

Investigating an open innovation platform to accelerate commercialisation

L. E MOHALAJENG
22016740

Thesis submitted in fulfillment of the requirements for the degree
Magister Commercii in Entrepreneurship at the Potchefstroom
Campus of the North-West University

Supervisor: Prof J Kroon

November 2015

It all starts here TM



ACKNOWLEDGEMENTS

The completion of this thesis is a result of God's faithfulness, mercy and eternal love in the form of many wonderful people who deserve my deepest gratitude. Soli Deo Gloria.

My study leader, Professor Japie Kroon, who has always believed in me long before I could realise my potential, thank you. I am forever indebted to your excellent guidance, patience, motivation and immense expertise throughout my research, academic journey and growth as an individual. I could not have imagined having a better mentor, life coach and advisor.

My heart's home, Siyabulela Mdaka, I believe God used your encouragement and positive mindset to keep my spirit alive. You constantly led and prayed me through each chapter of this thesis, just as I know you will through each chapter of our lives. You're greatly appreciated.

My parents, Matsoso and Philadelphia Mohalajeng, I am privileged to have you. Although we all experienced difficult times and numerous challenges throughout my academic journey, you have been with me through it all. Your selflessness carried me through! Thank you.

My dearest sister, Lereko Mohalajeng and my best-friend Refilwe Mohalajeng, I am grateful for your compassion and sweet vulnerability. I am inspired by you, blessed by you and forever thankful for you. *Mfethoo, me has amado en los tiempos más oscuro.*

My backbone, the Dikoebes, Dlavaness, Leepiles, Mokatsanes and Mohalajengs. Each of you has taught me so much. I could never repay you for the values you have instilled in me. You have moulded me into who I am today through your undying love. Thank you.

My mentor, Jonathan Muringani. Your insightful knowledge and thought-provoking advice are incomparable. Thank you for planting the seed of curiosity on the topic and for leading me as I experienced the practical issues of business beyond the textbooks.

Dr. Plantinga, thank you for the invaluable advice and for being so supportive during the fieldwork of the research.

Petro Beukes, thank you for the transcription of my audio files. Your efforts are astounding! Your constant reassurance always gave me comfort as I slaved over every word.

Dr. Henrico and Dr. Meintjes, thank you for your knowledge and expertise on the qualitative component of this research.

Energy Sonono, thank you for professionalism in analysing the data and helping me interpret the statistical results.

Lisa Anne Julien, thank you for the excellent language editing and for being so meticulous in order to deliver a good quality thesis.

Trish Hougaard, thank you for your friendship and your assistance with designing the figures.

To all the staff at the School of Business Management, thank you for your encouragement and support.

The North-West University, thank you for the financial support.

The Innovation Hub and RIIS, thank you for allowing me to conduct my research. Thank you to all the individuals who partook in the research by filling in the questionnaire and participating in the interviews.

ABSTRACT

Successful entrepreneurship is an essential part of the globalised world of business. In South Africa, stimulating entrepreneurial activity had become the forefront of the economic development agenda as this is the greatest contributor to job creation and economic growth. As the competitive market rises, businesses are required to increasingly innovate in order to obtain a competitive advantage. The existence of an effective and efficient innovation value chain from idea to market is important in order to encourage the survival and growth of new businesses in South Africa. Through the innovation value chain, businesses across all industries are starting to embrace Open Innovation in order to maintain their competitive advantage, remain sustainable and in essence, meet consumer needs.

Open Innovation is the use of inflows and outflows of knowledge beyond the boundaries of a business. The inflow of knowledge accelerates internal innovation while the outflow of knowledge expands the markets for the external use of innovation. It therefore plays a significant role in the economy as it stimulates entrepreneurship through commercialising new ideas. The problem is that whilst the benefits of Open Innovation in commercialising new inventions is widely spoken about, not much is understood on the successes of Open Innovation intermediaries (known as Open Innovation accelerators) in accelerating ideas to market or helping inventors and entrepreneurs commercialise their ideas.

The primary objective of this research is to investigate the ability of an Open Innovation platform to accelerate the commercialisation of new ideas and inventions. Entrepreneurship within the innovation value chain and the challenges and opportunities presented by Open Innovation were investigated throughout this research. Open Innovation is now becoming a progressive business practice. As a result, the study was able to obtain current knowledge and perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation in South Africa.

The researcher adopted a multi-methods approach to collect, analyse and report data. Multi-methods include both Quantitative and qualitative research methods. A total of 197 respondents and participants took part in the study. Data was collected primarily through the use of Quantitative research methods while qualitative data was collected to compliment the Quantitative information. The Quantitative method was used for analysing the demographic profiles of the respondents who participated in the research, as well as their perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation. A qualitative method was used to obtain a broader perspective of the Open Innovation platform from

its stakeholders. The statistical analyses of Quantitative data were done with the assistance of the Statistical Consultation Service of the North-West University (Potchefstroom Campus), while the qualitative data was analysed by the researcher with the assistance of an expert.

The results of the Quantitative and qualitative research indicate that respondents, regardless of their sector, business focus or level of education, have similar views regarding entrepreneurship, the innovation value chain, collaboration innovation, Open Innovation, Open Innovation accelerators and accelerating commercialisation in South Africa. Innovation, as the results highlighted, is applied throughout all functions of businesses and industries. It is a specific instrument of entrepreneurship and occurs in existing businesses, government agencies as well as research institutions across South Africa. When promoting Open Innovation it is important to ensure the collaboration and buy-in of the triple-helix because their involvement accelerates the process of making deals. Also, three supporting functions, marketing, funding and Intellectual Property protection, are required when employing Open Innovation in order to successfully accelerate commercialisation of a new product.

Open Innovation accelerators are recommended to seek technical measures for actively preventing IP leakage rather than just advising the solution providers in regards to IP. Various IP protection programmes and methods exist. For Open Innovation accelerators, exerting entrepreneurial behaviour is essential. This implies having the ability to identify opportunities and take calculated risks. Open Innovation platform stakeholders should continuously recognise opportunities for solving solutions in unexpected domains and as a result effectively market the challenges across domains.

Open Innovation in South Africa is a concept that is still emerging; patience and persistence is recommended if greater impact is to be realised. No one structure for Open Innovation is likely to be sufficient going forward. It is recommended that policymakers, research institutions and commercial enterprises explore various innovations across industries relevant to their Open Innovation proficiencies. Flexibility is therefore vital when implementing Open Innovation.

LIST OF KEY TERMS

For the purpose of clarification and consistency, the key terms namely business, entrepreneurship, innovation value chain, Open Innovation and business are defined as follows:

- **Business:** The term business is often used when defining the sale of goods and services in return for money. Businesses can be state-owned, privately owned or not-for-profit (Anon, 2014). It is in essence an industrial or commercial organisation run by one or more individuals. The term business is often interchanged with firm, organisation, enterprise, company and venture. For the purpose of this research, a business is defined as a firm, organisation, enterprise, company or venture that is government-owned, privately owned, not-for-profit or para-state with more than one employee that is run in order to make a profit or to serve a need.
- **Entrepreneurship:** Entrepreneurship is described as an activity that involves the discovery, evaluation and utilisation of opportunities in order to introduce new goods and services, ways of organising, markets, processes and raw materials through organising efforts that previously had not existed (Shane & Venkataraman, 2000:219). Innovation is therefore characterised as an attribute of entrepreneurship. By contrast, Schumpeter (1934:132) states that entrepreneurs need not have accumulated any kind of goods, or created original means of production, but have employed means the of production differently and more advantageously. They carry out new combinations and the surplus, to which no liability corresponds, is their entrepreneurial profit. For this research, the definition of entrepreneurship is adopted from Schumpeter (1934:78) as the ability of a talented individual (the entrepreneur), who comes across a worthwhile idea, to introduce his/her idea to a market or industry. Entrepreneurship is therefore the result of new combinations from existing inputs and the emergence of new industries.
- **Innovation value chain:** Innovation from its origin is the ability to invent something new (Gundogdu, 2012: 299). Innovation means creating products or services and further developing them technologically. Similar to the above definition of entrepreneurship, innovation involves bringing about any form of change. Innovation is a specific function of entrepreneurship as it is the means by which an entrepreneur creates new wealth-producing resources or endows existing resources with enhanced potential for wealth creation (Drucker, 2011:5). The innovation value chain presents innovation as a sequential process. This process entails idea generation, idea conversion and the diffusion of developed concepts. The innovation value chain is the process of transforming ideas into commercial outputs as an

integrated flow occurring inside a business unit, across units in a business and outside the business as well (Hansen & Birkinshaw, 2007:3).

- **Open Innovation:** Open Innovation is mass collaboration and is being used as a method of connecting solution seekers with solution providers (Piller & Diener, 2013:6). The purposive inflows and outflows of knowledge in order to accelerate internal innovation and expand markets for external use of innovation, respectively is defined to as Open Innovation (Chesbrough, 2003:xxiv). It refers to a set of defined processes and engagements with virtual and physical networks to discover, isolate and implement innovative ideas, technologies, products and capabilities from outside organisations to address identified problems/challenges (Chesbrough, 2003:xxiv). Another term used to explain Open Innovation and related activities is crowd-sourcing (Howe, 2009:1). This theory suggests that businesses can and should use external ideas as well as internal ideas. Open Innovation has emerged to become a progressive business practice. Internationally businesses across all industries are embracing Open Innovation in order to maintain their competitive edge and in essence meet consumer needs (Fikkert *et al.*, 2011:5).
- **Triple-helix:** The triple helix model is the relationship between university, industry and government (Leydesdorff, 2006:3). It is, in essence, the crossing over of businesses, public research and government regulations. The use of the triple-helix helps further develop structures for policy makers who continuously find ways to promote knowledge-based entrepreneurship. Viale and Etzkowitz (2010:3) add that with the triple-helix, the interaction between academia and industry through public intervention increases significantly. This occurs as government sustains the flow of innovation through institutional incentives, financial support and various mechanisms for the collaboration between academia and industry. For this research, the definition of the triple-helix is adopted from the OECD (2013:1) as the interaction of research, government and industry in order to promote business innovation.

LIST OF ABBREVIATIONS

GIKES	Gauteng Innovation and Knowledge Economy Strategy
IP	Intellectual Property
OECD	Organisation for Economic Co-operation and Development
OIA	Open Innovation Accelerators
R & D	Research and Development
SMME	Small, Medium and Micro-sized Enterprise
WIPO	World Intellectual Property Organisation

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	I
ABSTRACT	III
LIST OF KEY TERMS.....	V
LIST OF ABBREVIATIONS	VII
LIST OF TABLES	XV
LIST OF FIGURES.....	XVII
CHAPTER 1 INTRODUCTION AND BACKGROUND	1
1.1 INTRODUCTION	1
1.2 BACKGROUND OF THE RESEARCH.....	1
1.3 PROBLEM STATEMENT	2
1.4 GOAL AND OBJECTIVES OF THE RESEARCH	4
1.4.1 Primary goal	4
1.4.2 Secondary objectives.....	4
1.5 RESEARCH METHODOLOGY	4
1.5.1 Literature study.....	5
1.5.2 Empirical survey	5
1.6 PRELIMINARY CHAPTER CLASSIFICATION	11
1.7 SUMMARY	13

CHAPTER 2 ENTREPRENEURSHIP AND THE INNOVATION VALUE CHAIN.....	14
2.1 INTRODUCTION	14
2.2 DEFINING ENTREPRENEURSHIP	14
2.2.1 Entrepreneurship from a behavioural perspective	15
2.2.2 Entrepreneurship from an economic perspective	16
2.3 TYPES OF ENTREPRENEURSHIP	18
2.3.1 Traditional entrepreneurship: entrepreneurship	18
2.3.2 Corporate entrepreneurship: intrapreneurship	19
2.4 DEFINING INNOVATION	20
2.4.1 Sources of innovation	21
2.4.2 Types of innovation	22
2.5 THE LINK BETWEEN INNOVATION AND ENTREPRENEURSHIP	24
2.5.1 The era of innopreneurship.....	25
2.6 THE INNOVATION VALUE CHAIN.....	26
2.6.1 Idea generation phase.....	28
2.6.2 Idea conversion phase.....	30
2.6.3 Idea diffusion phase	33
2.7 SUPPORTING THE INNOVATION VALUE CHAIN.....	37
2.7.1 Marketing.....	37
2.7.2 Funding	40
2.7.3 Intellectual property	43
2.8 SUMMARY	45

CHAPTER 3 OPEN INNOVATION AND OPEN INNOVATION ACCELERATORS.....	47
3.1	INTRODUCTION..... 47
3.2	THE BIRTH OF OPEN INNOVATION 48
3.3	DEFINITION OF OPEN INNOVATION 49
3.4	OPEN INNOVATION PROCESS..... 51
3.4.1	Outside-in Open Innovation process..... 52
3.4.2	Inside-out Open Innovation process 52
3.4.3	Coupled Open Innovation process..... 53
3.5	BENEFITS AND CHALLENGES OF OPEN INNOVATION..... 54
3.5.1	Advantages of Open Innovation..... 54
3.5.2	Disadvantages of Open Innovation 55
3.6	OPEN INNOVATION ACCELORATORS (OIA)..... 57
3.6.1	Open Innovation techniques 58
3.6.2	The Innovation Hub Open Innovation Solution Exchange 61
3.7	SUMMARY 65
CHAPTER 4 RESEARCH METHODOLOGY	67
4.1	INTRODUCTION 67
4.2	EMPIRICAL RESEARCH..... 68
4.2.1	Literature study..... 68
4.2.2	Research design..... 69
4.2.3	Method of data collection..... 71
4.3	SAMPLING PLAN..... 75

