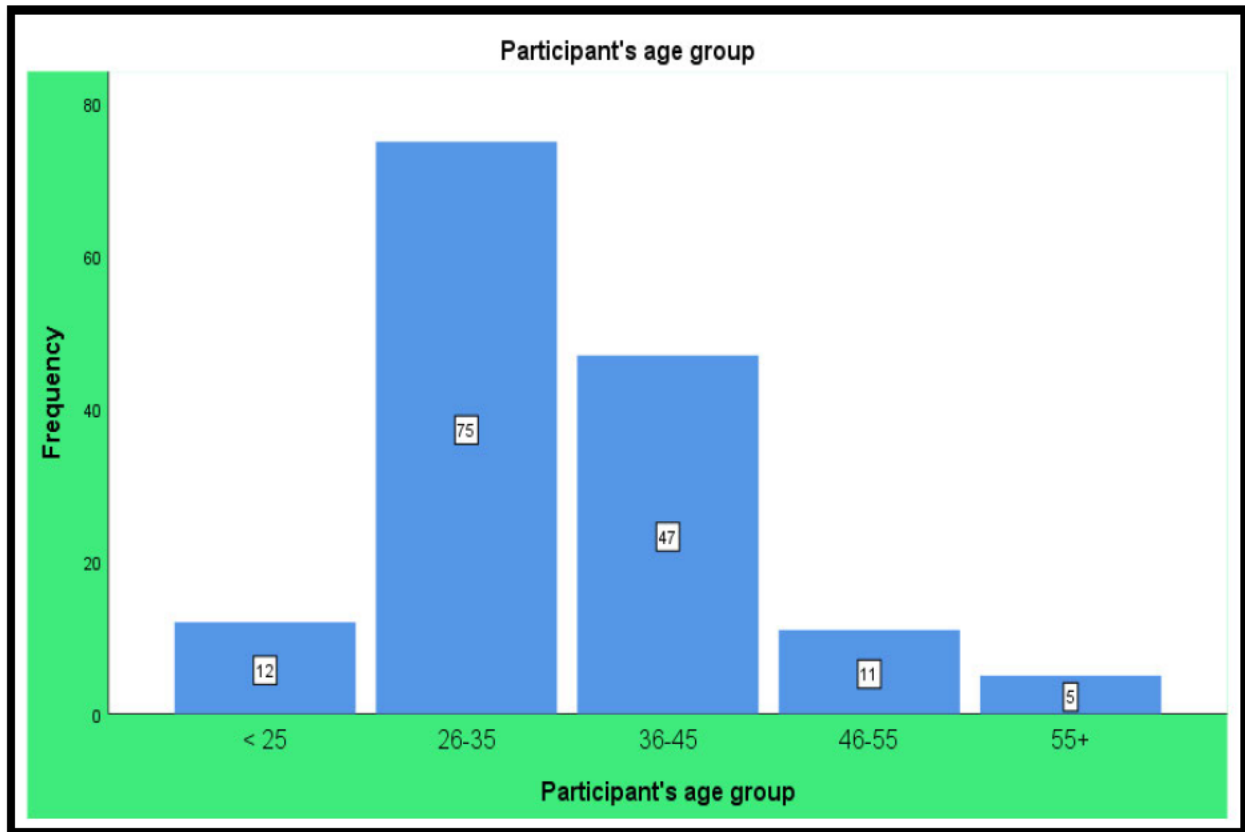
The section sought to present the general information on the participants involved in the study with regards to the age group, gender, engineering branch studied, industry sector and the current location. The demographic information points at the participant's suitability in providing some

answers on the investigating the development of engineers into entrepreneurs and the entrepreneurial orientation of engineers in South Africa.

#### 4.2.2 Age Distribution

From the Figure 4.1, the findings indicated that majority of participating engineers were aged 26-35 with 50 % and the smallest number were those aged 55+ with 3.3 % and others share the other 46.7 %.

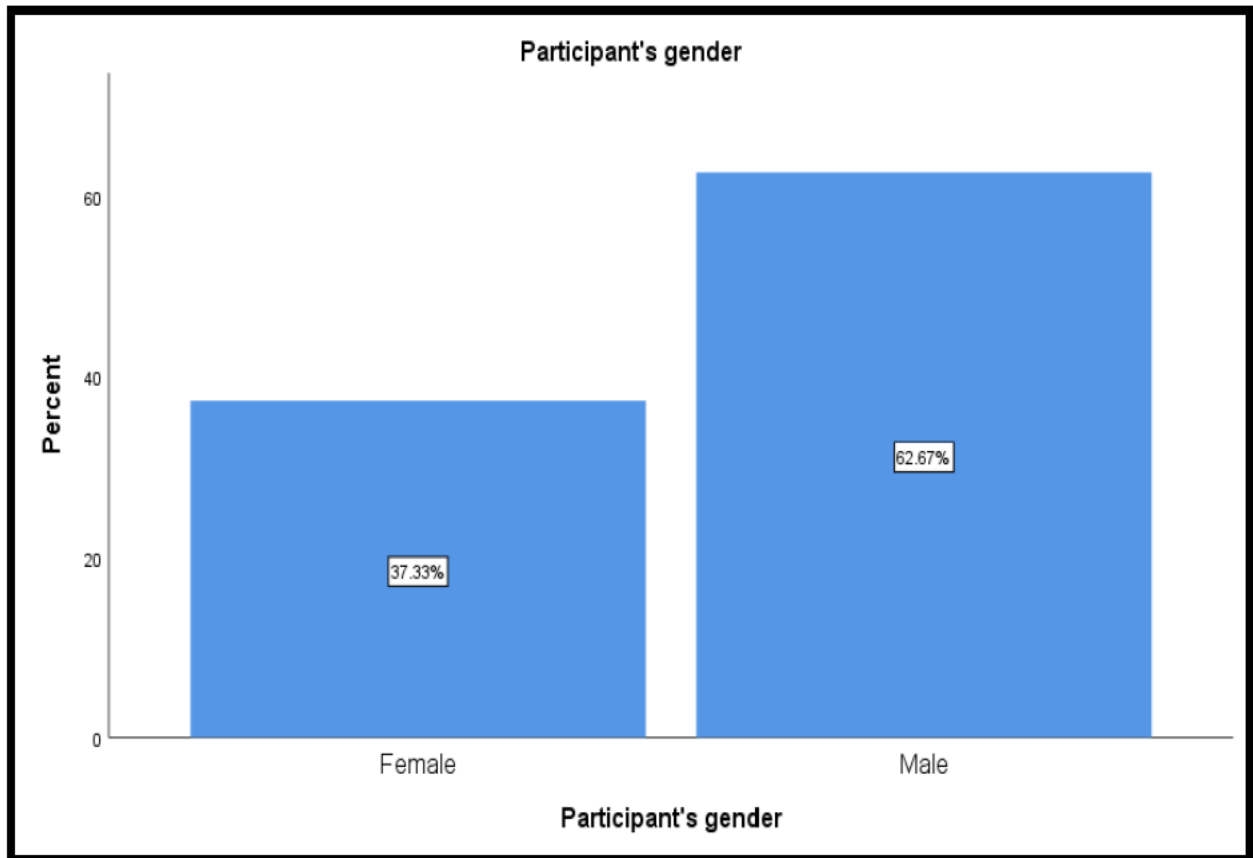
*Figure 4.1: Distribution of the participant's age group*



### 4.2.3 Gender Distribution

From Figure 4.2: The study recorded the higher response rate from males than females in their engineering careers with males at **63 %** and females at **37%**.

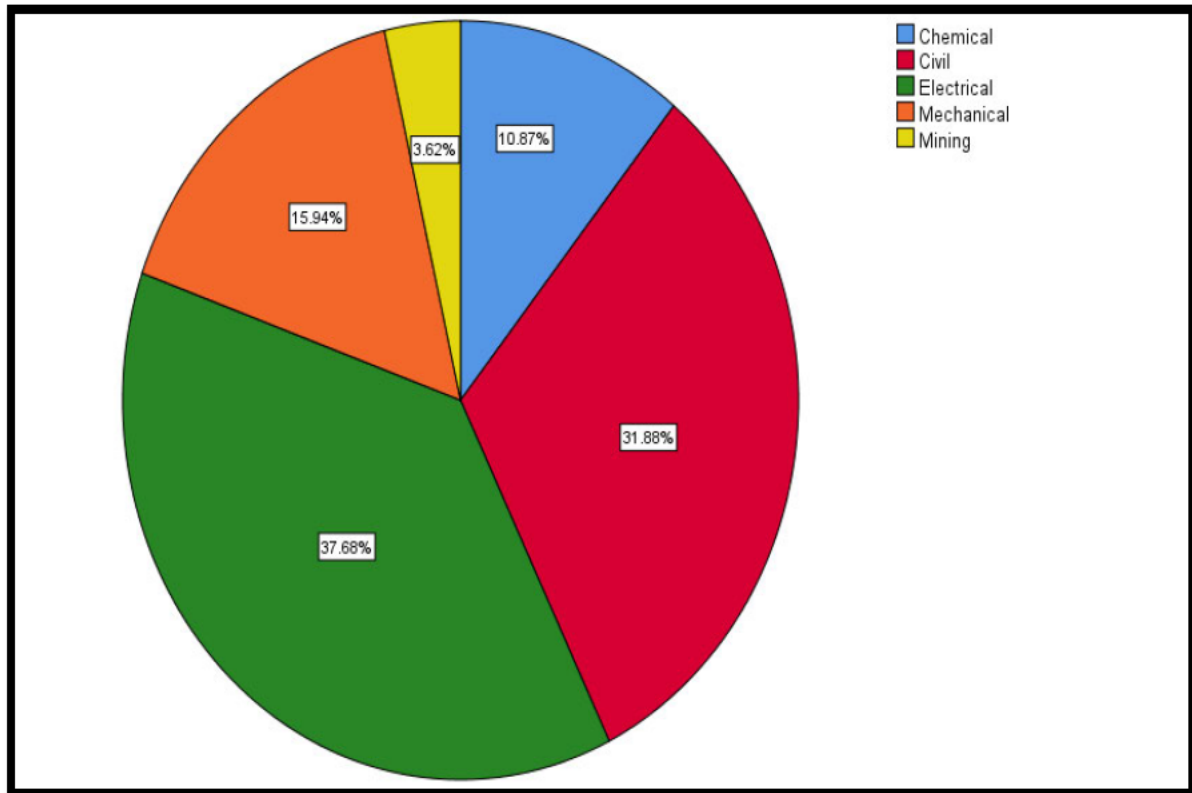
*Figure 4.2: Gender distribution of the participants*



#### 4.2.4 Engineering Branch Studied Distribution

This question sought to establish the engineering branch studied by the participants and the findings are as shown below in Figure 4.3. Overall, the study indicated that the most popular engineering branch amongst the participants is electrical engineering with **35%** engineers having studied electrical engineering.