4.3.1	Population	75
4.3.2	Sampling frame and unit.....	76
4.3.3	Sampling methods.....	77
4.3.4	Sampling size	82
4.3.5	Specify sampling plan.....	83
4.3.6	Sampling for qualitative research.....	85
4.3.7	Selecting the sample	88
4.4	RESEARCH INSTRUMENT: QUANTITATIVE RESEARCH	88
4.4.1	Aligning the literature study with the questionnaire	90
4.4.2	Designing the format of the questions.....	91
4.4.3	Choosing the wording of the questions	92
4.4.4	The sequence of the questionnaire.....	93
4.4.5	Explaining the purpose of the questionnaire	94
4.4.6	Pre-testing the questionnaire	95
4.5	RESEARCH INSTRUMENT: QUALITATIVE RESEARCH.....	95
4.5.1	Semi-structured interviews.....	95
4.5.2	One-on-one interviews.....	96
4.5.3	Development of the interview questions.....	96
4.5.4	Recording the interviews	97
4.5.5	Transcribing the interviews	98
4.5.6	Pre-testing the interview	98
4.6	DATA ANALYSIS	98
4.6.1	Data validation and editing	98

4.6.2	Data coding	99
4.6.3	Data entry.....	99
4.6.4	Logical cleaning of data	99
4.6.5	Tabulation and statistical analysis.....	100
4.6.6	Statistical methods and techniques used for Quantitative research	100
4.6.7	Effect sizes	104
4.6.8	Factor analysis	104
4.6.9	Reliability and validity	106
4.6.10	Method used for analysing qualitative data	109
4.7	TRIANGULATION	110
4.8	RESEARCH REPORT	110
4.9	SUMMARY	110
CHAPTER 5 EMPIRICAL RESEARCH: PRESENTATION AND DISCUSSION OF FINDINGS AND RESULTS		113
5.1	INTRODUCTION	113
5.2	QUANTITATIVE ANALYSIS	113
5.2.1	Demographic profile of respondents	114
5.2.2	Exploratory factor analysis.....	116
5.2.3	Factors extracted from EFA	116
5.2.4	Reliability	123
5.2.5	Validity.....	124
5.2.6	Inferential statistics	124
5.2.7	Cross tabulations.....	131

5.3	QUALITATIVE ANALYSIS.....	140
5.3.1	Demographic profile of participants in the qualitative research	141
5.3.2	Theme 1: Open Innovation accelerator.....	141
5.3.3	Theme 2: Accelerating commercialisation.....	145
5.3.4	Theme 3: Open Innovation	149
5.4	SUMMARY	151
 CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS		153
6.1	INTRODUCTION	153
6.2	OVERVIEW	153
6.2.1	Objectives of the research	154
6.2.2	Research methodology.....	155
6.3	CONCLUSIONS AND RECOMMENDATIONS PERTAINING TO EACH SECONDARY OBJECTIVE.....	156
6.3.1	Secondary objective 1: Investigate entrepreneurship in the innovation value chain.....	157
6.3.2	Secondary objective 2: Describe Open Innovation and the platform used in accelerating commercialisation	159
6.3.3	Secondary objective 3: Examine the challenges and opportunities presented by Open Innovation in accelerating ideas to market	161
6.3.4	Secondary objective 4: Determine perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation	163
6.4	LIMITATIONS OF THE RESEARCH.....	170
6.5	RECOMMENDATIONS FOR FUTURE RESEARCH.....	171

LIST OF REFERENCES 172

ANNEXURE A 184

ANNEXURE B 189

ANNEXURE C 191

ANNEXURE D 193

ANNEXURE E..... 195

LIST OF TABLES

Table 2.1:	Types of innovation	24
Table 4.1:	Target population for the research	76
Table 4.2:	Attributes of Internet questionnaires as well as delivery and collection questionnaires.....	89
Table 4.3:	Theory and objectives of the research found in the research instrument	91
Table 4.4:	Questionnaires collected.....	95
Table 4.5:	Questions asked in semi-structured interview	97
Table 5.1:	Demographic profile of respondents.....	115
Table 5.2:	Results of exploratory factor analysis (EFA).....	117
Table 5.3:	Innovation factor	117
Table 5.4:	Open Innovation accelerator factor	118
Table 5.5:	Open Innovation factor.....	119
Table 5.6:	Innovation value chain factor.....	120
Table 5.7:	Entrepreneurship factor.....	121
Table 5.8:	Collaboration factor	121
Table 5.9:	Accelerating commercialisation factor	122
Table 5.10:	Cronbach's alpha coefficients associated with factor analysis.....	123
Table 5.11:	Results of ANOVA tests regarding respondents' sector.....	125
Table 5.12:	Results of ANOVA tests regarding level of education.....	127
Table 5.13:	Results of ANOVA tests regarding respondents' sector.....	128
Table 5.14:	Summary of results from question 46 - 49.....	131

Table 5.15:	Cross tabulation of variables of interest and whether angel investors have financed respondents' innovation.	132
Table 5.16:	Cross tabulation of variables of interest and whether respondents have protected their IP by registering for a patent and/or trademark.....	134
Table 5.17:	Cross tabulation of variables of interest and whether respondents have applied for funding from government schemes.....	136
Table 5.18:	Cross tabulation of variables of interest and whether respondents have approached commercial banks for funding.....	138
Table 5.19:	Participants responses regarding defining a challenge.....	143
Table 5.20:	Participants responses regarding evaluation potential solutions.....	144
Table 5.21:	Participants responses regarding deal-making.....	145
Table 5.22:	Participants responses regarding protecting intellectual property.....	146
Table 5.23:	Participants responses regarding marketing.....	147
Table 5.24:	Participants responses regarding measuring success.....	149
Table 5.25:	Participants responses regarding collaboration.....	150
Table 5.26:	Participants responses regarding triple-helix.....	151

LIST OF FIGURES

Figure 1.1:	Synopsis of Chapter 1	1
Figure 1.2:	Research methodology	4
Figure 1.3:	Chapter outline of the research	12
Figure 2.1:	Synopsis of Chapter 2.....	15
Figure 2.2:	The innovation value chain.....	26
Figure 2.3:	Idea generation phase in the innovation value chain	30
Figure 2.4:	Idea conservation phase in the innovation value chain.....	33
Figure 2.5:	The idea diffusion phase in the innovation value chain.....	36
Figure 2.6:	Summary of marketing mix.....	39
Figure 2.7:	Funding streams in relation to the innovation value chain	40
Figure 3.1:	Synopsis of Chapter 3.....	48
Figure 3.2:	Open Innovation.....	51
Figure 3.3:	Three types of Open Innovation processes	54
Figure 3.4:	Conceptual framework of The Innovation Hub Solution Exchange	62
Figure 4.1:	Synopsis of Chapter 4.....	68
Figure 4.2:	Stages of the research process.....	68
Figure 4.3:	Summary of various sampling methods.....	78
Figure 4.4:	Quantitative sampling operational plan.....	83
Figure 4.5:	Stakeholders of the Open Innovation platform.....	86
Figure 4.6:	Qualitative sampling operation plan	87
Figure 5.1:	Synopsis of Quantitative analysis.....	114

Figure 5.2: Synopsis of qualitative analysis..... 140

Figure 5.3: Participants of the qualitative research..... 141

Figure 6.1: Synopsis of Chapter 6..... 153

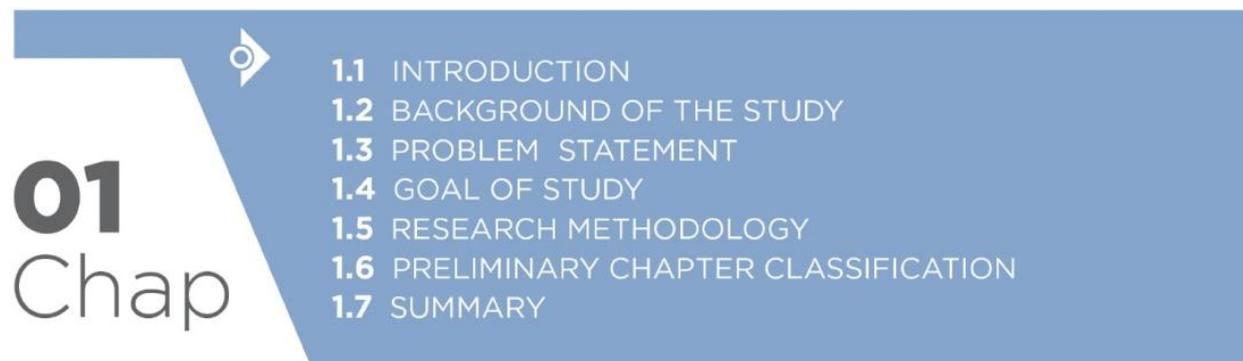
CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

In this chapter, the contextual background information regarding the research is outlined. The problem statement, goal of the research and an outline of the literature overview are also provided. The chapter concludes with a brief discussion of the research methodology and the preliminary chapter classification followed in this research. Figure 1.1 provides an abbreviated synopsis of Chapter 1 pertaining to the main sections that are to be discussed.

Figure 1.1: Synopsis of Chapter 1



1.2 BACKGROUND OF THE RESEARCH

Successful entrepreneurship is crucial for a growing economy. Developing countries are characterised by low Gross Domestic Product (GDP) per capita income and high Total early-stage Entrepreneurial Activity (TEA) rates. The low GDP is generally a result of either unemployment or very low wages in these developing countries. Subsequently, individuals find themselves starting businesses as a result of their inability to find jobs or supplement low wages. The Global Entrepreneurship Monitor (GEM) report has shown a direct relationship between the level of early-stage entrepreneurial activity and per capita income across a range of economies. This implies that the progress and development of entrepreneurship is vital for economic growth in developing countries (Turton & Herrington, 2012:41).

South Africa is a middle income country with relatively low GDP per capita income (Dutta & Lanvin, 2013:307). In effort to raise this GDP per capita income, the government has turned towards entrepreneurship and SMME development. There have been a number of initiatives and incentives that aim to achieve this. However, South Africa has shown very little early-stage entrepreneurial activity with a mere 7.3% TEA rate in 2012 which is far below the 14.3%

average for efficiency-driven economies (Turton & Herrington, 2012:8). The level of early-stage entrepreneurial activity in South Africa has implications on economic growth and job creation in the country.

One of the reasons for the low entrepreneurial activity is that whilst there's been policy pronouncements at a macro level, there has been very little follow up at the meso level, as well as disinterest from the micro level (Bodhanya, 2008:7). The meso level is made up of government and private agencies, as well as intermediaries who serve to translate government policy into tangible benefits for the micro level i.e. entrepreneurs and SMME's. Contributors in the meso level include science parks and incubators. While most of these meso players have concentrated on traditional incubation services, there has been a recent interest in using innovative approaches such as Open Innovation to stimulate entrepreneurship (Cunningham, 2012:77).

The Innovation Hub is a science park in Pretoria, South Africa. It uses Open Innovation as one of the methods to implement the Gauteng Innovation and Knowledge Economy Strategy (GIKES). One of the aims of this strategy is to stimulate innovation and successful commercialisation. The Innovation Hub Open Innovation Solution Exchange, a web-based platform, presents an opportunity to investigate the bridging or crossing of the chasm from invention to commercialisation (Anon, 2013).

Investigating the people, products, expectations and traction on the portal can lead to an in-depth understanding of what is needed to bridge the gap from invention or idea to market or successful commercialisation. The research helps policy makers in making better decisions about what is needed to encourage success in taking ideas to market and in essence promoting a total early-stage entrepreneurial activity. This research also helps inventors make better decisions in taking their ideas to market by enabling them to better understand the intricacies and complexities of what it takes to successfully take an idea to market.

1.3 PROBLEM STATEMENT

Early-stage entrepreneurial activity is essential for economic growth in developing countries. This means that the development and advancement of entrepreneurship is fundamental in developing countries (Turton & Herrington, 2012:41). An effective and efficient innovation value chain from idea to market is important in order to encourage the start, survival and growth of new businesses in South Africa. The country is currently challenged with encouraging entrepreneurial activity, the greatest contributor to job creation (Fal *et al.*, 2010:2).

Although there are schools of thought that technology innovation or invention is critical for entrepreneurship, SMME development and job creation, there's very little understanding about what is actually needed to successfully take ideas to market. There have been top-down policies seeking to stimulate technology innovation or invention without much success (Chaminade & Edquist, 2010). It appears that the understanding of idea-to-market has focused mainly on the extreme ends of the innovation value chain, i.e. R&D on one end and marketing on the other. In doing this, the range of activities and processes of this value chain have been overlooked.

There is no clear distinction between what constitutes an invention and what makes an innovation, therefore creating unrealistic expectations on what could be an entrepreneurial opportunity. An invention does not necessarily translate into an entrepreneurial opportunity (Braunerhjelm, 2010:19). The ideator or inventor often perceives him/herself as the only factor critical in taking his/her idea to market, not realizing that the ideator and the entrepreneur (the commercialisation entity) are not always present in one person (Stibel, 2009). Furthermore, this has been compounded by a lack of understanding of how the entrepreneur, if it's a different person, can add value and compliment the ideator in successfully taking the idea to market. Also, the role of venture capital has been misunderstood as it has created the impression of managing the ideator or inventor (Mbhele, 2012:95).