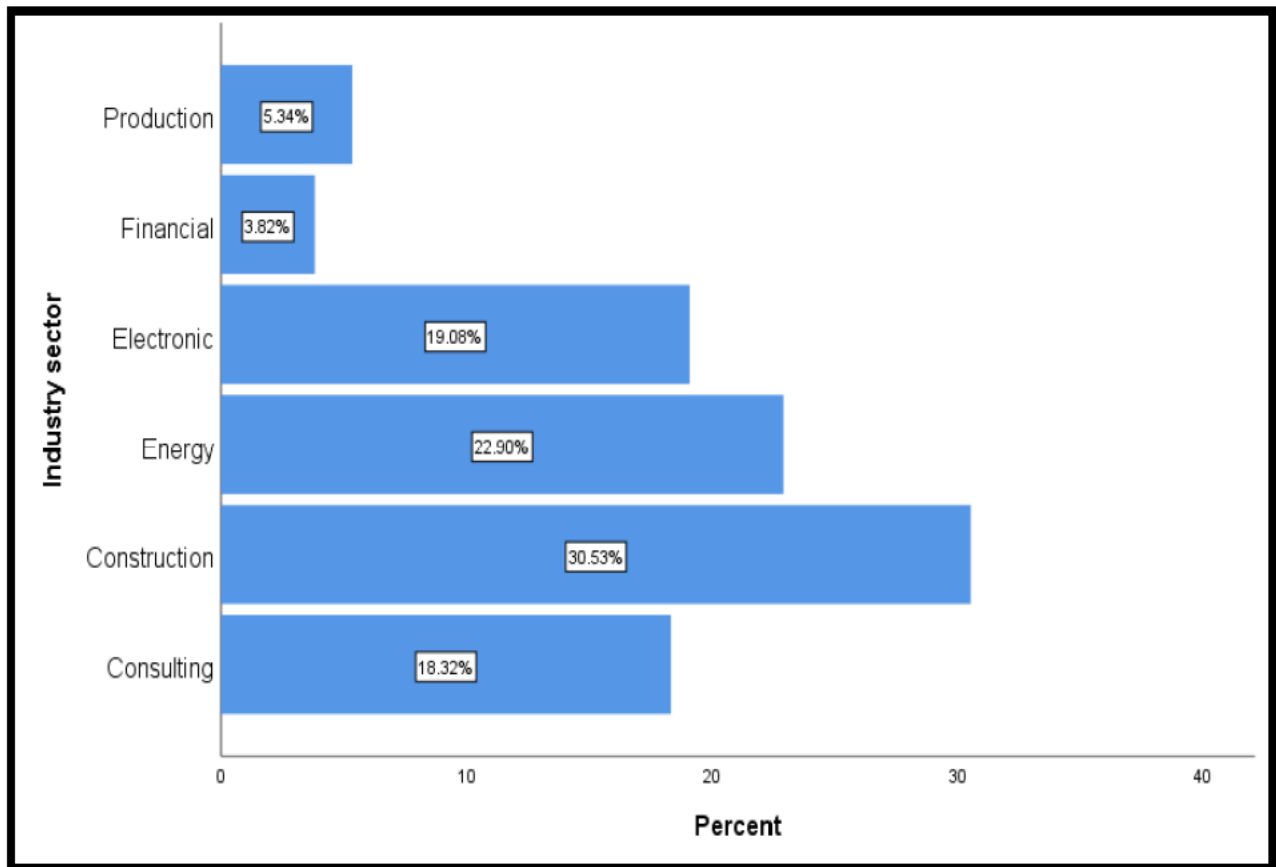
*Figure 4.3: Distribution of the engineering branch studied by the participants*



#### 4.2.5 Industry Sector Distribution

The question sought to establish the industry sector for the participants, the findings are illustrated below in Figure 4.4. The study recorded that majority of participants at **31%** were in the construction industry and fewer participants at **4%** were in the financial sector.

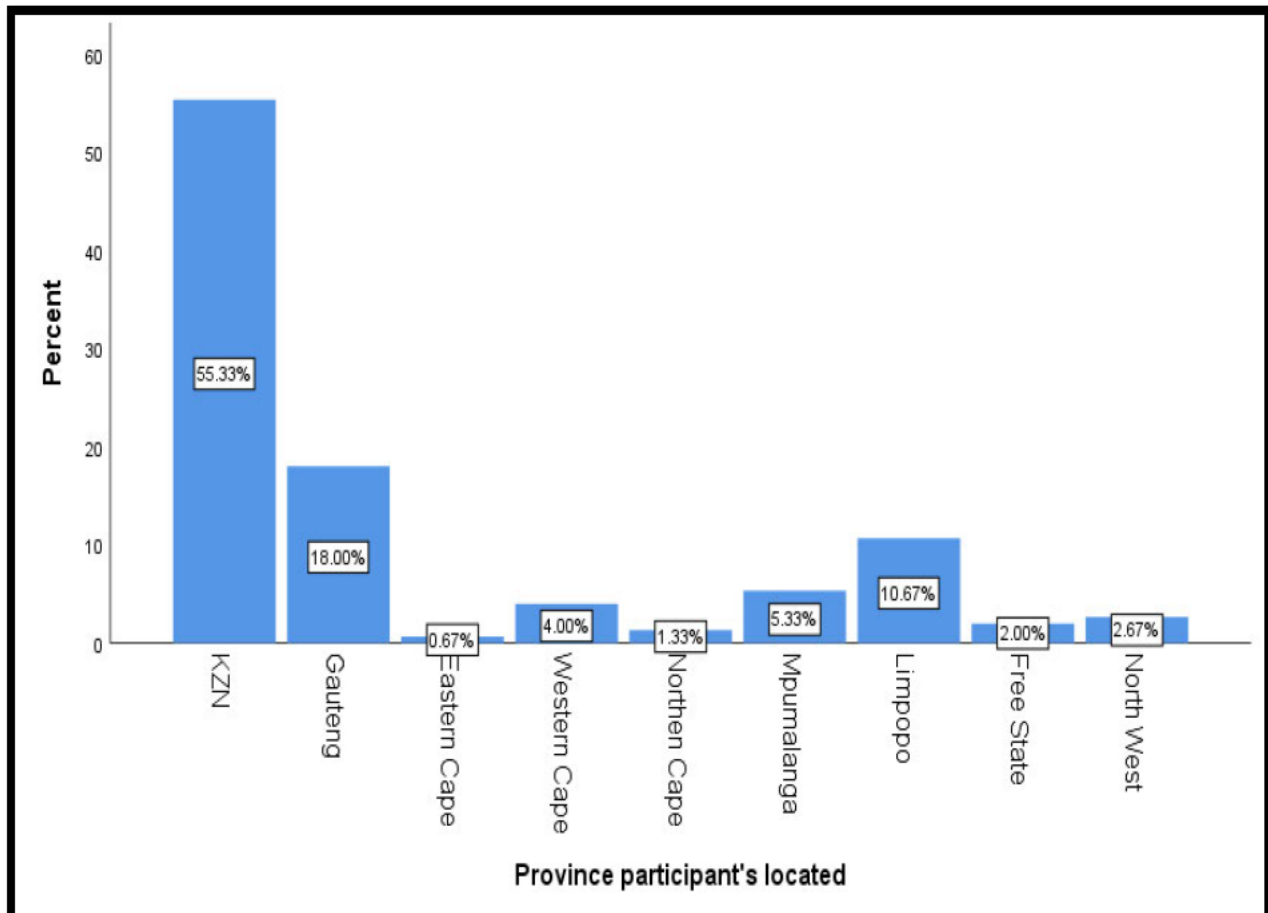
*Figure 4.4: Industry sector distribution of the participants*



#### 4.2.6 Current location distribution

This question sought to establish the current location of the participants, the findings were illustrated below. From Figure 4.5, the study recorded the highest number of participants at 55% were located in Kwa-Zulu Natal and participants from Eastern Cape were less than 1%.

*Figure 4.5: Current location distribution of the participants*



### 4.3 Section B: Development of an engineer into a business leader

The questions sought to establish the development of an engineer into a business leader. Using cross tabulation, the research looked at the career progression of the participants by looking at their **current position, qualification of engineers in senior management, years spent in technical roles, years spent in management and reasons for moving into management for all the participants**, below are the findings.

#### 4.3.1 Section B1: Career Progression

The Crosstabs procedure forms two-way and multiway tables and provides a variety of tests and measures of association for two-way tables. The cross tabulation shows the frequency of each response for both males and females.

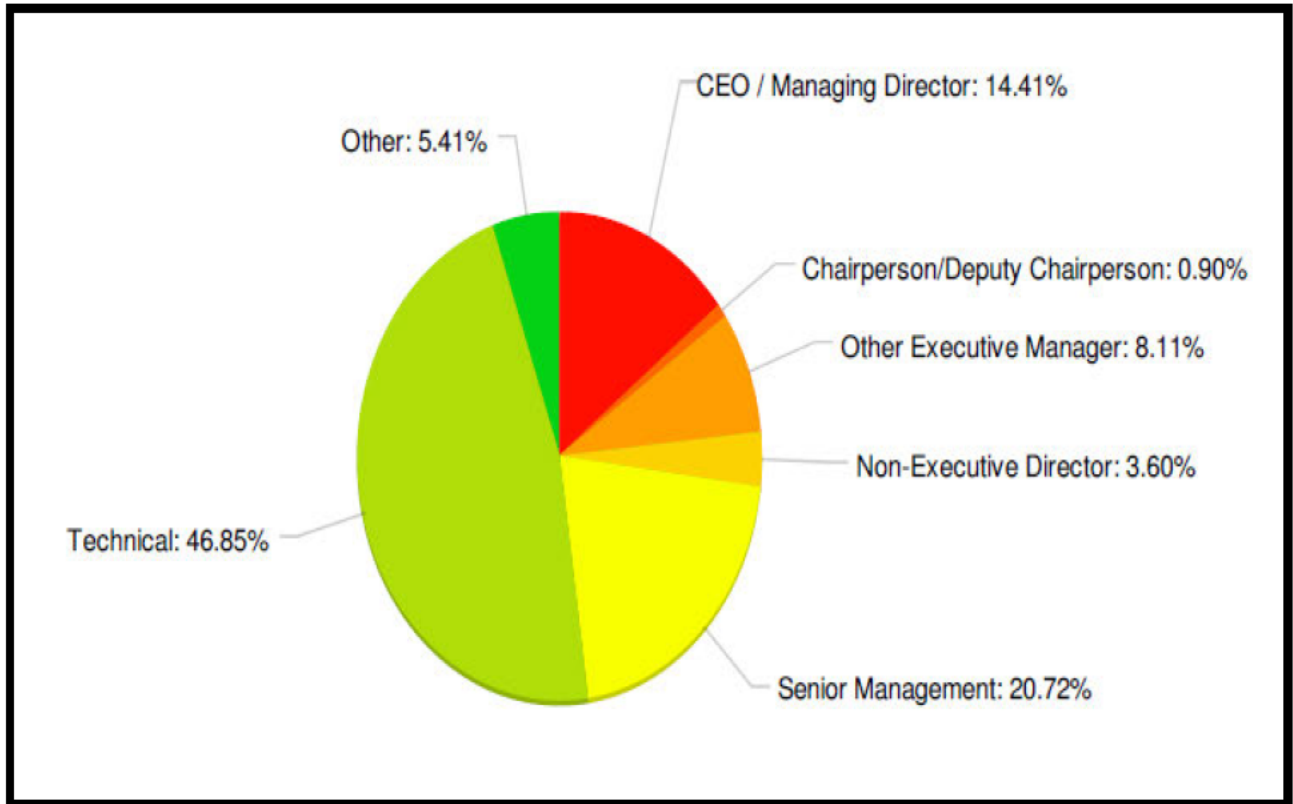
*Table 4.1: Statistical data for career progression*

Item Statistics			
	Mean	Std. Deviation	N
Current position	4.65	1.714	150
Qualification of engineer in senior management	4.06	1.329	150
Years spent in technical role	3.14	.804	150
Years spent in management role	2.06	.536	150
Reasons for moving into management	3.62	1.237	150

### 4.3.2 Current Position

The majority of the engineers who responded at **46.85%** are currently in the Technical role, with **20.72%** at Senior Management and only **14.4%** and **8.11%** who are CEO/ Managing Director and Other Executive Managers respectively.