Open Innovation is mass collaboration and is being used as a method of connecting solution seekers with solution providers (Piller & Diener, 2013:6). The solution providers could be inventors or entrepreneurs with an invention or solutions to organisational or market challenges and needs. Solution seekers could be understood as small to big businesses, as well as the market in general, seeking solutions to challenges within their businesses and its environment. Connecting solution seekers with solution providers relies on Open Innovation intermediaries (Anon, 2013). Open Innovation allows access to external resources since inventors are able to leverage on the global innovation community (Chesbrough, 2003:xxiv). This implies that Open Innovation connects the entrepreneur or inventor with funders, IP lawyers, physical facilities, associations, and standards as well as with other role players within the market place. The problem is that whilst the benefits of Open Innovation in connecting solution seekers with solution providers is widely spoken about, little is understood on the successes of Open Innovation intermediaries in accelerating ideas to market or helping inventors or entrepreneurs in commercialising their ideas.

The purpose for undertaking this research was to investigate an Open Innovation platform to accelerate commercialisation.

1.4 GOAL AND OBJECTIVES OF THE RESEARCH

1.4.1 Primary goal

The goal of this research was to investigate the ability of an Open Innovation platform to accelerate the commercialisation of new ideas and inventions.

1.4.2 Secondary objectives

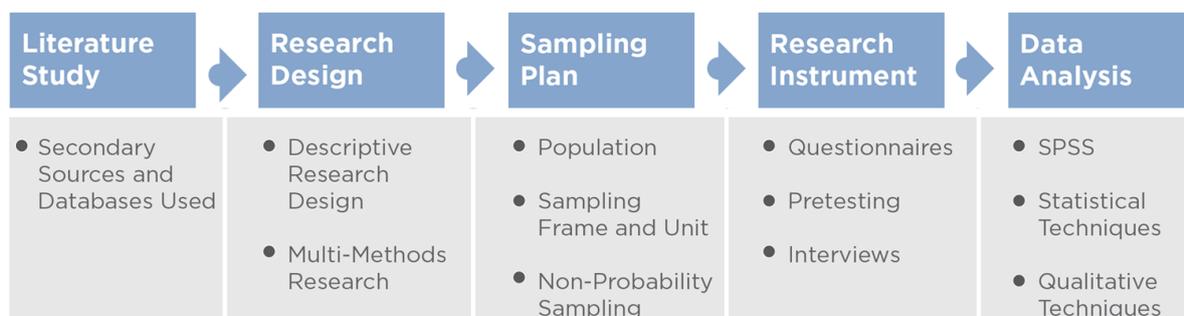
The secondary objectives of this research were to:

1. Investigate entrepreneurship in the innovation value chain.
2. Describe Open Innovation and the platform used in accelerating commercialisation.
3. Examine the challenges and opportunities presented by Open Innovation in accelerating ideas to market.
4. Determine the perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation.

1.5 RESEARCH METHODOLOGY

The research methodology describes the approach and methods that were used to collect data for the research. Data can be gathered using a choice of approaches as well as collection methods that accompany each of these approaches. Once this research design and method of data collection has been elucidated, the development of the sample plan as well as a clear description of the research instrument is provided (Creswell, 2013:8). Figure 1.2 provides an outline of the methodology used throughout this research.

Figure 1.2: Research methodology



Source: Berndt and Petzer (2011:42)

1.5.1 Literature study

Data that is collected by external parties is referred to as secondary data as this data may have been collected to solve other research problems. Normally this data is expensive, easy and quick to obtain (Berndt & Petzer, 2011:42). Secondary data, definitions of the research as well as theoretical foundations were obtained through an orderly approach by initially using electronic databases and subsequently gaining significant studies by scholars in the field of innovation, entrepreneurship and Open Innovation.

Secondary resources were obtained through the use of books obtained from libraries at the University of Pretoria, University of South Africa, North-West University as well as the Tshwane University of Technology. Secondary resources were also obtained through subject specific journals, websites as well as accredited and scholarly journal articles. The databases from which these secondary resources were found were SABICAT, EBSCO, Emerald, Google Scholar and SAE-publications. Accredited news websites, local government publications and comparative reports were utilised to establish the need for researching the problem.

A few of the sources that were consulted date back as far as 1934. The reason for consulting these older sources is attributed to the fact that their contributions, based on the authors' view of a specific school of thought or concept, are important in order to understand the full impact of the research problem. The older sources used for the literature study conducted in this study are provided in Chapter 4.

The literature study points out how various secondary data relate to one another and how the proposed research connects with them. The literature study is discussed in more detail within Chapter 4.

1.5.2 Empirical survey

The empirical research refers to the research design, data collection methods, development of the sample plan and the questionnaire of the research. The techniques which are used to analyse the data obtained by the questionnaires also forms part of the empirical research (Welman *et al.*, 2005:14).

1.5.2.1 Research design and method of data collection

The research design is the foundation of the study and is dependent upon the research question and type of information the researcher is seeking. There are three common research designs, namely descriptive, exploratory and causal (Kolb, 2008:5).

For this research, descriptive research methods were used to gather information. Descriptive research is defined as studies that are constructed to answer Who, What, When and How questions and are connected with providing an accurate picture of some aspects of the marketing environment (Cant, 2008:33).

This research design is ideal since its purpose is to (1) describe the characteristics of certain groups, (2) to estimate the proportion of people in a specified population who behave in a certain way and, (3) make specific predictions (Churchill & Iacobucci, 2005:163).

The above gives a clear justification for the research design method chosen for this research. The research was therefore descriptive in nature since the method allows for quantitative and qualitative data to be gathered.

Once the research design was chosen, the method of data collection was also selected in order to coincide with the purpose of the research. Data collection refers to the gathering of primary and secondary data. The collection of primary data can be done through qualitative research, quantitative research or a mixture of the two. Qualitative data is open, in-depth and unstructured data collected from individuals. This type of data often generates information that is difficult to find or quantify. Quantitative data, on the other hand, is collected from larger numbers of individuals with the intention that the results will be projected to a wider population (Tustin *et al.*, 2005:89).

The multi-method research design that was used in this research is the concurrent embedded status research design (QUAN/qual) (Johnson & Onwuegbuzie, 2004:22). The QUAN/qual notation indicates qualitative methods are embedded in a quantitative design just as the capitalisation indicates a priority on quantitative research (Creswell, 2009:210). In this research the capitalisation of the first letter of Quantitative indicates an emphasis on the method. The data was collected primarily through the use of Quantitative research methods while qualitative data was collected to compliment the Quantitative information. The researcher's primary aim was to collect Quantitative data and use a qualitative component to provide supportive information. The qualitative research was therefore embedded within a primarily Quantitative research. The embedded design was used to enhance and support the application of the Quantitative findings of the research. This means that neither the integration of data nor the connection of the data across phases in the research is being utilised. The researcher collected both Quantitative and qualitative data simultaneously.

Quantitative research using questionnaires was used to gather data relating to perceptions of respondents regarding Open Innovation. Questions helped gain information regarding

demographics, attitudes and intentions of inventors and stakeholders using the Open Innovation platform. Qualitative data collection through one-on-one interviews was used to explore, further understand and provide an in-depth description of the Open Innovation platform used in taking ideas to market.

1.5.2.2 Development of the sample plan

The sampling process involves defining the population, specifying the sample framework, selecting an appropriate sampling method and determining the sample size (Berndt & Petzer, 2011:170).

Population

The target population possesses a common set of characteristics which relate to the specific research problem (Cant, 2008:164). The population for this research was all individuals who have made use of Open Innovation platforms in South Africa, particularly the Open Innovation Solution Exchange run by the Innovation Hub which is based in the Gauteng Province.

Sample framework

The sampling framework refers to the available listing of all population elements from which the population is drawn. It may also be the basic units of the population to be sampled (Berndt & Petzer, 2011:172). For the purpose of this research, the sampling framework and units included start-ups, idea-to-market role players, government agencies, SMME's, inventors/innovators, entrepreneurs as well as venture capitalists that have registered onto the Open Innovation platform.

Sample method

Probability sampling is based on the concept of random selection in which a controlled procedure assures that each element in the population has a known chance of being selected as part of sampling (Berndt & Petzer, 2011:175). Probability sampling consists of five methods of gathering information, namely simple random sampling, stratified sampling, multistage sampling, cluster sampling and systematic sampling.

Non-probability sampling is explained as a sampling method that relies on the discretion of the researcher (Tustin *et al.*, 2005:344). Not all population elements have an equal chance of being included in the sample. Non-probability sampling consists of five methods, namely judgemental sampling, purposive sampling, quota sampling, snowball sampling and convenience sampling (Berndt & Petzer, 2011:174).

Of the two kinds of sampling methods, non-probability sampling was utilised in this research. Convenience sampling was used to gather Quantitative information. Convenience sampling implies that the researcher chooses any willing and available individuals as respondents provided they comply with the researcher's set criteria (Kolb, 2008:110). The manner in which respondents was chosen was convenient.

Purposive sampling was used when gather qualitative information. With purposive sampling, the researcher chooses participants whose answers will achieve the set objectives set by the researcher (Kolb, 2008:112). This research concentrated on accelerating processes within the innovation value chain through an Open Innovation platform. The criterion of the research therefore specified that the chosen respondents should be role players within the idea-to-market value chain and the Open Innovation platform.

Sample size

The greater the dispersion within the population and desired precision, the larger the sample must be (Berndt & Petzer, 2011:176). The specification of the sampling size was a subjective judgement made by the researcher. According to Shiu *et al.* (2009:462) a researcher's personal judgement is often based on past studies, experiences, availability of resources, industry standards and intuition. The researcher compared the benefits of obtaining the desired data against the costs associated with gathering that data. Since non-probability sampling was used for this research, the researcher used personal judgement and the study leader's advice when deciding on the size of the sample.

Participants for the qualitative component of this research were purposefully selected from the population. These participants have not necessarily registered on the platform nor attended workshops as partakers but instead are key stakeholders in the success of the platform and workshops held on Open Innovation awareness in South Africa.

1.5.2.3 Research instrument

Since multi-methods research was used for this research, two research instruments were employed. For obtaining Quantitative data, the primary instrument used was a self-administered questionnaire. On the other hand, qualitative data was obtained in the form of semi-structured interviews and the researcher herself was the means through which the data was gathered.

Quantitative research

The designed questionnaire only consisted of two sections that corresponded with the objectives set out for this research. Demographic variables were measured in section A and

contained close-ended multiple-choice questions. In section B, the perceptions of respondents regarding entrepreneurship, the innovation value chain and Open Innovation were measured. The first 46 questions in section B were close-ended five-point Likert-scale questions while the last four questions were dichotomous questions (see appendix A).

It was vital to ensure a high response rate from the population. The response rate is the number of respondents who completed the questionnaire divided by the sum of respondents who were asked to participate (Anon, 2010:1). The higher the response rate, the more useful the results will be. A high response rate was ensured as participants were motivated to complete the questionnaires in the following manner:

- Personalising the questionnaire: The North-West University letterhead was utilised, using recognisable graphics such as the logo. The cover letter included the study leader's contact information.
- Creating a participant-friendly questionnaire: The number of questions was limited to what was needed to be known. Clear and easy-to-follow instructions were provided with simple comprehensible language in order to make the questionnaire simple to complete. The questionnaire ended with a note thanking the participant and restated the due date for response. Traditionally busy periods such as long weekends and public holidays were avoided. Through these endeavours a high response percentage was reached.

Qualitative research

For the qualitative component of this research, data was collected by the researcher through the use of semi-structured interviews, where participants were asked open-ended questions. Interviews were conducted on a one-on-one base. The researcher asked opinion and knowledge questions. Opinion questions are aimed at understanding the cognitive and interpretive processes of key stakeholders in the Open Innovation platform (Patton, 2002:383). The interviews garnered their opinions and judgements about their experience and issues on the platform. Knowledge questions were asked to inquire about the factual information regarding the Open Innovation platform.

Interviews were recorded using a tape recorder. Recording the interview allowed the researcher to fully engage in and concentrate on the interviews. Using a tape recorder eliminates the need to take notes and rather allows the researcher to take more strategic notes (Patton, 2002:383). The recordings from the interviews were transcribed by an expert at the North-West University.

Key themes from the interviews were identified by the researcher during the data analysis phase and therefore reported on qualitatively to compliment the overall Quantitative research.

1.5.2.4 Data gathering

In order to ensure an adequate number of responses are gathered the following was done:

Quantitative data: Questionnaires were handed out at Open Innovation workshops. Workshops were usually attended by between 30 - 100 potential respondents. To ensure a high response rate, respondents were requested to hand in the completed questionnaire after the workshop. Respondents who did not attend workshops but were registered onto the Open Innovation platform were contacted via email and requested to complete an online version of the questionnaire. After a certain period of time, respondents were sent another email reminding them to complete the questionnaire. In doing so, a response rate of 192 respondents was obtained.

Qualitative data: The researcher performed semi-structured interviews with 5 participants. These participants had an in-depth understanding of Open Innovation in the South African context, the Open Innovation platform and components needed in accelerating ideas (solutions posted onto the platform) into commercialised entities. Unlike respondents for Quantitative data, these participants had not necessarily registered on the platform nor participated in workshops. They were key stakeholders in the success of the workshops and the overall Open Innovation platform.

1.5.2.5 Data analysis and reporting

Analysing **Quantitative data** involves deciding the exact kind of information which needs to be obtained and thereafter summarising that information gathered in terms of the research's objectives (Cant, 2008:204). Statistical Package for the Social Sciences (SPSS) version twenty by IBM program was used for statistical data processing and analysis.

The sample T-test was used in order to determine significant differences between two groups. When using this technique, the assumption was that the groups are independent of each other. When determining whether the means of two or more than two independent groups were the same or have significant differences, the One-way ANOVA technique was used. This technique assumed that there is normal distribution of the dependant variable.

Kaiser's Measure of Sample Adequacy (MSA) was used to determine whether a factor analysis was appropriate. Exploratory factor analysis (EFA) was conducted to identify the variables structure that explained each of the specified underlying items of using Open

Innovation to accelerate commercialisation. In order to confirm the reliability of the factors extracted through the EFA, Cronbach's alpha was utilised. Reliability is the relative freedom from random error variance. Random error is observable but can be estimated (Guion, 2004:70). The method of reliability estimation is on the basis of sorts of variance to be treated as error. In addition to reliability, this research also needed to be valid.

Validity is defined as the extent to which a measurement set measures the construct it intends to measure (Pallant, 2010:7). The measurement set for this research was conducted out of previous literature. For this research, content validity was determined through expert judgement of scholarly study leaders and supervisors. In order to determine the construct validity, confirmatory factor analysis (CFA) was completed.

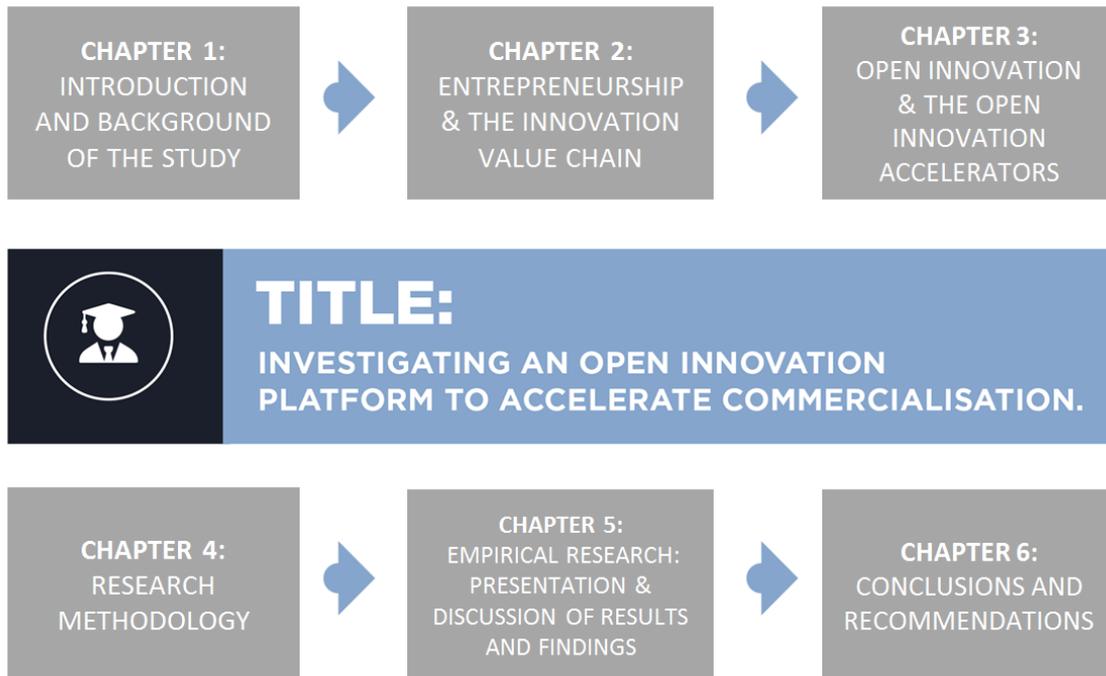
The analysis of **qualitative data** commenced when all five semi-structured interviews were recorded and transcribed. A content analysis method was utilised to analyse qualitative data, and involved systematically categorising responses with the aim to identify overall themes. The objective of the content analysis was to obtain a condensed and broad description of the Open Innovation platform.

Thus the qualitative data of this research underwent a process that concerned deriving themes in support of the Quantitative data but not according to previously defined structures or previous knowledge. Three themes emerged and were reported on. The direct quotations of participants were provided in order to support the findings. The reliability and validity of qualitative data was confirmed by ensuring the information obtained was dependable, credible and confirmable.

1.6 PRELIMINARY CHAPTER CLASSIFICATION

The primary objective of this research was to investigate the capability of an Open Innovation platform to accelerate processes within the innovation value chain in the Gauteng Province. This chapter served to provide an introduction and context of the research. The problem statement, objectives of the research and key concepts of the study were covered. Figure 1.3 illustrates the chapter outline for the entire research.

Figure 1.3: Chapter outline of the research



In order to address the research objectives, the literature review focuses on two main components namely, Open Innovation and Entrepreneurship. This literature review is assembled in chapter two and chapter three. **Chapter two** focuses on Entrepreneurship and the Innovation Value Chain from idea to market. Theory on entrepreneurship focuses mainly on innovation and commercialisation. Phases of the innovation value chain are discussed in detail i.e. idea generation, idea conversion, diffusion of concept and entrance into market (commercialisation).

In **Chapter three**, the definition and benefits of Open Innovation are discussed. The challenges as well as arguments around the topic are elaborated. The role Open Innovation accelerators as well as their benefits and arguments are discussed alongside The Innovation Hub Open Innovation platform.

Chapter four provides a detailed explanation of the research methodology used to achieve the objectives of this research. In this chapter the research design, sample plan, development of the questionnaire as well as the method of analysing the data are explained. The structure of this chapter is guided by the research process used in this research.

Chapter five delivers the results of the empirical research and presents the findings of the research. In this chapter the descriptions of key constructs are provided in terms of frequencies, means and standard deviation. Results are presented in the same order followed

in the questionnaire. Subsequently, the narrative descriptions of the qualitative findings are detailed.

In **Chapter six** a brief overview of the study is provided followed by a summary of the relationship between the primary goal and secondary objectives, the questions in the respective questionnaire, the main findings, conclusions and the recommendations. In this chapter a number of conclusions are drawn for each secondary objective, some based on theory and others based on the main findings formulated in chapter five. The chapter concludes with limitations pertaining to this research, and indicates possibilities for future research.

1.7 SUMMARY

This chapter has served to give an introduction and background of the research. This has been done by stating the research problem and the goals of the research. The purpose for undertaking this research is to investigate an Open Innovation platform to accelerate commercialisation. The approach and methods used to collect data for the research have been outlined and briefly explained. This research was descriptive in nature and employed a multi-methods research approach. Data was collected through the use of questionnaires as well as semi-structured interviews. Quantitative data was analysed statistically through the use of SPSS. Qualitative data was transcribed and interpreted in order to provide complimentary and supportive information for a predominantly Quantitative research. The chapter was concluded by giving an outline of this research, briefly describing the contents of the chapters that follow.

CHAPTER 2

ENTREPRENEURSHIP AND THE INNOVATION VALUE CHAIN

2.1 INTRODUCTION

Entrepreneurial activity is vital for a growing economy and developing countries. Developing countries are characterised by low Gross Domestic Product (GDP) per capita income and high Total early-stage Entrepreneurial Activity (TEA) rates. The low GDP is generally a result of either unemployment or low wages in these developing countries (Turton & Herrington, 2012:41). Subsequently, individuals find themselves starting businesses as a result of their inability to find jobs or in order to supplement low wages.

The Global Entrepreneurship Monitor (GEM) report has shown a direct relationship between the level of TEA and per capita income across a range of economies. A country's economic development therefore attributes directly to its level of entrepreneurship (Niewenhuizen & Nieman, 2009:3). This implies that progress and development of entrepreneurship are vital for economic growth in developing countries.

Economic growth is often also strongly associated with innovation. New and competitive businesses are created through new ideas. As ideas increase, innovation capabilities increase and subsequently the level of entrepreneurship increases. The nature of innovation is therefore linked to entrepreneurship (Bessant & Tidd, 2011:6).

The theory of entrepreneurship and its relation with innovation is discussed in this chapter. The innovation process, in taking an idea to market through commercialisation, can be referred to as the innovation value chain. Phases of the innovation value chain, namely idea generation, idea conversion, diffusion of concept and entrance into market (commercialisation) are discussed in detail. Figure 2.1 provides a brief summary of the Chapter 2.

2.2 DEFINING ENTREPRENEURSHIP

Entrepreneurship has, in the past, been conceptualised from two view points, from an economic view point and a behavioural view point (Niewenhuizen & Nieman, 2009:4). It is important that both perspectives of entrepreneurship be elaborated.

Figure 2.1: Synopsis of Chapter 2



2.2.1 Entrepreneurship from a behavioural perspective

Entrepreneurship has mostly been characterised by organisational behaviour, personality and psychology (Zhao, 2005:26). This perspective defines entrepreneurship through the character and the actions of an entrepreneur. The behaviour of the entrepreneur emulates a type of individual with the ability to see opportunities and a willingness to take risks.

Entrepreneurs often take calculated and higher risks; both personal and financial risks are incurred when undertaking entrepreneurship (Niewenhuizen & Nieman, 2009:9). Because of these risks, entrepreneurs first examine if a venture seems viable before investing all their resources and time (Lambing & Kuehl, 2000:17). Defining the risks earlier in the process, in hope of minimising them, is one method in which entrepreneurs manage their risks. Real entrepreneurs flourish when taking risks as they pitch their judgement against the odds and believe they will thrive regardless of the risk required (Burns, 2013:42). This sense of determination and belief entrepreneurs have in their ability to succeed plays an important role in entrepreneurship.

Entrepreneurship is often characterised by self-determination and drive, qualities associated with entrepreneurs. Their determination stems from a place of high self-motivation and a strong inner need for achievement. Successful entrepreneurs act out of choice, believing that their success depends on their own actions (Lambing & Kuehl, 2000:17). Their drive results in proactive and decisive behaviour. Entrepreneurs act rapidly and decisively, taking initiative in order to make the most of an opportunity before the opportunity is lost (Burns, 2013:40). The result of this characteristic, given that time is an important asset when pursuing opportunities, is that entrepreneurs learn through their actions.

Timmons and Spinelli (2010:159) consider entrepreneurship to be the ability to create and seize opportunities with the aim to pursue them. Entrepreneurs recognise, discover and utilise

opportunities. Where average individuals often see problems and are disinclined to pursue the uncertainty that brings change, entrepreneurs find real business opportunities in those circumstances (Burns, 2013:39). The pursuit of an opportunity is often accompanied by ambiguity. With entrepreneurship there is no guarantee of success; uncontrollable factors such as customer needs and the state of the economy often have a major effect on the business (Lambing & Kuehl, 2000:17). Entrepreneurs often have a sense of comfort with this lack of clarity. This uncertainty that entrepreneurs are faced with is often accepted because they have a holistic understanding of the business environment, including risk and macro-level uncertainty.

Entrepreneurs are visionary, with clear, strategic goals and ambitions. Their vision is what gives them direction during times of uncertainty (Burns, 2013:42). Entrepreneurs have an ability to scan business environments and industries in order to obtain insight, and subsequently formulate a clear picture of a business activity. Part of the entrepreneur's vision is the prospect of being rewarded.

Another distinguishing factor of entrepreneurs is their need for achievement through rewards or other motivating factors (Lambing & Kuehl, 2000:18). Entrepreneurs are not only motivated by money or making a profit. They are also driven by other factors such as increasing the value of the business through growth or satisfying a market need (Niewenhuizen & Nieman, 2009:9). The entrepreneurs' need for achievement is converted into drive and initiative, resulting in accomplishments and rewards.

Another distinguishing factor of entrepreneurs is their ability to innovate. Innovation is the primary instrument used in creating and exploiting opportunities. Although innovation is difficult to define and can take many forms, entrepreneurs are often in some way or another innovative (Burns, 2013:39). Associating entrepreneurs with innovation is seen as an economic perspective of entrepreneurship.

2.2.2 Entrepreneurship from an economic perspective

The economic perspective of entrepreneurship associates entrepreneurs with innovation. This association considers the role of the entrepreneur as the driving force of economic development and growth (Niewenhuizen & Nieman, 2009:5). For the economy to flourish, business opportunities need to be identified and businesses need to be created. This essentially requires entrepreneurship, given that entrepreneurs are associated with sourcing opportunities and taking risks.

Entrepreneurship is crucial in the path to economic growth and progression. It contributes significantly towards the quality, development and progress of an industry, economy or a country (Soriano & Huarng, 2013:1964). The role of entrepreneurs from an economic perspective is seen as one that informs the market of new elements. Entrepreneurs are innovators who identify gaps within the market and are determined to fill these gaps (Hague *et al.*, 2011:156). In doing so, new economic activities are created and essentially generate jobs, wealth and contribute to the overall well-being of the community.

Businesses are the main contributor to the growth of a country's regional and local economy (Hague *et al.*, 2011:156). Elements of entrepreneurship stem from variables found in the industry, economic geography as well as standard micro-economic theories. Examples of these variables are industry growth, profits, increasing capital requirements and the need for product differentiation (Braunerhjelm, 2010:12).

The level and growth of GDP, unemployment, inflation, interest rate levels and investments determine entrepreneurship in a country (Braunerhjelm, 2010:11). These factors influence an entrepreneur's decision to start a new venture, create new innovations and improve existing businesses. The state of a country therefore has an effect on entrepreneurial activities within the country.

Countries that have an immense agricultural industry are driven by high levels of unemployment, high inflation and a weak manufacturing base since the majority of its population live in rural areas and therefore sustain themselves with natural resources (Turton & Herrington, 2012:14). Entrepreneurs living in these conditions are able to increase economic development through exploiting these natural resources to make a living. Entrepreneurship in these countries is undertaken as a method of survival and a way to increasing the country's standard of living and economy. Fostering and supporting entrepreneurship therefore becomes the main source of economic development in these countries (Hague *et al.*, 2011:156).