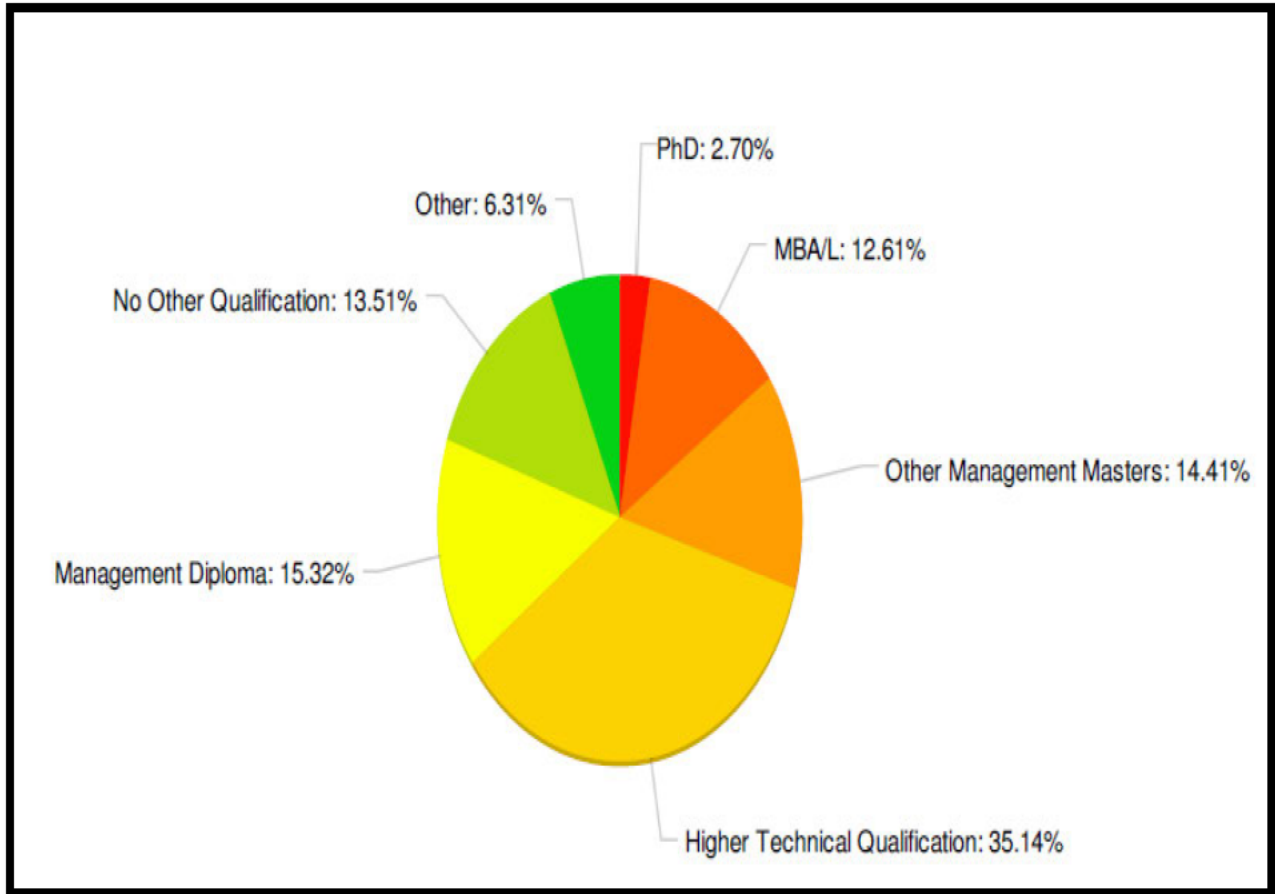
*Figure 4.6: Current position distribution of the participants*



### 4.3.3 Qualification of engineers in Senior Management

The majority of Senior Management engineers at **35.14%** had higher technical qualifications. There was a very similar distribution between those that held management diploma and other management masters. Below in Figure 4.7 is the qualification of senior management distribution.

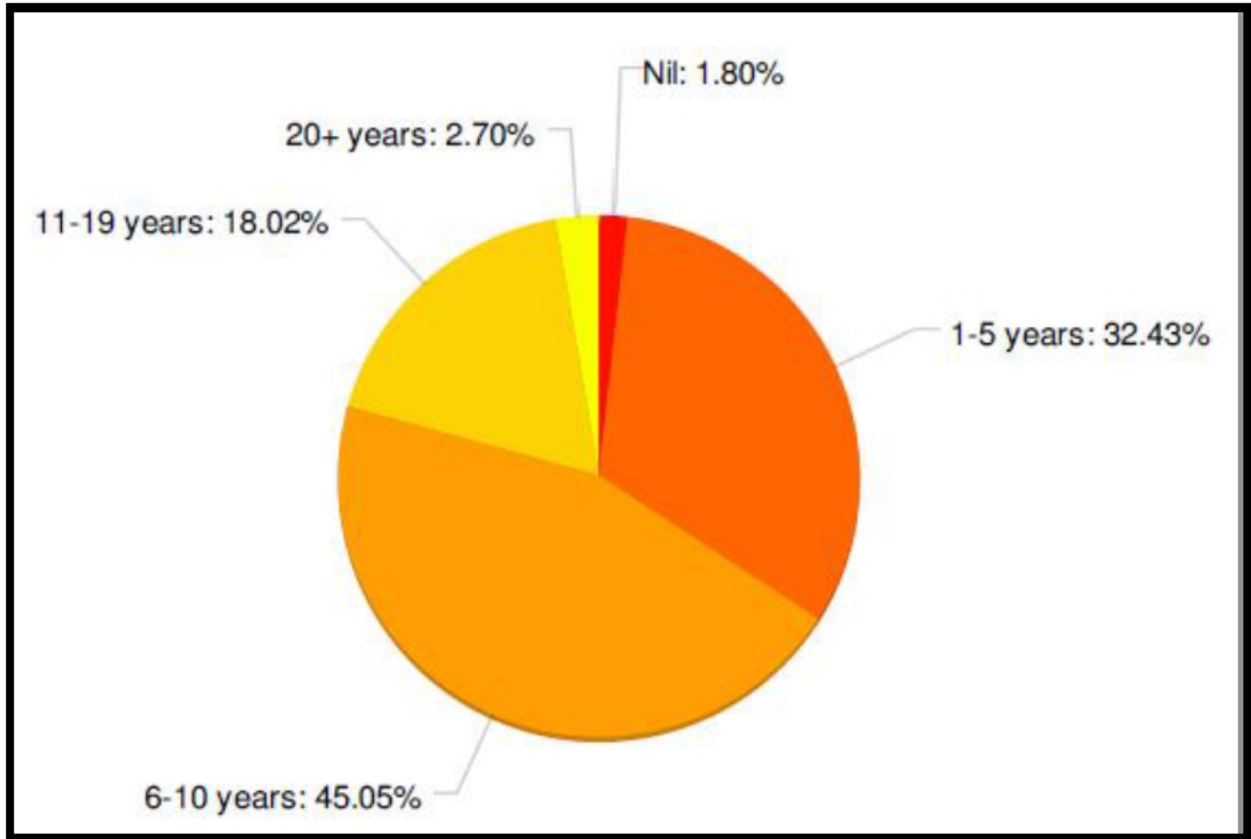
*Figure 4.7: Qualification distribution of the participants*



#### **4.3.4 Years spent in technical roles**

The majority of engineers at **46%** spent 6-10 years in technical roles. More males **29%** spent 6-10 years in technical role compared to females **17%**. It is noted that there are no females who spent more than 20 years in a technical role.

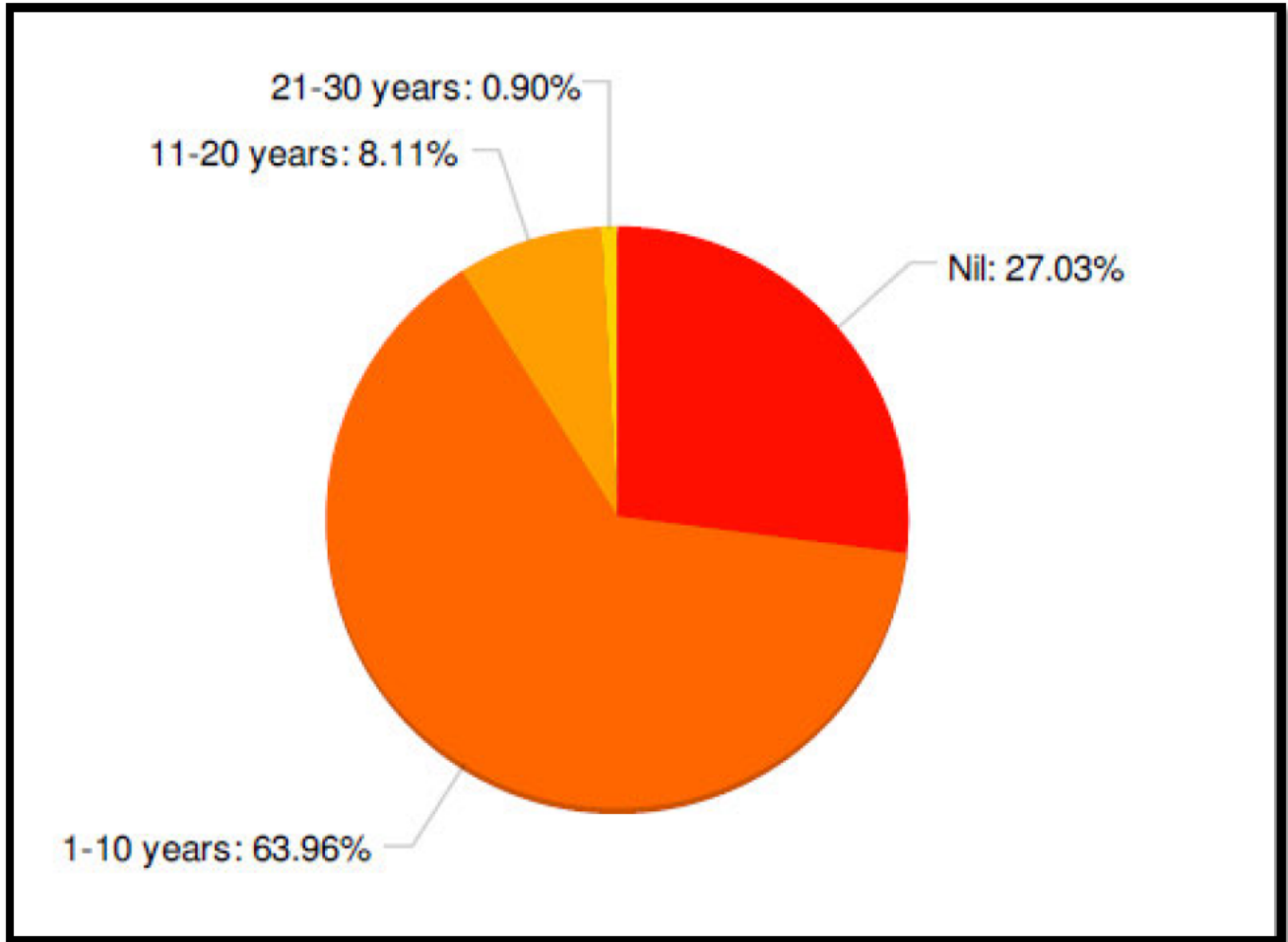
*Figure 4.8: Years spent in technical role distribution of the participants*



#### **4.3.5 Years spent in management roles**

The majority of engineers at **63.96%** spent 1-10 years in management role and **8.11%** spent 10-20 years in management roles. There were more males at **39.62%** who had spent 1-10 years in management role compared to females at **24.34%**. There were no female participants who spent 21-30 in management roles and only one male participant. **27.03%** of the participants have not spent any time in any managerial role.

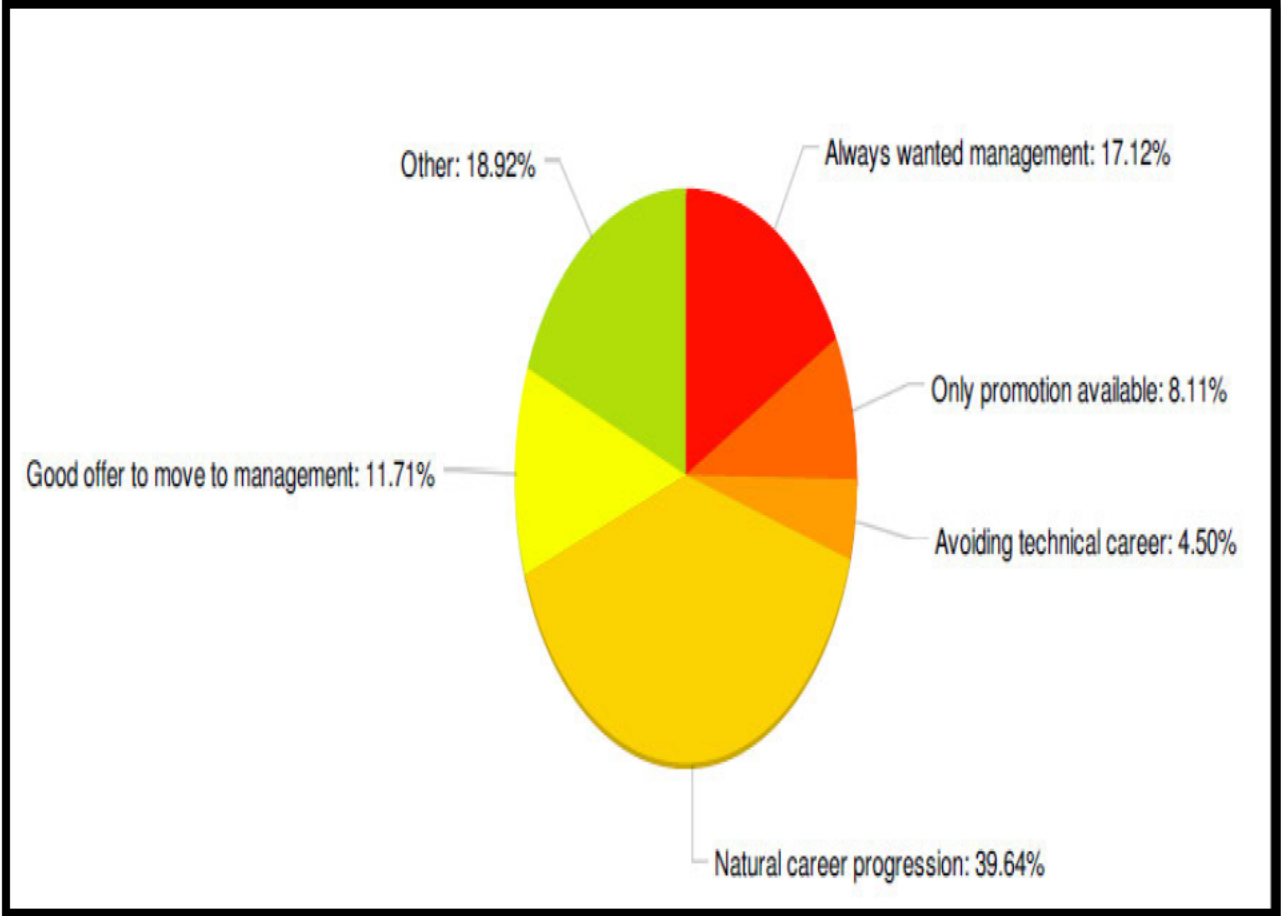
*Figure 4.9: Years spent in management role distribution of the participants*



#### **4.3.6 Reasons for move into management**

39.64% of the participants indicated that their reasons for moving into management was “natural career progression”. There were fewer engineers at 4.5% who moved into management to avoiding a technical career compared to those of 8.11% who moved into management for promotion purposes.

Figure 4.10: Reasons for move into management distribution of the participants



#### 4.3.6.1 Section B2: Career-Related Characteristics

How important has each of the following been to you in your career-decision-making so far

**Table 4.2: Job Security cross tabulation**

		Having a secure job					Total
		Not at all important	Slightly important	Neutral	Moderately important	Extremely important	
Gender	Female	18	10	8	8	12	56
	Male	36	20	11	19	8	94
Total		54	30	19	27	20	150

The majority engineers at 54 (36%) indicated that it was not at all important to have a secure job and with 19 (12.6%) remaining neutral.

**Table 4.3: Well Paying Job cross tabulation**

		Having a well-paying job					Total
		Not at all important	Slightly important	Neutral	Moderately important	Extremely important	
Gender	Female	23	10	6	6	11	56
	Male	36	23	9	14	12	94
Total		59	33	15	20	23	150

The majority engineers 59 (39 %) indicated that it was not at all important to have a well-paying job.

**Table 4.4: Job that is a stepping stone to other opportunities cross tabulation**

		Finding a job that is a stepping stone to other opportunities					Total
		Not at all important	Slightly important	Neutral	Moderately important	Extremely important	
Gender	Female	21	10	6	8	11	56
	Male	40	12	14	10	18	94
Total		61	22	20	18	29	150

The majority engineers 61 (41 %) indicated that it was not at all important to find a job that is a stepping-stone to other opportunities.

**Table 4.5: Job that is intellectually interesting cross tabulation**

		Having a job that is intellectually interesting					Total
		Not at all important	slightly important	Neutral	Moderately important	Extremely important	
Gender	Female	25	9	4	9	9	56
	Male	37	18	11	11	17	94
Total		62	27	15	20	26	150

The majority engineers 62 (41 %) indicated that it was not at all important to have a job that is intellectually interesting

**Table 4.6: Job with high level of independence and self-direction cross tabulation**

		Having a job with a high level of independence and self-direction					Total
		Not at all important	slightly important	Neutral	Moderately important	Extremely important	
Gender	Female	28	7	5	5	11	56
	Male	34	24	7	11	18	94
Total		62	31	12	16	29	150

The majority engineers 62 (41 %) indicated that it was not at all important to have a job with a high level of independence and self-direction.

#### 4.3.6.2 B2: Social and Family Considerations

How important has each of the following been to you in your career-decision-making so far?

**Table 4.7: Job that allows me to contribute to fixing problems in the world cross tabulation**

Doing work that allows me to contribute to fixing problems in the world					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all important	66	44.0	44.0	44.0
	Slightly important	27	18.0	18.0	62.0
	Neutral	22	14.7	14.7	76.7
	Moderately important	23	15.3	15.3	92.0
	Extreme important	12	8.0	8.0	100.0
	Total	150	100.0	100.0	

The majority of engineers 66 (44 %) indicated that it was not important for them to work that allows them to contribute to fixing problems in the world.

**Table 4.8: Job that allows me to contribute to the good of society cross tabulation**

Having a job that allows me to contribute to the good of society					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all important	65	43.3	43.3	43.3
	Slightly important	35	23.3	23.3	66.7
	Neutral	17	11.3	11.3	78.0
	Moderately important	18	12.0	12.0	90.0
	Extremely important	15	10.0	10.0	100.0
	Total	150	100.0	100.0	

The majority engineers 43% indicated that it is not at all important to have a job that allows them to contribute to the good of society and the minority of engineers 10% said it is extremely important to have a job that allows you to contribute to the good of society.

**Table 4.9: Job that would please my family cross tabulation**

Having a job that would please my family					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all important	32	21.3	21.3	21.3
	Slightly important	31	20.7	20.7	42.0
	Neutral	39	26.0	26.0	68.0
	Moderately important	22	14.7	14.7	82.7
	Extremely important	26	17.3	17.3	100.0
	Total	150	100.0	100.0	

In the table above the majority responses occur in the middle, meaning there were 39 (26 %) who were neutral that having a job that would please the family.

**Table 4.10: Job that gives me time for family, friends and hobbies cross tabulation**

Having a job that gives me time for family, friends and hobbies					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all important	57	38.0	38.0	38.0
	Slightly important	34	22.7	22.7	60.7
	Neutral	20	13.3	13.3	74.0
	Moderately important	12	8.0	8.0	82.0
	Extremely important	27	18.0	18.0	100.0
	Total	150	100.0	100.0	

The table above recorded that the majority engineers 38% said it was not at all important having a job that gives you time for family, friends and hobbies, whilst the minority engineers 8% indicated that it was moderately important having a job that gives you time for family, friends and hobbies.

### 4.3.7 Section C: Characteristics required to develop an entrepreneur and Entrepreneurial Orientation

This section explores the characteristics required to develop an entrepreneur and the entrepreneurial orientation of the respondents. In this Section there is a mix of both qualitative and quantitative data. In respect of the qualitative data for each question asked, NVIVO was utilised to present the data using frequency themes. NVIVO was used to identify the key word and phrases mentioned frequently by the participants.

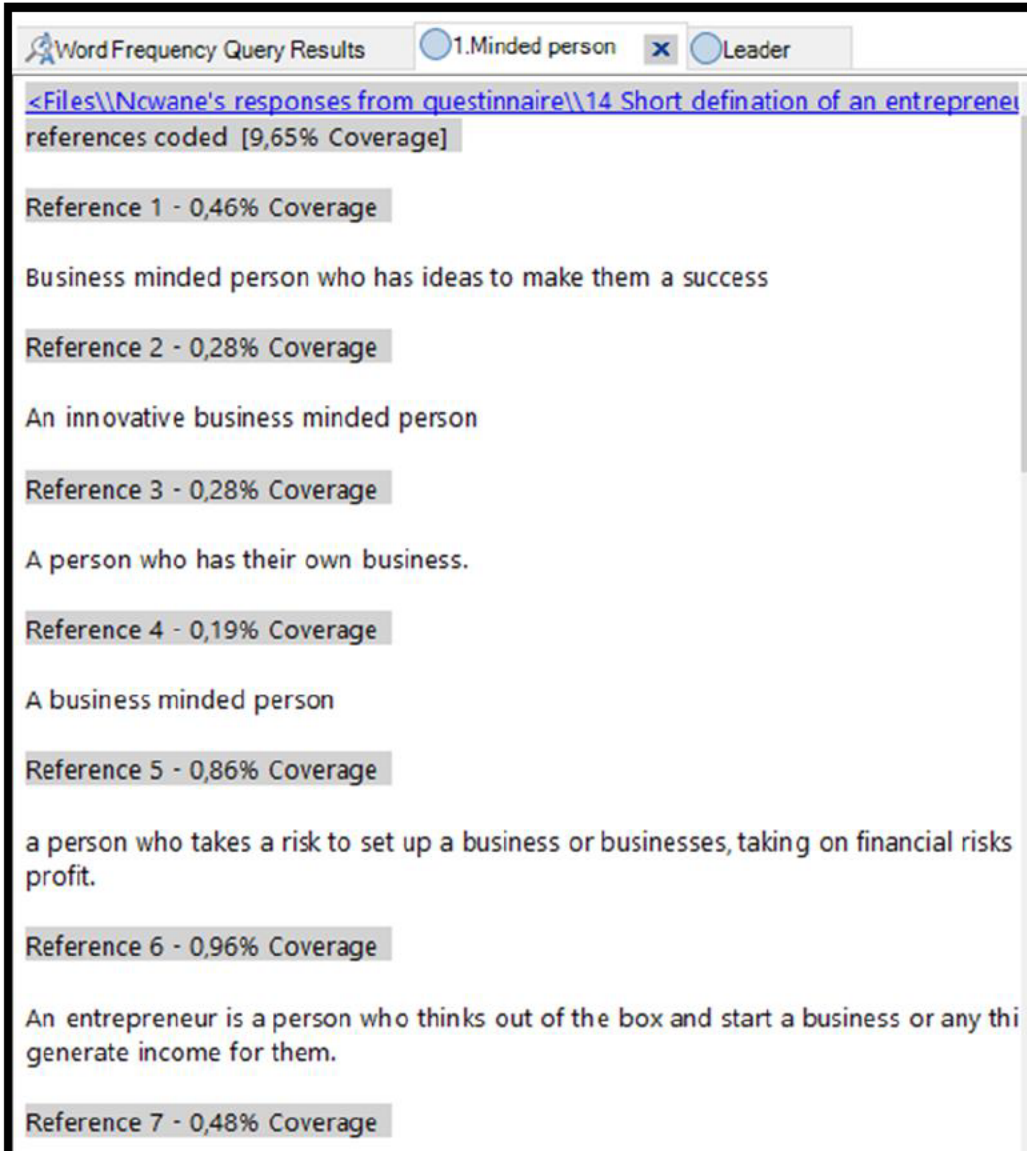
#### 4.3.7.1 What is your short definition of an entrepreneur?

NVIVO outlines two approaches to coding, broad brush coding using queries, and manual coding in sources. Broad brush coding which was used in this instance automatically codes sources based on the words or phrases they contain. This can be done using word frequency searches or text search queries. Based on the coding below is a codebook for the node themes which have been organised into sub themes. A node is a collection of references about a specific theme, case, or relationship.