As entrepreneurship increases and economies emerge, countries become efficiency-driven. This means more focus is placed on the labour, goods markets, technology, financial efficiency and higher education (Turton & Herrington, 2012:14). Entrepreneurs therefore view these challenges that developing countries face as opportunities to create innovative solutions that will in turn increase the country's economy. Entrepreneurship therefore has a direct relation to the development of an economy. South Africa is recognised as an efficiency-driven country since its GDP is relatively low (Turton & Herrington, 2012:15). The South African government

has turned towards entrepreneurship development because of its implications on economic growth and job creation in the country.

From both economic and behavioural perspectives of entrepreneurship, it can be concluded that entrepreneurship is a mind-set. Entrepreneurs are risk-takers and opportunists who are driven and seek achievement. Entrepreneurs are innovators at heart, producing innovation that, in essence, contributes to the growth of an economy. Entrepreneurship is therefore a creative and innovative act (Zhao, 2005:28). Entrepreneurship as innovation can be described as the creation of something that did not previously exist. In its most primitive sense, entrepreneurship is the ability to capture an idea, convert it into an innovative product or service and then construct a venture for taking it into the market (Johnson, 2001:138). Although entrepreneurship is often associated with the starting of a new venture it also occurs within large businesses (Zhao, 2005:27). This therefore implies that there are in actual fact two types of entrepreneurship, that which is associated with new ventures and that which occurs within already established businesses.

In summary, entrepreneurship is not only centred on the characteristics of the entrepreneur but is fundamentally intended for the development of an economy and the overall well-being of society. Entrepreneurs not only seek opportunities that are present within gaps in the market but also provide the market with innovations that fill these gaps.

2.3 TYPES OF ENTREPRENEURSHIP

Entrepreneurship is divided into two categories, namely traditional entrepreneurship, which in all cases is referred to as entrepreneurship; and corporate entrepreneurship which is often referred to as intrapreneurship.

2.3.1 Traditional entrepreneurship: entrepreneurship

Referred to as entrepreneurship, traditional entrepreneurship is the concept that has been defined in the previous section. It implies that the entrepreneur or group of entrepreneurs act autonomously and independently of any association with existing businesses (Gundogdu, 2012:298). This form of entrepreneurship entails creating and starting a new business. The entrepreneur starting the new business is therefore independent from other business he or she may have operated in.

Kuratko (2014:23), defined entrepreneurship as an individual noticing and seizing opportunities; converting the opportunities into commercial products by adding value through processes, capital and skills and thereafter confronting the risks of a competitive market.

These entrepreneurial activities may also occur within an established and existing business (Gundogdu, 2012:299). Entrepreneurship occurring within existing businesses is referred to as corporate entrepreneurship (Soriano & Huarng, 2013:1964).

2.3.2 Corporate entrepreneurship: intrapreneurship

Corporate entrepreneurship denotes a practice by which an entrepreneurial individual operates in an existing business and creates a new business or brings about innovation within that business (Zhao, 2005:28). New ideas and products, as well as new organisational structures and production processes are generated and introduced within the existing business.

Corporate entrepreneurship, often referred to as “Intrapreneurship”, implies that the possibility of managers and employees demonstrating entrepreneurial behaviour does exist (Gundogdu, 2012:299). Managers and employees may increase the profitability and growth of the business through seizing opportunities stemming from innovative and entrepreneurial behaviour. Intrapreneurship enables businesses to tap into the innovative talents of its employees and managers (Kuratko & Hodgetts, 1995:95). These intrapreneurs take proactive responsibility and obligation for the creation of innovation within the business.

Intrapreneurs renew and reinvent the business in regards to what it offers to the market and how it creates and delivers that particular offering. They are responsible for the drive and motivation in taking the risks associated with the development of new ideas generated within the business (Bessant & Tidd, 2011:11). Intrapreneurship boosts and manages new entrepreneurial businesses parallel to the larger business’s existing activities. It may be managed separately from the business’s conventional activities. Burns (2013:243) mentions that intrapreneurship can be an isolated activity. This implies that the new innovations are commercialised separately, either as part of the business or as spin-offs of it. The intrapreneur is therefore in charge of crafting innovation, in an entrepreneurial manner, from within the large business.

For this research, the definition of entrepreneurship is adopted from Schumpeter, (1934:78) as the ability of an entrepreneur or intrapreneur, who comes across a worthwhile idea, to introduce his idea to a market or industry. Entrepreneurship therefore results in innovation from existing inputs and the emergence of new industries.

The term “innovation” appears quite often when unpacking the concept of entrepreneurship. Entrepreneurs are at times regarded as innovators. As stated previously, entrepreneurship is viewed as an innovation. This means that innovation is a specific tool of entrepreneurship

(Zhao, 2005:28). Innovation addresses market needs and involves entrepreneurship in order to successfully commercialise ideas. It is therefore vital that various aspects of innovation be understood.

2.4 DEFINING INNOVATION

The term innovation was derived from the Latin word “innovare” which means “to do something new” (Gundogdu, 2012:299). Innovation, from its origin, is therefore the ability to invent something new. The Organisation for Economic Cooperation and Development (OECD) closely links innovation to the creation of a technology. This implies that innovation means creating products or services and further developing them technologically. Nonetheless innovation is more than invention and doesn't necessarily need to be technical. Not all inventions are developed to the stage of successful commercialisation. Inventions that find markets and are successfully commercialised are referred to as innovations (Smith, 2006:5). Innovation is about taking advantage of ideas, practices or objects.

Innovation is any form of development that brings about change. Mourkogiannis (2006:1) mentions that innovation takes place through ideas and inventions being made available to consumers in the marketplace or being produced in any new fashion. It is a process of fast-tracking ideas, and then revising them towards a useful product, process or service (Bessant & Tidd, 2011:204).

Drucker (2011:207) describes innovation as is a specific instrument of entrepreneurship occurring in new and existing businesses as well as government agencies. Innovations are new effects applied in the business throughout all its functions (Smith, 2006:6). Innovation is associated with the change in working conditions, managerial and organisational tasks as well as workforce talents and skills. Innovation is also concerned with renewing, improving and growing a product or service range (Gundogdu, 2012:299). In doing so, innovation in essences involves new operations and business models.

In recent years, the focus on innovation has inclined towards focusing on business strategy, consumer-centeredness through value creation, team recognition and the use of innovation resources as part of all business units (Hattori & Wycoff, 2002:27). The capacity of a people to be creative has consequently been put into perspective as a tool for innovation. The outcome of a new product, service, or process is expected to provide real value to customers and the overall business.

Drucker (2011:208) states that innovation hardly ever originates from a flash of inspiration but instead stems from the analysis of several kinds of opportunities. These opportunities serve as sources of innovation.

2.4.1 Sources of innovation

Innovations often require continuous research and exploration of opportunities. These innovation opportunities are time and again found in only a few circumstances (Drucker, 2011:208). The sources of innovation are concerned with where the new ideas for innovation emerge.

2.4.1.1 Unexpected incidences

Random occurrences, because they are unplanned and unanticipated, give rise to new awareness; this insight then forms the basis for new ideas which essentially lead to innovations (Kurakto, 2014:149). Random incidences are the most basic source of innovation opportunities because opportunities, in essence, come from the unexpected. Unexpected successes or failures serve as insights to new innovation opportunities (Drucker, 2011:210). Often failure is disregarded and marginalised. Bessant and Tidd (2011:230) state that accidents possibly prompt innovation and introduce unexpectedly new ideas. Entrepreneurs are able to spot these failures and accidents as opportunity and thereafter develop them into an innovation.

2.4.1.2 Process needs

As a result of the need for improvement, “process needs” are in some cases referred to as “pain” in the marketplace (Kurakto, 2014:149). Frustrations often provide significant signs for change and process needs. Process improvements are more relevant in the public sector since the focus is not necessarily to create wealth but instead to provide value through service delivery (Bessant & Tidd, 2011:211). As demands within various processes increase, solutions to such needs are birthed through the need to innovate. Process needs stimulate innovation in more mature industries undergoing the pressure of competition (Smith, 2006:96). The competitive environment gives rise to the need to keep finding innovative ways to better service or product offerings.

2.4.1.3 Demographic and perceptual changes

Drucker (2011:216) argues that demographics are the utmost dependable sources of innovation outside a business but are often neglected. Innovation opportunities are made possible as changes in age, population size, geographic locality, education and occupation

occur. Pursuing entrepreneurship based on demographics is the least risky, and often has the most innovation opportunities (Kurakto, 2014:150).

As demographics change, circumstances are perceived differently. Changes in perceptions do not alter facts but instead change their meaning (Drucker, 2011:218). People's understanding of concepts and facts serve as a source of innovation. As individuals begin to emphasise the importance of healthy living, opportunities for health foods and fitness centres arise. Entrepreneurs have the ability to view perceptions of stakeholders as opportunities for innovation.

2.4.1.4 Industry and market changes

Repeated modifications in the marketplace result in structures of the industry and market changing (Kurakto, 2014:150). Changes in consumer preferences, improvements in technology, as well as the growth in the classification of industries and markets are good sources of innovation and entrepreneurial opportunities (Drucker, 2011:215).

2.4.1.5 New knowledge

The prospects that arise from various scientific research studies form the basis of many innovations (Bessant & Tidd, 2011:204). R&D departments play an important role in finding new knowledge, problems and challenges that, in essence, service as innovation opportunities. Continuous investigation and information gathering through extensive reading, attending professional workshops and working with individuals in unrelated fields produces new knowledge (Kurakto, 2014:153). Accumulating new knowledge regarding problems, challenges or opportunities provide entrepreneurs with an understanding of the manner in which an opportunity can be utilised.

Drucker (2011:219) emphasises that innovations that stem from new knowledge differ from others in that they have lengthy lead times and are unpredictable. These knowledge-based innovations are whimsical and often hard to direct.

It can be concluded that innovation requires various kinds of knowledge. New knowledge originates from demographic, perceptual, industry and market changes. Unexpected incidences, as well as needs within various processes provide new knowledge for innovation. Innovation is multidimensional and has various types (Zhao, 2005:27).

2.4.2 Types of innovation

Innovation can be radical or incremental, product-based or process-based.

2.4.2.1 Radical innovation versus incremental innovation

The design of a completely new innovation is what constitutes a radical innovation (Smith, 2006:29). Radical innovations are new designs using a set of new design components. Bessant and Tidd (2011:248) remark that radical innovations require experimentation since the area is unfamiliar. Radical innovations carry high risks because there's often no clear direction of the outcome. Radical innovations are revolutionary, original and pioneering innovations (Zhao, 2005:27). These innovations are relatively uncommon and are associated with introducing new technologies.

Kurakto (2014:163) defines incremental innovation as extension. Extension of the innovation also implies using the already existing product or service for a different application. Incremental innovations are minor advancements made on already established processes, services and products (Zhao, 2005:27). With incremental innovation risk is much lower because there is an extent of familiarity. Incremental innovation does not change components (that would be radical) but instead improves existing components (Smith, 2006:29). This type of innovation is the most common since expansions and enhancements in materials of and knowledge in services and products occur over a long period of time.

2.4.2.2 Product innovation versus process innovation

Product innovation refers to the changes and improvements in products or services that a business offers to its customers (Bessant & Tidd, 2011:19; Zhao, 2005:27). This indicates that product innovations largely focus on the end-user. Consumers' perceptions on and experience with the product or service generates new knowledge regarding ways to improve the product or service offerings (Smith, 2006:90). As products improve consumer needs are in essence met. Product innovation also includes the improvement of machinery and equipment sold to other providers.

With process innovation, products and services are not changed but instead the way in which they are created and delivered changes (Bessant & Tidd, 2011:19). Process innovations are less renowned than product innovations since they occur within the business and are not often shared with the public. Process innovations have dramatic impacts on society (Smith, 2006:25). This is because they affect working practices and the physical infrastructure of cities. Table 2.1 provides examples of these types of innovation in order to obtain a better understanding of their differences.

Table 2.1: Types of innovation

	Radical Innovation	Incremental Innovation
Product Innovation	<ul style="list-style-type: none"> • Changed products or services • New product ranges and technology <p>Toyota Prius: introducing new concept of hybrid engines</p>	<ul style="list-style-type: none"> • Improvements in products or services • No changes, just enhancements <p>Improving Windows 98 to Windows XP: enhancing software</p>
Process Innovation	<ul style="list-style-type: none"> • New configurations and architecture • Products or services aren't changed but processes are <p>Mobile banking in SA: using phones rather than banking systems</p>	<ul style="list-style-type: none"> • Improvements in processes and systems • Improvements in infrastructure and architecture <p>Vodacom: Improved network services across geographic areas</p>

Source: Smith (2006:29); Bessant and Tidd (2011:248); Zhao (2005:27).

From defining innovation along with its sources and types, it can be concluded that most innovations result from purposeful searches for new opportunities (Kurakto 2014:162). Innovations are directed to a detailed and clear design application. They create new customers and markets through new knowledge generated when seeking opportunities. Innovation and entrepreneurship are therefore complementary as both concepts have similarities. The synergy between innovation and entrepreneurship is vital to understand.

2.5 THE LINK BETWEEN INNOVATION AND ENTREPRENEURSHIP

As previously highlighted innovation is a key function of entrepreneurship (Drucker, 2011:207). Innovation is the process in which entrepreneurs convert opportunities into commercial solutions (Kurakto, 2014:162). The behavioural and economic perspectives of entrepreneurship allow for innovation to occur. In other words innovation is underpinned by the vision and drive of an entrepreneur to create an idea, as well as the motivation they have to endure with the concept right through to commercialisation (Kurakto, 2014:162). The entrepreneur's orientation towards achievement and sense of self-determination allow the entrepreneur to innovate.