*Table 4.11: Codebook for node theme organized into sub themes*

Name	Files	References
Business	1	1
1.Minded person	1	17
2. Seizes opportunities	1	10
3. Starter	1	17
Innovative	1	18
Leader	1	21
Risk taker	1	11

**Figure 4.11: Reference Coverage**



**4.3.7.2 In your opinion, do you believe that entrepreneurs are born, or can they be developed?**

*Table 4.11: Development of Entrepreneurs*

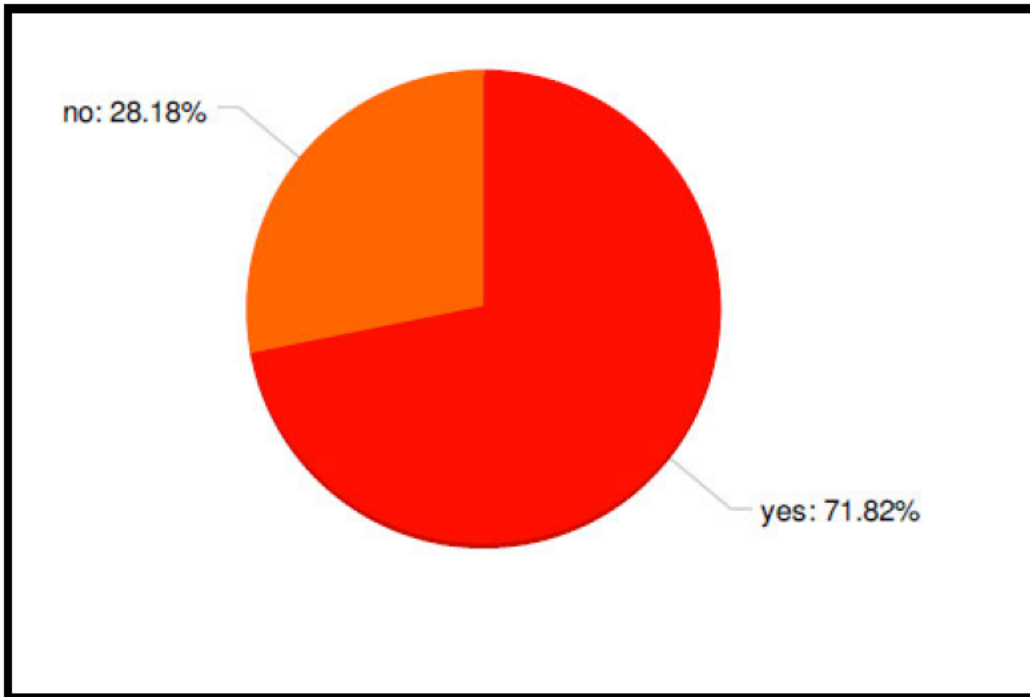
		In your opinion, do you believe that entrepreneurs are born or can they be developed?			Total
		Born	Developed	Both	
Gender	Female	17	22	17	56
	Male	23	54	17	94
Total		40	76	34	150

The cross tabulation recorded the responses by the participants and 51% of the participants believe that entrepreneurs can be developed while 27% believe that entrepreneurs are born. In addition, 22% of participants believe that an entrepreneur can both be born and developed.

**4.3.7.3 Are you interested in becoming an entrepreneur?**

According to Figure 4.12 below 71.82% of participants were interested in becoming and out of those 51% were male participants compared to female participants with 21.82%. There were 28.18% participants who were not interested in becoming an entrepreneur out of those 16.18% were female participants compared to 12% of the male participants.

*Figure 4.12: Interested in becoming an entrepreneur*



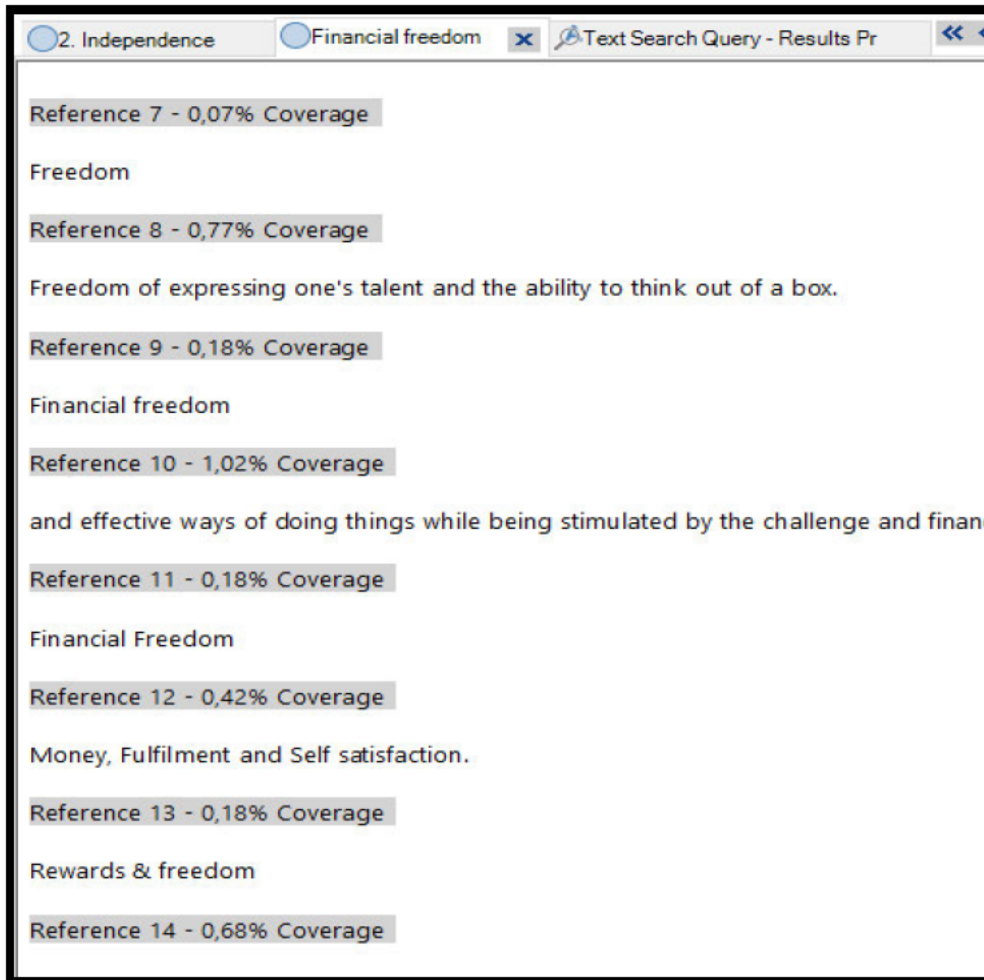
**4.3.7.4 What is the driving force behind your aspirations of becoming an entrepreneur?**

Again, NVIVO was used to analyse the data for the above question. Following the very same process used above in analysing the definition of an entrepreneur, a word frequency search query and keyword search was run to identify keywords and phrases mentioned by the participants. It was noted that the frequently used words were “**Independence, financial freedom**” which had **54** references with a coverage percentage of **4.96 %**. The findings are shown below:

*Table 4.12: Codebook for node theme organized into sub themes for driving forces*

Name	Files	References
Driving forces	0	0
1. Self-employed	1	1
1.CEO	1	1
2. Independence	1	17
2. Passion	0	0
1. Money	1	5
Financial freedom	1	14
3. Employment	1	9
4. Building	0	0
1. Legacy	1	4
4.Opportunities	1	3
5.Determination	0	0
6.Economy	1	2

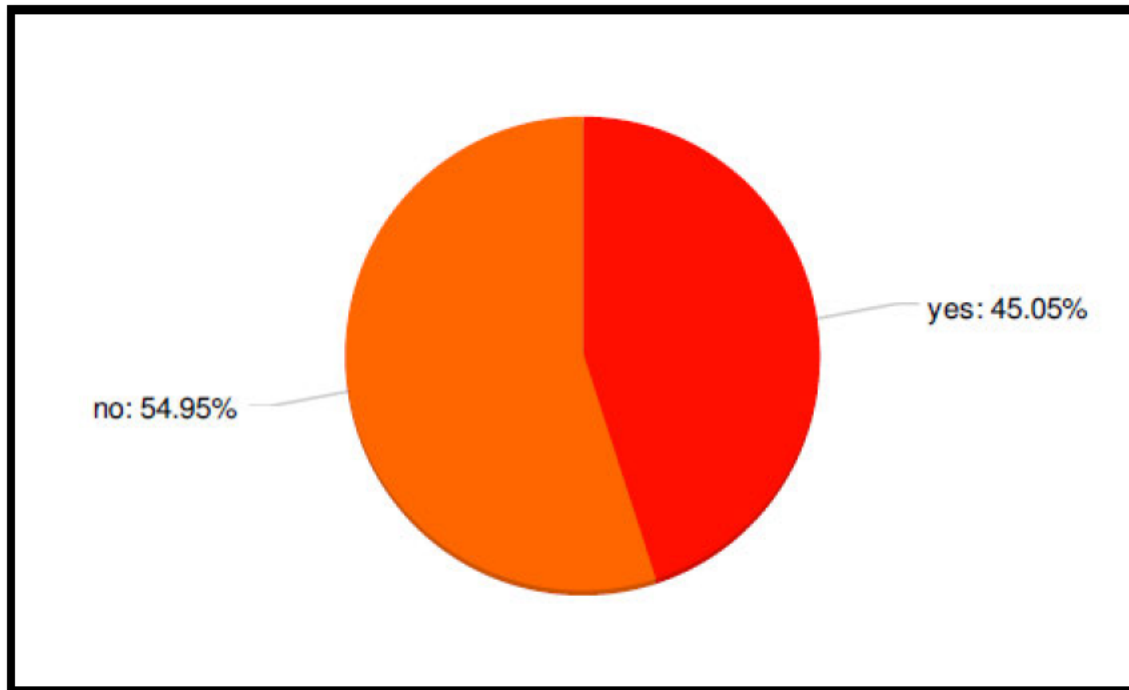
**Figure 4.13: Reference Coverage- Driving Force**



#### 4.3.7.5 In your career path so far, have you started or co-founded your own company?

The Figure 4 below shows that a slight majority of 54.95% of the participants had not as yet started a business in their career thus far.

*Figure 4.14: Split between those that have started a company and those that have not*



#### 4.3.7.6 Are you looking to start a company or an organization in the near future? If your answer is yes what industry are you looking to start a company or an organization?

Of the 150 participants through observation of the response 62% of the participants indicated that they are looking to start a company or an organisation in the near future. 15% of the participants indicated that they already had existing companies hence why they would not start a new company, the remainder 23% were not interested in starting their own company. The large majority of the participants who indicated that they would start a company indicated that this would be within the engineering space. However there was a variety of industries indicated by participants which did not fall within the

engineering industry such as property development, farming, carpentry and entertainment industry.

**4.3.7.7 If you have no ambitions of becoming an entrepreneur or starting a business in the near future, please provide some reasons for your decision?**

Of the 28,18% of the participants who had indicated that they had no interest in becoming entrepreneurs or starting their own business various responses were provided however the most common themes have been tabulated below:

*Table 4.13: Codebook for node theme organized into sub themes for no ambitions of becoming an entrepreneur*

Common Theme
Financial Stability
Risk
Stress
Remain in technical role
Job security
Fear of failure

### 4.3.8 Section D: Influential factors and Challenges

#### 4.3.8.1 What skills and attributes does one need to become a successful entrepreneur?

Using NVIVO 12 Pro to analyze the response from the participants to this particular question; the frequently mentioned words were “**Disciple, Determination and Patience**” which had 39 references and a coverage percentage of 4.29 %.

*Figure 4.15: Codebook for node theme organized into sub themes for skills and attributes*

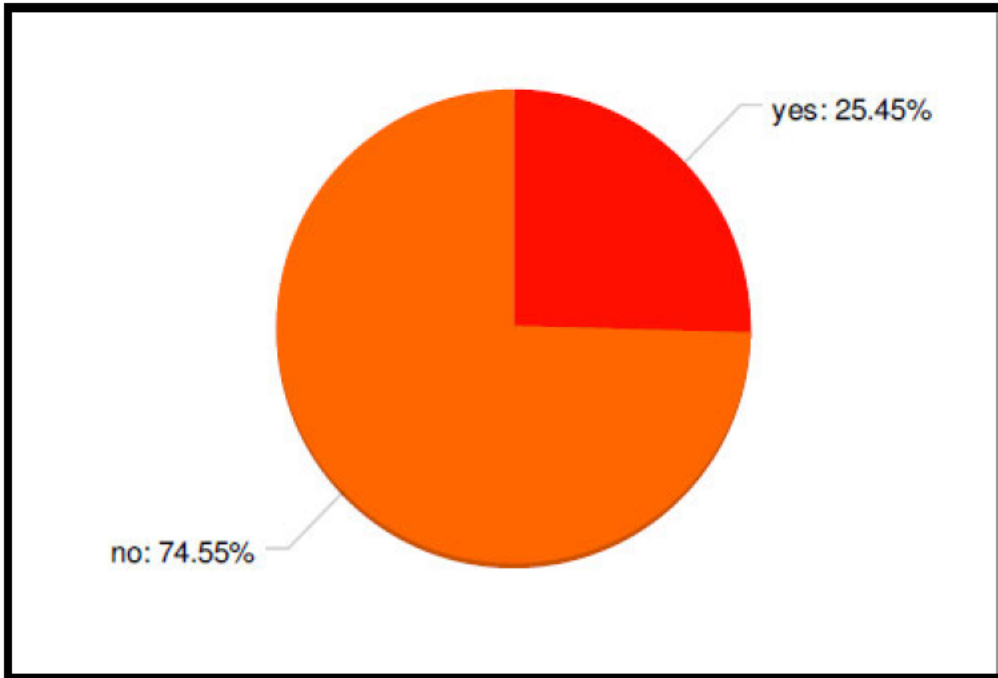
The image shows a screenshot of the NVivo 12 Pro codebook interface. The main title is "Skills and attributes of being an entrepreneur". The interface is organized into two main categories: "Attributes" and "Skills". Each category has a list of sub-themes with corresponding file counts and reference counts.