Zhao (2005:33) discovered that the innovation and entrepreneurship are complimentary because innovation is at the source of entrepreneurship simultaneously entrepreneurship enables an innovation to achieve its economic value. Investment from the entrepreneur in the innovation is therefore essential. The entrepreneur invests his or her time, capital and skills in creating an innovative product or service (Michael & Pearce, 2009:289). Persevering through

the investment forms part of the risks the entrepreneur takes, especially since the outcome of the investment is not entirely known.

Since entrepreneurial activity may occur within an established business (referred to as intrapreneurship), innovating within the business can increase its scope and stimulate growth. Innovation and entrepreneurship can therefore not be restricted to only the opening of a new business (Zhao, 2005:33). Intrapreneurship allows employees within businesses to participate in the innovation process through generating ideas and confidently commercialising them through the business (Soriano & Huarng, 2013:1964). This implies that through innovation and entrepreneurship, businesses are able to enhance their performance. Innovation through entrepreneurial activities is a continuous process within businesses and should not be taken lightly because it effects the growth of businesses and essentially the economy. Smith (2006:182) adds that as the innovation reaches commercial success the business also grows.

It is highlighted in the previous sections that entrepreneurship is a mind-set. In order for innovations to successfully reach the market, the correct mind-set of an entrepreneur is needed. Zhao (2005:33) states that the businesses should encourage opportunity seeking and idea generation as part of its organisational behaviour and culture.

Bessant and Tidd (2011:11) remark that innovation is a managed process and the driving force for this process is entrepreneurship. This means that through the skills, capital, vision and determination of entrepreneurs, innovation is made possible whether radical or incremental. The synergy between innovation and entrepreneurship introduces a new phenomenon: Innopreneurship.

2.5.1 The era of innopreneurship

In the 21st century, as more business ventures are being established, businesses is finding it tougher to survive. The increase in businesses has subsequently led to increased competition from businesses in all sectors, industries and markets (Soriano & Huarng, 2013:1964). For businesses to prosper above the competition, as well as overcome economic uncertainties and recession, being innovative has become mandatory.

Entrepreneurial traits such as taking risks, investing capital, displaying self-confidence, achievement-orientation and determination are no longer sufficient for moving forward. While these attributes help in developing and maintaining a business, they may fall short when trying to reach a competitive advantage in this current futuristic market. In order to maintain sustainable competitive advantage entrepreneurs need to strive for innovation (Gundogdu, 2012:300). Entrepreneurs should rework themselves into being innopreneurs.

Innopreneurs are innovation-oriented entrepreneurs. Gundogdu (2012:301) emphasises that innopreneurship is characterised by the entrepreneurs awareness of R&D. Innopreneurship is thus a concept synchronising and integrating entrepreneurship, intrapreneurship and innovation.

2.6 THE INNOVATION VALUE CHAIN

From the above sections, it can be concluded that innovation and entrepreneurship do not happen overnight but instead take place through a sometimes difficult extensive process. This process of taking an idea and turning it into a successful commercial product or service is referred to as the innovation value chain (Smith, 2006:107).

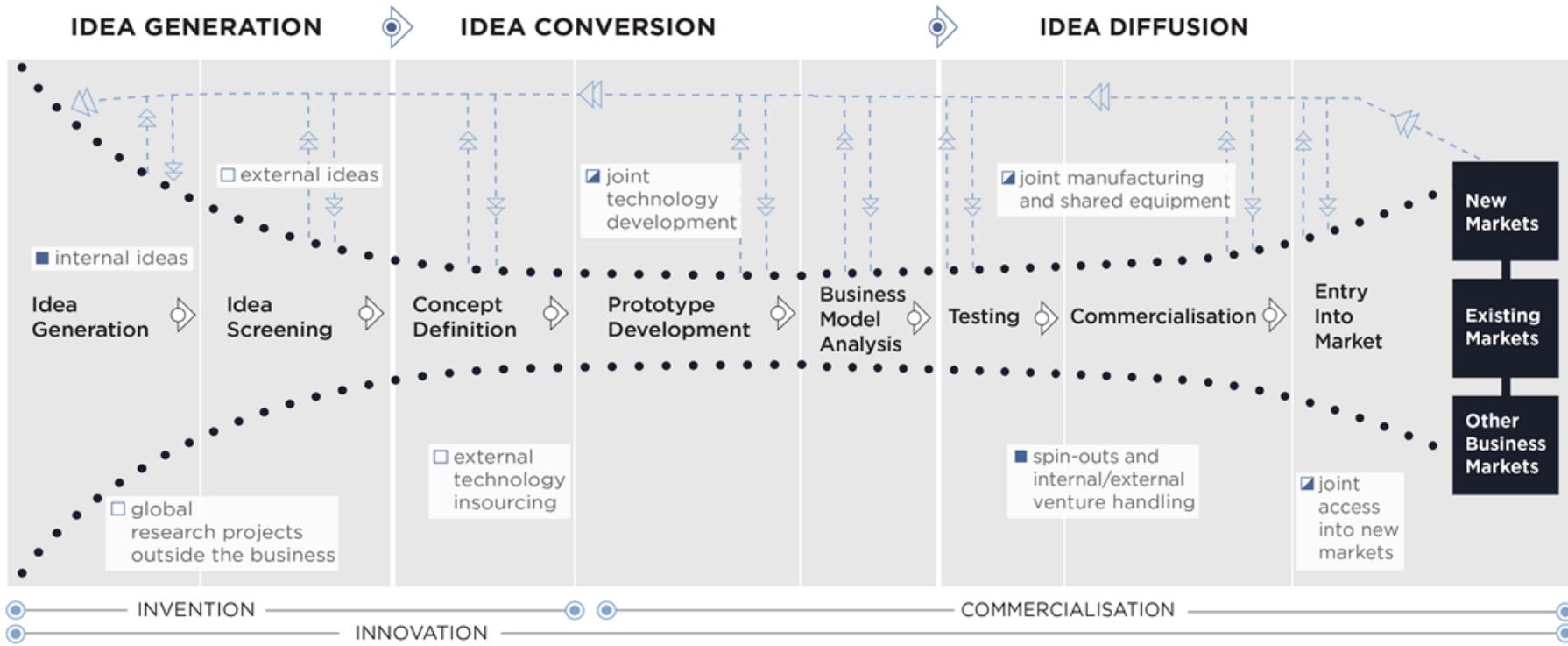
The innovation value chain occurs when businesses generate ideas and new knowledge needed for innovation, convert this new knowledge into products or services and later exploit such innovations in order to escalate the business's growth and the value provided to the consumers (Ganotakis & Love, 2012:840). This means that there are a number of activities involved in turning an invention into successful commercialisation. The innovation value chain is a steady process helping to reduce uncertainty through various phases in the chain (Bessant & Tidd, 2011:390). The number of phases and how they link to one another depend mostly on the nature of the product. Developing new innovations is often a complex process and it is different in most practices. Although that is the case, the major phases in the generic innovation value chain show a sequence beginning from idea generation and ending with a finished product or service going into the market.

Hansen and Birkinshaw (2007:3) have concluded that the innovation value chain embodies innovation as a “sequential, three-phase process” comprising of idea generation, idea conversion into a concept and diffusion of the concept into the market. These serve as the key phases in the innovation value chain although the terminology and steps within each phase may differ across industries.

The following sections serve to examine the activities that take place in the innovation value chain. The three phases, as well as the various steps within each phase are elaborated. Figure 2.2 serves to illustrate the entire innovation value chain from idea generation to idea diffusion, as well as the supporting activities necessary for the success of the innovation value chain. Open Innovation, which is discussed in Chapter 3, is also built into the illustration.

Figure 2.2: The innovation value chain

- Ideas generated within the business
- Ideas generated through Open Innovations



	IDEA GENERATION	IDEA CONVERSION	IDEA DIFFUSION
Marketing		Identification of Target Market market segmentation	Establishment of Position positioning strategy
			Build a Brand product awareness
			Develop Marketing Mix 4P's of marketing
			Marketing Plan objectives and campaigning
			Market Launch
	CONTINUOUSLY CONDUCT MARKET RESEARCH		
Funding		Bootstrapping and Personal Savings family/friends [<R25k]	Speed Capital active & passive investors [R25k- R500k]
			Pre-venture Capital active investors [R500k- R1m]
			Venture Capital institutional venture capitalists [+R1m]
Intellectual Property	IP Acquisition and Generation non-disclosure agreements	IP Protection patent and trademark registration	IP Exploitation and Maintenance licensing
	DUE DILIGENCE: AUTHENTICATE NEW PARTNERS CREDIBILITY		

2.6.1 Idea generation phase

The most basic definition of this phase is the activity of generating ideas and knowledge. This phase may occur within a business department, across departments in a business, as well as outside the business (Hansen & Birkinshaw, 2007:3). The idea generation phase may be divided into two steps, namely idea generation and idea screening.

Idea generation

This is the initial step in the innovation value chain and is strongly linked to the sources of innovation discussed in previous sections (see section 2.4.1). During the idea generation phase new opportunities and customer requirements are identified (Marias & Schutte, 2010:102). Businesses often search inside their own business units to identify ideas. Research is done within the business and gives rise to new ideas and concepts (Smith, 2006:108). Research often provides the basis for ideas. Ideas may stem from unexpected incidences, process needs, demographic and behavioural changes, industry and market trends as well as new knowledge as a result of individual genius (see section 2.4.1). Ideas are generated in a large number of ways but it is important that these ideas serve to add value to the end-user. The selection of viable ideas then takes place through idea screening.

Idea screening

Once ideas are generated, strong screening mechanisms need to be in place (Hansen & Birkinshaw, 2007:5). Idea screening and selecting involves filtering the ideas according to the business's innovation strategy. During this stage the feasibility of ideas is evaluated (Marias & Schutte, 2010:102). During screening and selection it is important to ensure that ideas integrate with the various product or service offerings as well as the objectives of the business. The capability of the business to carry out the idea and also meet its future demand should be analysed. There are various ways to screen and select ideas before they are further developed. According to Bessant and Tidd (2011:395) ideas may be screened through the following:

- **Ranking:** this implies listing the ideas in order of its value or worth for business support. Ideas are also ranked according to their forecasted financial costs.
- **Profiling:** ideas are given scores based on a set of criteria. Ideas which prevail on the majority of the criteria are selected.

- Scenario building: alternative visions of future based outcomes are played out; ideas yielding different pay-offs in the different outcomes are selected.

There are various methods in which ideas are screened. These methods vary from business to business. The above screening methods are the most commonly used.

2.6.1.1 Open Innovation in the idea generation phase

Open Innovation is the practice of merging a business's internal assets and resources, with those outside the business, in order to acquire the best value from existing and available information (Anon, 2013b). Open Innovation plays a role within each on the phases in the innovation value chain. Other than generating ideas from within the business and departs, ideas may stem from external knowledge bases (Hemert *et al.*, 2011:430). Businesses often depend on the support of intermediary services to implement Open Innovation. These intermediaries are known as Open Innovation Accelerators (OIA) and help accelerate ideas to market.

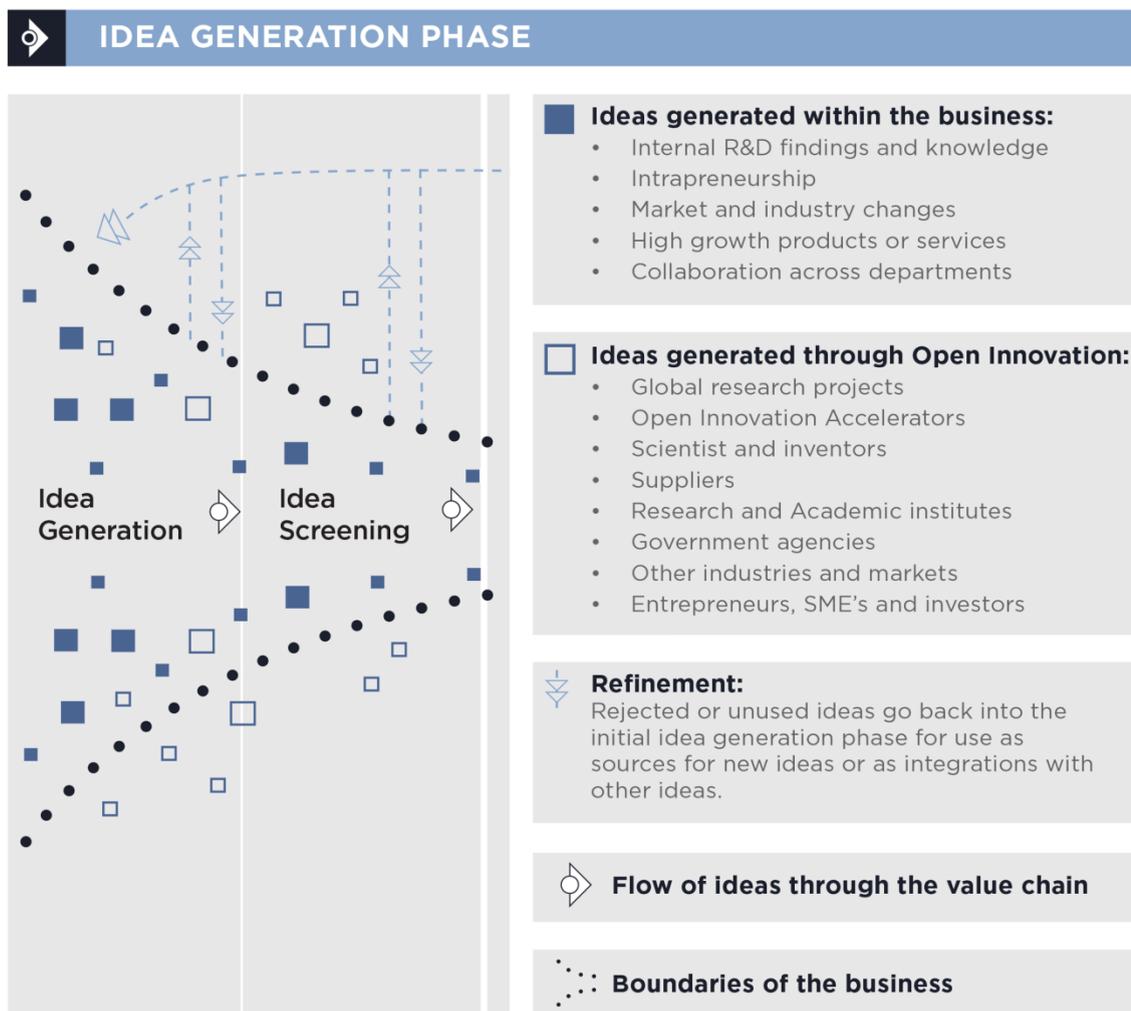
In the idea generation phase businesses make use of Open Innovation in various forms. Ideas may be sourced externally from other businesses within the same sector and even outside that sector through Open Innovation (Hansen & Birkinshaw, 2007:4). This means ideas may originate from various role players within academia, industry and government. This relationship is referred to as the triple-helix. With Open Innovation ideas and new knowledge for ideas are generated from suppliers, consumers, competitors, academia, investors, government agencies as well as independent entrepreneurs.

It is imperative for OIAs to have cross-industry associations, widespread knowledge regarding industry-specific issues and an overall innovation eco-system when generating ideas through collaboration. Protection of ideas is vital since ideas are shared within multi-disciplinary teams (Janssen *et al.*, 2014:18).

Businesses in South Africa needing to utilise external parties within their idea generation phase are able to use The Innovation Hub Open Innovation Solution Exchange, a web-based platform. Businesses are able to use this platform to present problems that require solutions. This Open Innovation accelerator then translates the problem into a technology brief that describes the problem. The technology brief is posted on the web-based platform for various external parties to stimulate solutions.

Another way in which ideas are generated from various businesses on the web-based platform is through technology offers. Entrepreneurs and small business owners are able to post their technology onto the platform; businesses interested in collaborating with these entrepreneurs through the use of their knowledge or technology are then able to contact the entrepreneurs. Entrepreneurs are able to gain surprising returns through integrating their ideas, concepts into existing innovation value chains (Gans & Stern, 2003:333). Figure 2.3 illustrates how Open Innovation plays a role within the idea generation phase of the innovation value chain.

Figure 2.3: Idea generation phase in the innovation value chain



Source: Own compilation.

2.6.2 Idea conversion phase

Once ideas have been generated, the second phase of the innovation value chain begins. Here, ideas that have been selected are converted to products or services (Hansen & Birkinshaw, 2007:3). This phase comprises of all activities involved in taking the chosen idea

and bringing it into a product or service which will be ready for commercialisation. During this phase funding and development of the selected ideas take place. The steps involved in the idea conversion phase are concept definition, prototype development and business model analysis.

Concept definition

This step in the idea conversion phase encompasses transforming and combining ideas which have been selected into concepts that are formally defined and have features that add consumer value (Marias & Schutte, 2010:102). During this step, the various functions within the business collaborate to sort out specific concerns and make decisions on the details of the innovation.

Business functions involved in defining the concept include the R&D personnel, designers and marketing departments (Bessant & Tidd, 2011:393). Knowledge is transferred to these departments and is then translated into innovation outputs. The new knowledge generated from ideas may sometimes form different outcomes other than what was expected from the initial idea (Ganotakis & Love, 2012:840). In such cases the new knowledge is either sent back for refinement or used despite being different to what was expected. The defined concepts are then developed through prototyping and feasibility assessments.

Development of prototype

Once the concept of an idea is defined, that concept is then further developed into a model and prototype (Marias & Schutte, 2010:102). During the idea conversion phase, constructing a model and prototype of the idea is important.

Models are designed to demonstrate the appearance of the future product in order to give an impression of the overall look of the invention; as yet, they have no functioning capability (Smith, 2006:111). Modelling can be done through concept drawings and sketches; through mock-ups and site models and through various simulations.

The concept and model are turned into an invention through prototyping the fundamental working principles of the defined concept. Unlike models, prototypes are designed for functionality in order to ensure that the operations of the future product are as projected (Smith, 2006:112). The prototypes are later used when evaluating the performance of the future product. Bessant and Tidd (2011:396) emphasis that prototypes undergo much iteration as the designers come to learn more about the problem and alternative solutions. Frequent prototyping assists the various role players in better understanding the future product.

Prototypes assist in having reliable assessments of preferences and recommendations. It is important to note that prototyping happens continuously. Although the prototype is not ready for entrance into the market it obtains many characteristics of the final product (Smith, 2006:110). It therefore can be used in the next steps of the idea conversion phase.

Business model analysis

Once the prototype has been developed, additional information is used to determine the feasibility of the prototype (Marias & Schutte, 2010:102). During this step, the fit of the prototype with the overall business model is investigated. A solid business model for the prototype is analysed, meaning the materials that will be used for manufacturing the product as well as the process by which the product will be manufactured are evaluated (Smith, 2006:114). During this phase IP protection decisions are made (see section 2.7.3).

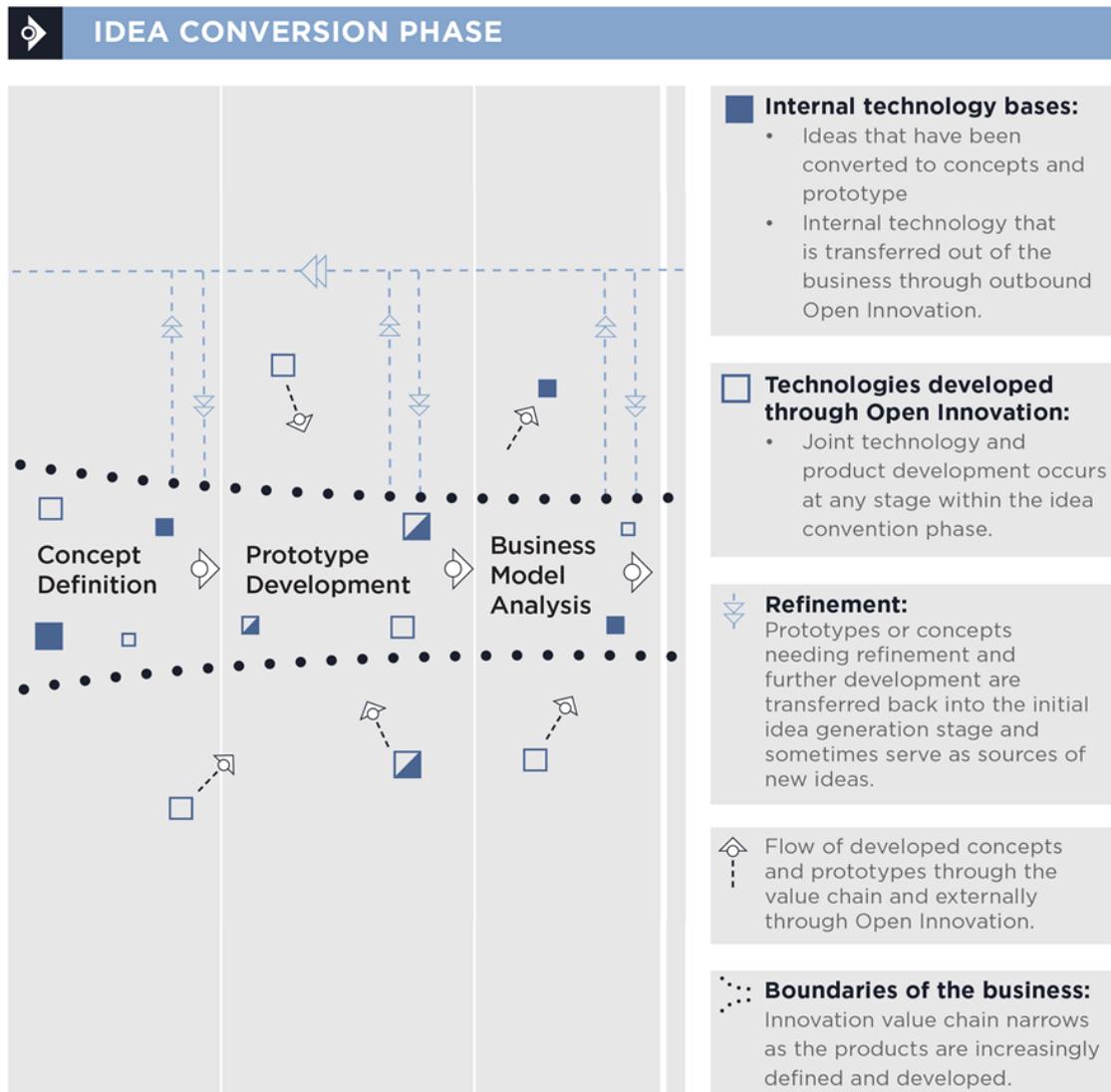
2.6.2.1 Open Innovation in the idea conversion phase

During the idea conversion phase, Open Innovation practices are applied through the use of joint technology development as well as joint product development (Theyel, 2013:264). Developing the technology with external parties such as customers and suppliers allows the business to understand the needs of the public as well as the limitations the concepts may have. Joint development with suppliers offers businesses the prospect of understanding the importance of materials and equipment to be used (Theyel, 2013:264).

Sourcing external technology through Open Innovation also occurs during the idea conversion phase. Technology that has been discovered or created outside the business may be acquired when defining the concept and developing the prototype through continuous feasibility studies (Marias & Schutte, 2010:104). Conversely, prototypes and technologies developed internally during this phase may be transferred out of the business through outbound Open Innovation. This situation can occur, for instance, when the business does not have the ability to realise sufficient revenue in its own market or when the technology is a spin-off which cannot be used for the core business (von Nell & Lichtenthaler, 2011:133).

Open Innovation accelerators are therefore required to have the ability to manage collaborations effectively through multi-level involvement and governance (Janssen *et al.*, 2014:19). The Innovation Hub Open Innovation Solution Exchange, using its innovation ecosystem, is able to market the challenge and ensure solution seekers are connected with a variety of external possible technologies which are often new and unknown to the seeker (Piller & Diener, 2013:5). The idea conversion phase is best summarised as part of the innovation value chain in Figure 2.4.

Figure 2.4: Idea conservation phase in the innovation value chain



Source: Own compilation.

2.6.3 Idea diffusion phase

Quite often the idea conversion phase overlaps into the diffusion phase (Bessant & Tidd, 2011:393). This is because the developed concept often requires buy-in from the rest of the business departments within the business as well as their targeted market. Hansen and Birkinshaw, (2007:5) emphasize that businesses need relevant units that serve to support and spread new product concepts and business models across all areas within and outside the business. During the idea diffusion phase concepts are tested and implemented in the market for further development opportunities as feasibility studies. It is vital that new products and services are rolled out across various distribution channels and markets. The idea diffusion phase takes place in two steps namely testing and commercialisation.

Testing

Products that have come out of the idea conversion phase need to be tested. Testing the products ensure their functionality is as intended and that their performance is what the end-users require (Smith, 2006:110). The prototypes are tested in various environments and conditions. If the performance of the prototypes is poor during testing, they are sent back for further development and modifications.

Introducing the prototypes to various markets during testing helps identify audiences that are most receptive to the product. When testing the prototypes, the primary and secondary requirements of the consumers should be listed along with any dislikes they may have (Bessant & Tidd, 2011:395). The relation between the consumers' requirements and the technical characteristics of the prototype should be measured in order to ensure an appropriate design fitting both needs is completed.

During testing it is imperative that products are projected as profitable to the business in addition to their appeal to the consumer. Refined products, after initial testing, are retested in order to determine their overall value to the consumer (Smith, 2006:117). Refinement is an iterative process.

Commercialisation

Once products have been refined, formalised and introduced to the market through testing, the commercialisation step commences (Marias & Schutte, 2010:103). Commercialisation is the final step in the innovation value chain and involves manufacturing and launching the final product for entrance into the market (Smith, 2006:108).

After the prototype has been approved, production and manufacturing gets underway. Designers help simplify the prototype in order to make it appropriate for manufacturing it in batches. The manufacturing and production that takes place is not yet full-scale since individuals operating the manufacturing process need to familiarise themselves with the production of the new product (Smith, 2006:118). During manufacturing and production a range of components need to be finalised. Businesses need to decide on whether machinery or labour will be used, where raw materials and equipment should be sourced from, as well as the various supporting tools and information that should be incorporated (Smith, 2006:116). During the manufacturing process potential flaws in the product may be picked up; these faults serve as information for further development but may be supplied to the consumers for their perception on the product (Smith, 2006:118).

The main purpose of commercialisation is generating ideas into new markets and extending the business offerings in existing markets (Marias & Schutte, 2010:103).

Launching the product or services into the market is another crucial step in commercialisation. Hemert *et al.* (2013:438) highlights that continually engaging in the market, through meetings with business partners, consumers, business communities and everyday individuals, allows businesses to have an understanding of the market and gain useful insights regarding the overall industry. Launching the product through buy-in from various role-players speeds up the commercialisation process. Market-launch requires a substantial input from marketing departments (Smith, 2006:118). This is due to the fact that most of the activities associated with the launch involve exhibitions, online marketing, advertising, developing product briefs and collaterals, as well as ensuring the availability of stock in various outlets.