Name	Files	References
Attributes	0	0
Attitude	1	2
Determination	1	12
Discipline	1	8
Education	1	5
Good communication	1	4
Independence	1	8
Passion	1	8
Patience	1	11
Risk taker	1	3
Vision	1	4
Skills	0	0
1. Bussiness	1	8
2. Technical	0	0
3. Networking	1	3
4. Leadership	1	4

#### 4.3.8.2 In your opinion did your engineering degree prepare you enough to become an entrepreneur?

The overwhelming majority of the participants as shown below in Figure 6 which is **74.55%** indicated that their engineering degree or qualification did not prepare them enough to become entrepreneurs. Whilst the remaining **25,45%** agreed that their engineering degree or qualification did prepare them to become entrepreneurs.

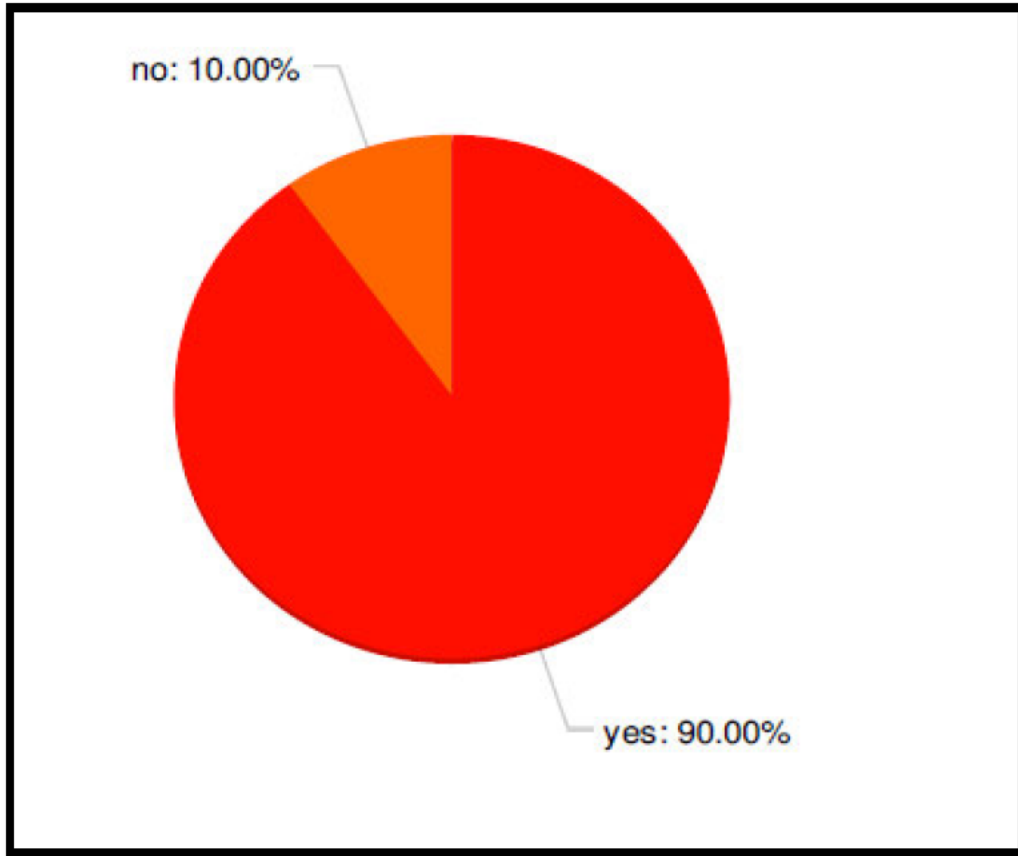
*Figure 4.16: Engineering Degree in preparing engineers to be entrepreneurs*



#### 4.3.8.3 Should the engineering degree curriculum pay much more attention on entrepreneurship?

The overwhelming majority of the participants as shown below in Figure 7 which is **90%** indicated that their engineering degree or qualification curriculum should pay much more attention on entrepreneurship. Whilst the remaining **10%** disagreed that their engineering degree or qualification should pay more attention on entrepreneurship.

*Figure 4.17: Should the Engineering Curriculum pay more attention to entrepreneurship*



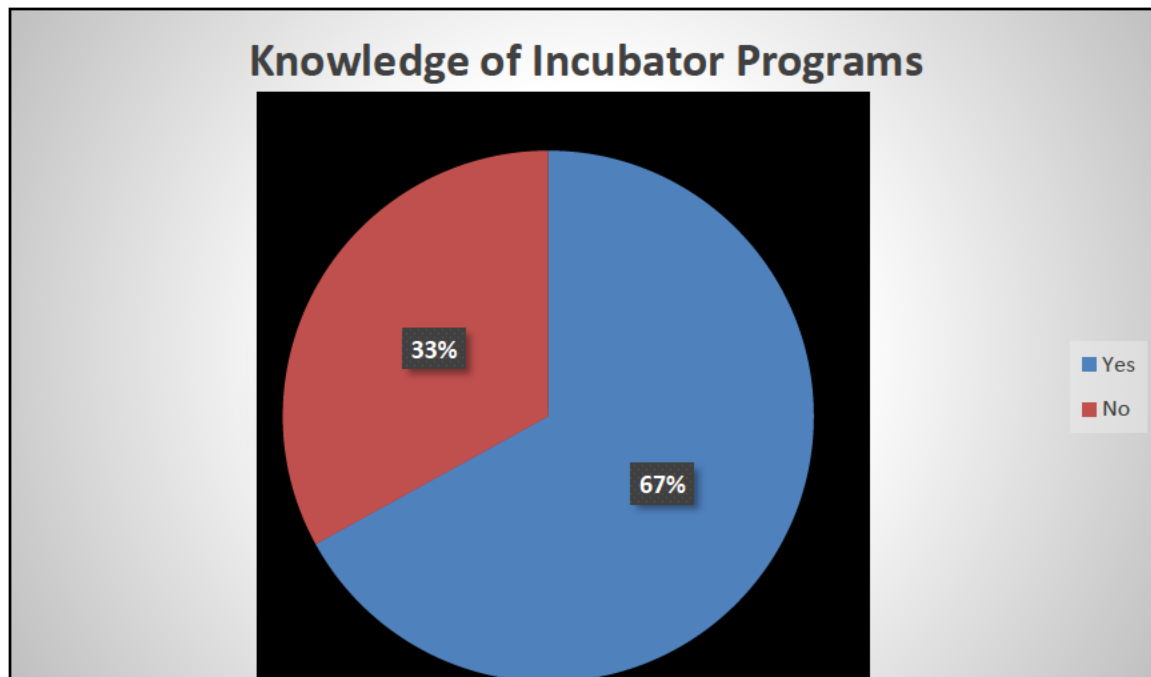
**4.3.8.4 If you are already an entrepreneur and a business leader, what are the biggest challenges that you have faced?**

Using NVIVO 12 Pro to identify the key words and phrases in order to detect the trends and patterns, word frequency search and text search queries was used to get a feel of what participants were saying about the challenges, It is noted that majority of participants mentioned that the biggest challenges was “**Start-up capital**” which has **15** references with a coverage percentage of **13.6 %**, and the minority indicated that the biggest challenges were “**Marketing**”. Table 4.14 below shows the nodes and Figure 4.18 shows the word cloud of the findings:



participants who indicated that they were aware of such incubator programs.

*Figure 4.19: Awareness of incubator programs*



#### **4.3.8.6 In your opinion what support should be provided to engineers who are aspiring entrepreneurs and where can this support come from?**

Using NVIVO 12 Pro to identify the key words and phrases in order to detect the trends and patterns, the researcher used word frequency search and text search queries to get an analysis what participants were saying about the support that should be provided to aspiring entrepreneurs. It was noted that majority of participants mentioned that the support to be provided was **“Mentorship by other businessman, by other parastatal and by industries”** which has **12** references with a coverage percentage of **2.14 %**, other participants mentioned that **“Government support is crucial”** which has **11** references with a coverage percentage of **7.67 %**. The findings are shown below in Figure 4.20 and Figure 4.21:

Figure 4.20: Theme nodes for support to be provided to entrepreneurs

support should be provided to entrepreneurs			
Name	Files	References	
Support		1	1
Financial		0	0
Government		1	11
Mentorships		1	12
Technical		1	2

Figure 4.21: Word map for support to be provided to entrepreneurs



### 4.3.9 Section E: Strategies and Recommendations

#### 4.3.9.1 Based on your experience in business and leadership please provide any strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa?

NVIVO 12 Pro was used to analyse this question in order to identify the trends and patterns from the response by participants. Using word frequency searches and text key searches to identify the frequently mentioned words by the participants, the words most frequently mentioned in the response were “**Mentorship, training**” which has **38** references and a coverage percentage of **2.44 %**. **Figure 4.22** below shows the theme nodes and **Figure 4.23** is the word map from the theme nodes.

*Figure 4.22: Theme nodes for the strategies on how engineer can be developed into entrepreneurs*

Name	Files	References
Strategies	0	0
Funding	1	3
Mentorship	1	15
Opportunities	1	2
Support	1	6
Training	1	24

Figure 4.23: Word map for the strategies on how engineer can be developed into entrepreneurs



## **4.4 Discussion**

This section of the chapter an in-depth discussion of the results will be conducted, the layout of the discussion will be in relation to the research objectives that were set out in Chapter 1. The discussion will also try to also integrate the literature review with the findings of the results. The discussion will seek to correlate the responses provided by participants to the questionnaire. This correlation will assist the researcher in proving answers to the research question and from this discussion the researcher will be able to also provide recommendations which will however be discussed in the next chapter.

### **4.4.1 Objective 1- To establish the characteristics required to develop an entrepreneur and a business leader**

In understanding the purpose of the research which is to investigate the development of engineers into entrepreneurs and business leaders in South Africa, it was imperative for the researcher to establish the characteristics required from the engineer in order for them to develop into an entrepreneur and a business leader. One of the fundamental questions that were asked of the participants in relations to the characteristics required to develop an entrepreneur and a business leader was for the participants to provide a short definition of what they thought was an entrepreneur. Looking at the node themes in Table 4.11 the participant's response seems to be line with or correlate the definition provided by Shelton and Darling (2011) as "*an individual who is innovative, a developer and is able to recognize opportunities that can be converted into workable ideas to add value.*" With this definition at hand it will them form the bases of the discussion regarding the characteristics of a successful entrepreneur.

In order to assist the researcher with the establishment of these characteristics the participants were asked a serious of questions, these questions related to the participant's career progression and advancement. The participants were also asked to provide their own views of the skills and attributes required by an entrepreneur to be successful. Figure 4 provided the researcher with the node themes in relation to skills and attributes of a successful entrepreneur. It is clear to see that an entrepreneur needs an array of skills and attributes to be successful, but the critical ones seem to be innovation, discipline, visionary, opportunistic, risk taker, dedication, independent and passion. Further to the discussion in relation to the characteristics the response by the participants seems to confirm as extremely important factors such as having a job that is intellectually

interesting, having a job with a high level of independence and self-direction as well as doing work that allows one to contribute to fixing problems in the world. These are presented in Table 4.5, Table 4.6 and Table 4.7 respectively. Based on the available literature a person's characteristics will encourage risk-taking or networking and co-ordination to bring about a successful entrepreneurial venture. What the individual does in this process is helped or hindered by personality characteristics that play a role in guiding the use of mechanisms to perform successfully. It is therefore imperative to understand or to establish the characteristics required for the development of a successful entrepreneur.

#### **4.4.2 Objective 2- To examine the entrepreneurial orientation of engineers in South Africa**

If one wants to effectively analyse the development of engineers into entrepreneurs and business leaders it is imperative for one to understand and examine the entrepreneurial orientation of the engineers. To start off in this discussion it was important to understand the definition of an entrepreneur from the perspective of the engineers. This definition has been discussed above and therefore the discussion in this section will be as a result of that discussion. Participants were initially asked whether an entrepreneur was born, developed or both. As per the results presented majority of the respondents indicated that they believed that entrepreneurs are developed through knowledge, exposure to different scenarios and thus an individual will be able to realise gaps in the market to develop a business that they would have ordinarily not have been exposed to.

Entrepreneurial intention is the precursor to any entrepreneurial activities by any individual and to this end participants were asked if they had any interest of becoming entrepreneurs. A resounding majority of over 70% of the participants were interested in becoming an entrepreneur. The main driving forces for the participants wanting to be entrepreneurs was the ability to own their time and financial freedom which come with one being an entrepreneur. When participants were asked if they had founded or co-founded a company in their career, 54% indicated that they had not but this is contrasted with the fact that over 60% of them indicated that they had ambitions of starting a company in the near future. Those that indicated that they had no ambitions of becoming entrepreneurs or start a business indicated risk and job security as the main factors for them not wanting to become an entrepreneur. According to the participants as presented in the results, skills and attributes associated with the success of entrepreneur in the main are what is referred to in the literature as the entrepreneurial orientation dimensions. The five dimensions indicated by the

participants are innovation, risk taking, independence (autonomy), go getter (pro-activeness) and opportunistic (competitive aggressiveness). In relation to literature review on entrepreneurial orientation, the data collected suggests that the participants have a high entrepreneurial orientation which is backed by the positive entrepreneurial intention which is key to the development of engineers into entrepreneurs and business leaders.

#### **4.4.3 Objective 3- To determine the driving factors of engineers becoming entrepreneurs and business leaders in South Africa**

With so many of the participants indicating their desire to become entrepreneurs, one of the objectives of this research is to determine the driving factors of them wanting to be entrepreneurs. With the current economic conditions in the country many of the participants indicated that there was no longer anything such as job security as even the big corporates find themselves having to restructure and retrench. This situation has resulted in most of the participants indicating that their biggest driving factors to become entrepreneurs are financial freedom and independence. These two factors were the most frequently mentioned as supported by the results presented in Table 4.12.

However, there were many other factors which were indicated by the participants which three of them will be elaborated on further in this section as in the context of the country's economic situation are important to mention. The first one is to use their engineering abilities to provide solutions to some of the societal problem which the country needs entrepreneurs to provide solutions for. Secondly in the wake of the highest unemployment the country has ever experienced particularly amongst the youth, many of the participants indicated that they want to create sustainable employment especially for the youth. The third one is to create exposure to young up and coming leaders so as to produce future entrepreneurs. Based on the literature review on the influence in which entrepreneurs have been able to transform economies and create employment, these driving factors indicated by the participants are therefore in line with the norm as South Africa is in dire need of entrepreneurs to boost the economy which in turn will create employment.

#### **4.4.4 Objective 4- To identify challenges faced by engineering entrepreneurs as business leaders in South Africa.**

As mentioned before the success of entrepreneurs in an emerging country like South Africa is imperative as they have the ability to boost economic growth for the country. It is therefore just as important to identify and understand the challenges that are faced by engineers who are already entrepreneurs or those looking to venture in to entrepreneurial space. From analysing the data presented above in Table 4.14 and Figure 4.18 it was clear to see that the two biggest challenges faced by entrepreneurs are finance and access to capital. In this section these two challenges will be discussed further, this discussion will assist in terms of understanding whether these challenges are unique to engineers or are they the norm in the entrepreneurial space.

Many participants cited finance in many ways as one of the biggest challenges that they are facing. Based on the participants these challenges also come in a number of forms such as the ability to raise funding for their start-ups. Whilst still on the financial challenges many participants pointed further at cashflow issues which are caused by late payment by clients. Cashflow as indicated is the lifeline when it comes to SMME's. In relation to late payment government at all levels was pointed out as the biggest culprit as they continue to pay service providers beyond the 30 days which is the acceptable norm. The failure of service providers to be paid on time was also cited as one of the reasons why many businesses especially SMMEs fail as oppose to big business who are able to ride this wave due to their bigger bank balance. The researcher asked the participants to provide what they hope would be solutions to the issue of finance. The most popular response was for government working with the private sector to develop transparent venture capital funds which will assist with funding start-ups. With this sentiment it is clear that current funding models through the various funding institutions set up by government are not playing the role which they are created for.

The second biggest challenge as indicated by the participants is access to market as there are barriers to entry and thus shutting the new players out of the market and causing great frustration for the entrepreneurs. One of the solutions to this challenge indicated by the participants was for the government working together with the private sector to create quotas that will be set aside for start-ups to the market in the sectors where possible. This will in a short address the issue of access to market for the start-up until such a point the new business is financially stable and are then able to compete in the market.

As one of the solutions to the challenges being faced by engineers who want to be entrepreneurs is mentorship, this mentorship can be both informal and formalized into incubator programs. The South African government understanding the need to develop entrepreneurs created a number of institutions to assist with the development of entrepreneurs by creating incubator programs and has spent a lot of money creating these incubator programs. However even with all the money spent it seems as though it is not working because when the participants were asked if they were aware of these programs, 63% of the participant indicated that they were not aware of any incubator programs. It is clear therefore that a great deal of work still needs to be done to educate a great of the population about the opportunities that are there for aspiring engineers who want to be entrepreneurs. The challenges indicated by the participants are a direct contrast to the environmental factors which impact on venture creation as highlighted by Gartner (2015) and Morsky (2013). Hence for the entrepreneurs to be successful these challenges can be overcome by ensuring that the environmental factors which impact on successful venture creation are put in place.

#### **4.4.5 Objective 5- To recommend strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa**

The purpose of this objective was clearly to use the data collected to develop and recommend strategies on how to develop engineers into entrepreneurs and business leaders. Whilst there were many strategies indicated by the participants however for the purpose of this research and using the analysis, only three strategies will be discussed. The three strategies are changing the curriculum, business mentorship and incentives.

Firstly, in assessing the development of entrepreneurs, a question was asked as to whether the engineering qualification assisted in preparing the engineer into an entrepreneur and whether the curriculum should pay more attention to entrepreneurship. Over 60% of the respondents indicated that their engineering qualification did not prepare them to be entrepreneurs, further to that 90% of the participants indicated that the engineering curriculum should pay much more attention to entrepreneurship. The sentiments shared by the participants on the engineering curriculum is in line with the shift by institutions of higher learning in the western world where the engineering qualification has shifted to pay great emphasis on entrepreneurship. Essentially the curriculum must be moving towards Engineering Entrepreneurship Programs which should be driven by a public private partnership. Literature review confirms that creating these university-based

programs has reaped positive economic impact and is testimony to the fact that entrepreneurship skills and know-how can be taught, and entrepreneurs can be nurtured through supporting programs in university-based incubators.

Secondly based on the data collected it is clear that most participants believed that business mentorship would be one of the strategies to develop entrepreneur. However, the participants indicated that the formal business mentorship should be a one stop shop for engineers in their development similar to an incubator program. Whilst there are incubator programs which the government has created however it has proven that they are not effective or are unknown to the engineers who want to become entrepreneurs. The incubator programs for engineers should be driven by engineers who are likely to have a better understanding of other engineers.

The third strategy that came out of the data collected is the fact that government needs to create an enabling environment for engineers to develop into entrepreneurs through incentives that can be provided to aspiring engineers. This can be achieved in two folds, firstly by creating a transparent funding solution which will be start-up friendly. Essentially a venture capital funding vehicle which engineers with great and innovative ideas can receive funding and allowing them to develop their business. Secondly government should increase their spending in procurement with SMME's which will create the much-needed market for start-ups. In this strategy incentives should also be provided to private companies for doing business and mentoring engineers who are entering the entrepreneurial space.

Overall the findings in terms of the recommendations from the research appear to link up with the literature in relation to the triple helix model of innovation which advocates for the interaction between government, academia and industry which fosters both social and economic development and the three components are academia-industry interaction, government-academia interaction and government-academia interaction. (Etzkowitz and Leydesdorff, 2000).

#### **4.5 Summary**

The purpose of this chapter as set out in the introduction was to pronounce, present and discuss the results which have emanated from the data collected. Using the Cronbach Alpha test the reliability and the validity was confirmed. The tool of analysis such as SPSS and NVIVO 12 Pro were clearly articulated so as to provide the reader with a better understanding of how the data

was analysed. Each of the questions from the questionnaire was analysed and presented in accordance to the different sections of the questionnaire. The discussion of the results in relation to the data collected was presented for each of the research objectives. From the above it is clear to see that the objective of this chapter has been fulfilled and the next chapter will deal with conclusion and recommendation of the research.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Introduction**

This study has undertaken to investigate the development of engineers into entrepreneurs and business leaders in South Africa. The purpose of this chapter will be to provide a conclusion and establish whether the research has been able to resolve the problem statement. Essentially the purpose of this chapter will be to link the findings to the objectives of the study. The conclusion will be set out to conclude each of the objectives based on the information gathered in the literature review, results presented from the data collected and the discussion provided in the previous chapter. This chapter will briefly highlight the limitations of the study and will conclude with some recommendations for future studies.

#### **5.2 Research Objectives Conclusions**

The aim of the study was to investigate the development of engineers into business leaders and entrepreneurs, the study was limited to engineers in South Africa. There was however no limit on the level of the engineer's career standing. A mixed research methodology was adopted and both an online survey and emailed questionnaire was utilized for the primary data collection. There were five specific objectives of the study which are to establish the characteristics required to develop an entrepreneur, to examine the entrepreneurial orientation of engineers, to determine the driving factors of engineers becoming entrepreneurs, to identify challenges faced by engineering entrepreneurs and to recommend strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa. The results and discussion of the findings for each of the research objectives were discussed in detail in the previous chapter. The brief conclusion in respect of research objectives are presented below.

##### **5.2.1 Objective 1- To establish the characteristics required to develop an entrepreneur and a business leader**

In the context of the research as a whole it was imperative for the research to establish the characteristics required to develop an entrepreneur. One can conclude by saying that there are a number of characteristics which one needs to have in order to be developed into a successful entrepreneur and some of these characteristics have been presented above and are supported by both the literature and the data collected. The characteristics required to develop an entrepreneur

are but not limited to innovation, discipline, visionary, opportunistic, risk taker, dedication, independent and passion. Based on the definitions of an entrepreneur provided by both the literature and the participants the research was able to meet the set-out research objective.

### **5.2.2 Objective 2- To examine the entrepreneurial orientation of engineers in South Africa**

The purpose of this research objective was to examine the entrepreneurial orientation of engineers generally in South Africa. Entrepreneurial orientation can be briefly described by the five entrepreneurial orientation dimensions which are innovativeness, risk-taking, pro-activeness, autonomy and competitive aggressiveness. However, one further revelation was the importance of entrepreneurial intention which is said to be the precursor to any entrepreneurial activities, meaning no matter how high one's entrepreneurial orientation is but if one does not possess entrepreneurial interest, they are unlikely to start a business. With just a bit more than 70% of the respondents indicating that they are interested in becoming entrepreneurs one can conclude that South African engineers do possess the required entrepreneurial intention. From the data collected it can be concluded South African engineers do possess a level of entrepreneurial orientation and also do have the required entrepreneurial intention to develop into entrepreneurs.

### **5.2.3 Objective 3- To determine the driving factors of engineers becoming entrepreneurs and business leaders in South Africa**

In order to analyse the development of engineers into entrepreneur it is imperative to determine the driving factors, and this was the aim of this research objective. Five driving factors were identified as the key driving factors for engineers to become entrepreneurs and these are financial freedom, independence, the use of the engineering abilities to provide solutions to societal problem, the creation of sustainable employment especially for the youth and lastly to create exposure to young up and coming leaders so as to produce future entrepreneurs. With the entrepreneurial intention of the engineers having been established this will complement the fulfillment of these driving factors. It is therefore clear to see that the driving factors were determined and therefore the research objective was met by the research.

#### **5.2.4 Objective 4- To identify challenges faced by engineering entrepreneurs as business leaders in South Africa.**

This research objective's intention was to identify some of the challenges that are faced by those engineers who are already entrepreneurs and business leaders. Whilst there was a plethora of challenges indicated by the engineers however the two most significant ones which were the most frequently mentioned are: 1) financial challenges which are access to funding and cashflow due to late or nonpayment for services rendered and 2) access to market. These challenges seem not to be unique to engineering entrepreneur but are general challenges for all entrepreneurs in any sector and therefore it's a challenge that government needs to find a way to urgently address it. Business mentorship or lack thereof is a challenge worth noting. Despite the government's intervention in the form of business/entrepreneurship incubator program through institutions such as SEDA, most of the engineers were not aware of such programs which could assist them in their development. As mentioned above there was a plethora of challenges indicated by the engineers and the most frequent ones have been identified and discussed in length and therefore the aim of the research objective was met by the study. The challenges indicated by the participants are a direct contrast to the environmental factors which impact on venture creation as highlighted by Gartner and Morsky

#### **5.2.5 Objective 5- To recommend strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa**

The intention of this particular research object was to get from the engineers some strategies which can be utilized by government and other institutions in the development of engineers into entrepreneurs. The three strategies that were discussed are changing the curriculum, business mentorship and incentives. In the discussion each strategy was discussed in the context of them being able to respond to the challenges raised in research objective four. From the discussion it is clear each of these strategies has a great number of sub challenges that they are able to respond to them. Engineers as confirmed in the literature review already have an advantage of creative thinking, which must be natured because entrepreneurs must go beyond thinking to doing so the it would be important for these strategies to be implemented so to ensure that the objectives of such a study can bare positive fruits.

### **5.3 Implications of this Research**

As alluded in the introduction of the research that over the years there has been a great emphasis on the study of the transition of engineers to managers across business but with very limited research has been done on the transition or development of engineers into entrepreneurs. This research will certainly contribute to the body of knowledge in relation to the development of engineers into entrepreneurs. This research was also able to substantiate the existing literature, most importantly the data collected could and should be used by the NSBE-SA to guide their strategy in assisting their members to develop into successful entrepreneurs.

### **5.4 Limitations of the Study**

In as so far as limitations, it is safe to say that every study undertaken has limitations to it and this study was exception. Listed below are some of the limitations which the researcher encountered in this study:

- a) The quality of the research is only as good as the individual skills of the researcher and may be influenced by the personal biasness of the researcher. To improve the skills of the researcher and subsequently the quality of the research, the researcher studied research methods of successful undertaken previously
- b) One of the obvious limitations is the is the small sample size in relation to the number of engineers in the country and the sample population was not well distributed in terms of the location of engineers
- c) In the initial stage of the data collection the questionnaire was circulated via email and this caused a lot of delays from respondents to return the questionnaire, this was rectified by the researcher using an online survey which made it easier for the respondents to respond.
- d) There was a large volume of qualitative data to analyse using NVIVO, this was time consuming.
- e) The questionnaire was mainly administered to engineers who were members of the NSBE-SA, the questionnaire was later distributed to non NSBE-SA engineers to try and get a wider view.

## **5.5 Recommendations to solve problem facing the development of engineers into entrepreneurs and business leaders in South Africa**

This research through the response from the respondents there have been a number of recommendations that can be implemented to assist with the development of engineers into entrepreneurs. Below is the main recommendation from this study:

The institutions of higher learning in the western world such as the University of Central Florida, Rose-Hulman Institute of Technology and many others have long realised the need to formalize the training or development of engineers into entrepreneurs. With a great majority the engineers in the research indicating that the engineering curriculum should pay much more emphasis to entrepreneurship, the researcher would strongly advise on this view being taken up with the institutions of higher learning in South Africa. Institutions such as UKZN should look at developing an Engineering Entrepreneurship Programs which should be designed equip or prepare engineering students with the necessary tools and opportunities for them to succeed as entrepreneurs. This type of program will certainly assist in the facilitation and incubation of start-ups which are technology based as this is likely to increase the entrepreneurial activities. The proposed program should be created or packed to cater for engineers at different levels such as undergraduate and continuous short courses for post graduate engineers.

## **5.6 Recommendations for Future Studies**

This study has been able to establish that the entrepreneurial orientation and entrepreneurial intentions of South African engineers is positively high and therefore every effort to develop them should be done. With this said the previous section recommended that an Engineering Entrepreneurship Program should be established then the recommendation for future studies in this context will be:

A study in collaboration with institutions of higher learning to investigate the possibility and practicality of establishing an Engineering Entrepreneurship Programs within one of the existing engineering schools in South Africa as a pilot project. This study must also be in a position to establish the industries that may be required in the current environment of knowledge economy and the fourth industrial revolution. The research did not seek to establish the industries in which

the engineers are interested in. This would be imperative for the Engineering Entrepreneurship Program to establish such in order to tailor make the programs to reap maximum innovative results.

## **5.7 Summary**

The potential for engineers to develop into entrepreneurs is a great opportunity for the country to grow the economy and create sustainable employment opportunities for the great majority that languishes in abject poverty. Chapter one of this study provided the reader with the general overview of the research and background thereto research problem against the objective and the significance of the study. Chapter two provided an in-depth literature review on the key concepts and provided key definitions of an entrepreneur, definition and discussion of entrepreneurship, entrepreneurial orientation, entrepreneurial intention and transitional leadership.

Literature review which provides in depth analysis and evaluation of current knowledge regarding research problems that this study tends to examine. Key sections discussed in this chapter includes engineers as entrepreneurs and business leaders, the definition and discussion of an entrepreneur, definition and discussion of entrepreneurship, entrepreneurial orientation, entrepreneurial intention and transitional leadership. These theoretical definitions and discussions were imperative so as to provide the researcher with the theoretical understanding of the problem statement. Chapter three provided the research design and methodology for the study and it went on to provide key information such as the sample size, research instrument, validity and reliability of the research and finally the ethical consideration of the researcher and the research.

Contrasting the results of the research which were presented in Chapter four and the research objectives which were outlined in Chapter 1, the discussions outlined in Chapter 4 and the conclusions in Chapter five clearly show that the data collected and presented was of great assistance in solving the research problem statement. It can therefore be concluded that whilst the entrepreneurial intention and the entrepreneurial orientation of the engineers in South Africa are both high, the challenges being faced by the engineers seems to be a stumbling block in their ability to flourish. The study went on further to provide some practical recommendations which can be implemented by government in collaboration various institutions both private and public. The study went on further to recommend a long-term strategy of developing an Engineering Entrepreneurship Program in collaboration with the institutions of higher learning. With the above

said the findings of the study are supported in the main by the literature that exist currently on the subject matter, this therefore points to the fact that the research project has been a success.

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## Appendix 1- Questionnaire

**UNIVERSITY OF KWAZULU-NATAL  
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP**

Dear Respondent,

**MBA Research Project**

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**Supervisor:** Dr R. Sibanda (031 260 1479)

**Research Office:** Ms P Ximba 031-2603587

I, **Lungelo Reginald Ncwane** an MBA student, at the Graduate School of Business and Leadership, of the University of KwaZulu Natal. You are invited to participate in a research project entitled **The Development of Engineers into Entrepreneurs and Business Leaders in South Africa**. The aim of this study is to: **investigate the development of engineers into entrepreneurs and business leaders in South Africa.**

Through your participation I hope to understand the **development of engineers into entrepreneurs and the entrepreneurial orientation of engineers in South Africa**. The results of the research are intended to contribute to the final thesis

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey/focus group. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business and Leadership, UKZN.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about 20 minutes to complete. I hope you will take the time to complete this survey.

Sincerely



Investigator's signature \_\_\_\_\_ Date : 21 September 2018

**This page is to be retained by participant**

**UNIVERSITY OF KWAZULU-NATAL  
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP**

**MBA Research Project**

**Researcher:** Lungelo Ncwane (082 382 7442/ silungelo26@gmail.com)

**Supervisor:** Dr R. Sibanda (031 260 1479)

**Research Office:** Ms P Ximba 031-2603587

**CONSENT**

I.....(full names of participant)  
hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT:

DATE:

.....

**This page is to be retained by researcher**

**Section A: Personal data of the respondent**

Please indicate with an X in the appropriate box.

Please do not indicate your name or identity on this document.

1. Which one is your age group?

Less 25 years	26 – 35 years	36 – 45 years	46 – 55 years	More 55 years

2. Gender?

Male	Female	Other

If you answer is other, please specify\_\_\_\_\_

3. Engineering Branch Studied?

Chemical	Civil	Electrical	Electronics	Mechanical	Mining	Other

If you answer is other, please specify\_\_\_\_\_

4. Industry sector?

Consulting	Construction	Energy	Electronics	Production	Financial	Other

If you answer is other, please specify\_\_\_\_\_

5. Current Location?

KZN	Gauteng	Eastern Cape	Western Cape	Northern Cape	Mpumalanga	Limpopo	Free State	North West	Other

If you answer is other, please specify \_\_\_\_\_

**Section B: Characteristics required to develop an entrepreneur and a business leader**

This section explores the characteristics required to develop an entrepreneur and a business leader.

There are no right or wrong answers and please indicate your immediate impression.

**Section B1: Career progression**

1. Current Position?

CEO / Managing Director	Chairperson/ Deputy Chairperson	Other executive manager	Non-Executive Director	Senior Management	Technical	Other

If you answer is other, please specify \_\_\_\_\_

2. Qualification of engineers in senior management?

PhD	MBA/L	Other Management Masters	Higher technical qualification	Management Diploma	No other qualifications	Other

If you answer is other, please specify \_\_\_\_\_

3. Years spent in technical roles?

Nil	1-5 years	6-10 years	11-19 years	20+ years

4. Years spent in management roles?

1-10 years	11-20 years	21-30 years	31-40 years	41+ years

5. Reasons for move into management?

Always wanted management	Only promotion available	Avoiding technical career	Natural career progression	Good offer to move to management	Other

If you answer is other, please specify \_\_\_\_\_

**Section B2: Career-Related Characteristics**

This section explores the career related characteristics of the respondents. There are no right or wrong answers and please indicate your immediate impression.

1	= Not at all important
2	= Slightly important
3	= Neutral
4	= Moderately important
5	= Extremely important

<b>B2: Career Advancement</b>						
<b>How important has each of the following been to you in your career-decision-making so far?</b>						
1.	Having a well-paying job	5	4	3	2	1
2.	Having a secure job	5	4	3	2	1
3.	Finding a job that is a stepping stone to other opportunities	5	4	3	2	1
4.	Having a job that is intellectually interesting	5	4	3	2	1
5.	Having a job with a high level of independence and self-direction	5	4	3	2	1

<b>B2: Social and Family Considerations</b>						
<b>How important has each of the following been to you in your career-decision-making so far?</b>						
1.	Doing work that allows me to contribute to fixing problems in the world	5	4	3	2	1
2.	Having a job that allows me to contribute to the good of society	5	4	3	2	1
3.	Having a job that would please my family	5	4	3	2	1
4.	Having a job that gives me time for family, friends and hobbies	5	4	3	2	1

### **Section C: Entrepreneurial Orientation**

This section explores the entrepreneurial orientation of the respondents. There are no right or wrong answers and please indicate your immediate impression.

#### **1. What is your short definition of an entrepreneur?**

**2. In your opinion do you believe that entrepreneurs born or can they be developed?  
Why?**

**3. Are you interested in becoming an entrepreneur?**

**4. What is the driving force behind your aspirations of becoming an entrepreneur?**

**5. In your career path so far, have you started or co-founded your own company?**

**6. Are you looking to start a company or an organization in the near future? If your answer is yes what industry are you looking to start a company or an organization?**

**7. If you have no ambitions of becoming an entrepreneur or starting a business in the near future, please provide some reasons for your decision?**

## **Section D: Influential factors and Challenges**

This section explores the influential factors and challenges that engineers face in becoming entrepreneurs and business leaders. There are no right or wrong answers and please indicate your immediate impression.

**1. What is the main reason for you to become an entrepreneur?**

**2. What skills and attributes does one need to become a successful entrepreneur?**

**3. In your opinion did your engineering degree prepare you enough to become an entrepreneur?**

**4. Should the engineering degree curriculum pay much more attention on entrepreneurship?**

**5. If you are already an entrepreneur and a business leader, what are the biggest challenges that you have faced?**

**6. Are you aware of any incubator programs run by various institutions that are available to assist aspiring entrepreneurs?**

**7. In your opinion what support should be provided to engineers who are aspiring entrepreneurs and where can this support come from?**

**Section E: Recommendations and Strategies**

**Based on your experience in business and leadership please provide any strategies on how engineers can be developed into entrepreneurs and business leaders in South Africa**

## **Appendix 2- Ethical Clearance**

## **Appendix 3- Turnitin Report**