Once the product has successfully been launched, it then creates financial value for the business and social value for those consuming the product or service. The products, processes and services are continuously evaluated. Knowledge sourced from evaluation then serves as input for improving these processes, products and services through incremental innovation.

2.6.3.1 Open Innovation in the idea diffusion phase

During the idea diffusion phase, businesses are able to sell prototypes to external parties as they perceive them not feasible for the business's own model but may be worthwhile in other industries or markets. This is referred to as outbound or inside-out Open Innovation (Gassmann & Enkel, 2004:10).

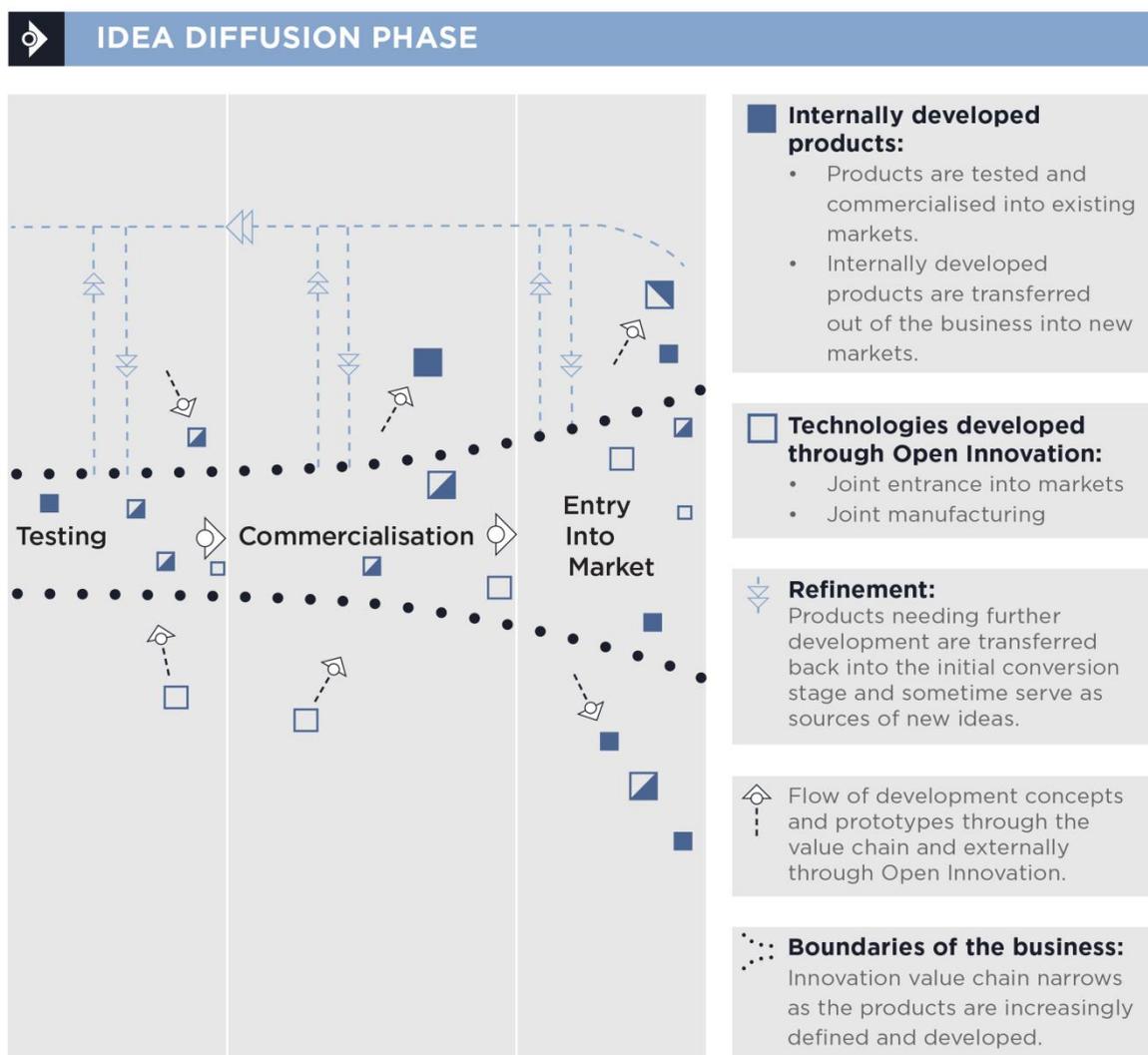
For start-up entrepreneurs, commercialisation through Open Innovation occurs through identification and implementation of agreements with businesses seeking solutions for commercialisation (Gans & Stern, 2003:336). Entrepreneurs therefore yield returns by commercialising their inventions through existing innovation value chains. Open Innovation therefore strengthens established market power and simultaneously moderates competition in the market.

During the manufacturing and production of the products, through Open Innovation equipment is shared with external parties and manufacturing may be a joint undertaking (Theyel, 2013: 264). This often occurs when the businesses taking part in Open Innovation are in close proximity and sharing manufacturing and equipment makes commercial sense.

Through Open Innovation as a commercialisation strategy, there is joint access to new markets through co-branding (Mortara *et al.*, 2009:12). This helps entrepreneurs lower the cost of trying to identify and access new markets. Strategic alliances with other entrepreneurs, outsourcing agreements, as well as entering into supplier-customer relations are typical practices of Open Innovation at the commercialisation stage (Hemert *et al.*, 2013:436).

Open Innovation Accelerators do not play a great role in the idea diffusion phase because at this stage the process is placed at the hands of the business and the external party for confidential deal-making (The Innovation Hub, 2013:4). Open Innovation Accelerators are able to assist when businesses are seeking ready-to-commercialise products for their markets. Figure 2.5 illustrates how Open Innovation plays a role within the idea diffusion phase of the innovation value chain.

Figure 2.5: The idea diffusion phase in the innovation value chain



Source: Own Compilation.

Commercialisation plays an important part in innovation and entrepreneurship. Although it has been depicted as a step within the idea diffusion phase commercialisation, it is in fact the entire process of taking a raw idea and successfully introducing it to the marketplace. As mentioned previously, what converts a mere invention into an innovation is the commercialisation of that invention (Smith, 2006:6).

The innovation value chain serves as a generic adaptation of various innovation processes that may take place. Innovation value chains may differ according to the industry, the business as well as the product being commercialised.

2.7 SUPPORTING THE INNOVATION VALUE CHAIN

Smith (2006:106) has found that although ideas are screened and become prototypes many of these inventions are commercial failures and do not make it into the marketplace. This indicates that the innovation value chain is a process requiring number of support activities to ensure the successful commercialisation of inventions.

Marketing activities, funding the innovation and protecting IP are three key supporting functions necessary for the success of inventions through Open Innovation. These may pose as challenges found in the innovation value chain.

2.7.1 Marketing

Introducing the invention to the public, as either a product or a service, forms part of the innovation value chain. Smith (2006:118) refers to this as the market launch. There are a number of activities that are required to ensure that the product or service is made known to and desired by the marketplace. These activities tend to pose as a challenge because of the inability to acquire input from marketing departments.

Marketing activities should occur during the idea diffusion phase in the innovation value chain. This is because the developed concept requires buy-in from the rest of the business departments as well as the target market. The marketing department needs to be involved by spreading the new product concepts and business models across all functional areas within and essentially outside the business (Hansen & Birkinshaw, 2007:5). The marketing of a new innovation, product or even entrepreneurial business that's occurred through Open Innovation consists of a range of areas that need to be considered.

2.7.1.1 Selecting the target market

In order for the new product or service to succeed, the business and external parties, involved through Open Innovation, have to target a specific market. It is important to identify groups of customers within the industry, the business and its collaborative partners to engage with (Barringer & Ireland, 2008:317). The target market selected should be distinct so that the marketing campaigns appeal specifically to them. In order for the new product or service to appeal to the market it is important to have an understanding of the market and its needs. Some businesses make the mistake of launching a new product to a specific market without understanding its customers. The prime challenge faced when selecting a market for new products or services is choosing a market that is attractive enough to be interesting yet different enough that the product or service doesn't disappear into the crowd (Barringer & Ireland, 2008:317). It's vital that the selected market be in line with the business's background, business model and the skills of its founders.

2.7.1.2 Establishing a position

In addition to selecting the right target market, it is the responsibility of the marketing department to establish a position that differentiates the new product or service from potential competitors (Barringer & Ireland, 2008:317). The position is what the business claims as its own and what customers use when differentiating between the various products or services in that specific market.

If the business launching the new product already has a well-established target market and position in that market, the marketing department needs to focus on building the brand of the new product or service in line with the businesses product range or service offerings.

2.7.1.3 Building a brand

Marketing departments are responsible for communicating the benefits of purchasing the new product or service. The mistake often made when launching new inventions is that marketing personnel rush to point out the features and specifications of that particular invention rather than simply highlighting how the invention would enhance the customer's life (Barringer & Ireland, 2008:321). Customers opt for benefits rather than features.

It is essential that the brand of the new product or service sets out the new product or services attributes. The main purpose of branding new products and services is for product identification, allowing marketers and consumers to distinguish the new products and services from competitors (Lamb *et al.*, 2013:170).

Lamb *et al.* (2013:170) emphasises that marketing departments should consider the customer's loyalty towards a brand, the recognition of the brand, the perceived quality of the business's overall products and services and the associations made with the brand.

Since the new products or services are developed through Open Innovation, other proprietary assets such as patents and trademarks should be considered. Through the high-quality partnerships and agreements made during the conversion and diffusion phases of the innovation value chain, co-branding arrangements may be made. This takes place when the businesses' brands promote one another. The marketing department should consider whether the branding partnership will strengthen the new product or service's brand image or whether lengthening the brand image with an undesirable product will damage the original brand (Gbadamosi *et al.*, 2013:189).

2.7.1.4 Marketing mix

Once the target market, position and brand has been established, the marketing department should now set marketing tools that will be used to yield the response desired from the market (Barringer & Ireland, 2008:326). Marketing departments arrange their marketing mix into four categories: product, price, place and promotion. These are commonly known as the 4P's of marketing and will be illustrated in Figure 2.6. The 4P's of marketing are variables that marketing departments can control and merge together in order to satisfy customers in the target market in the best way possible (Anon, 2014).

Figure 2.6: Summary of marketing mix

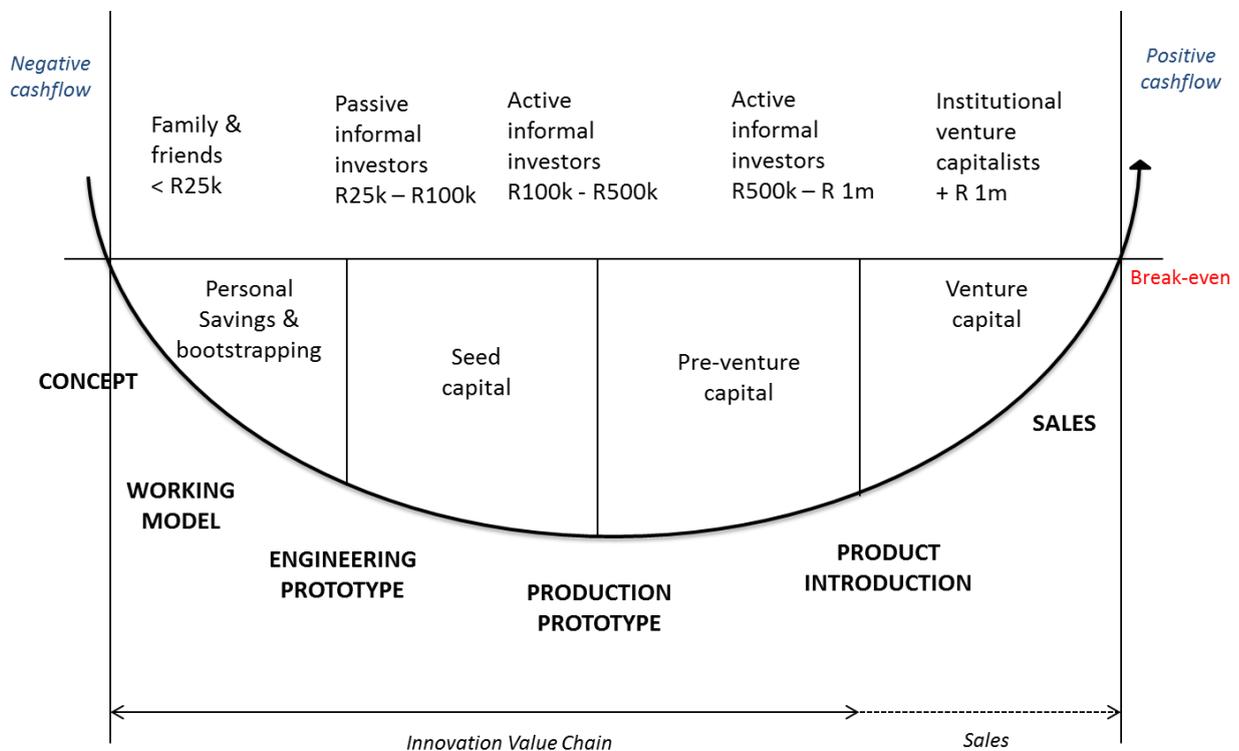


Source: Anon (2014)

2.7.2 Funding

As discussed in section 2.4, innovation refers to exploiting ideas and inventions and turning them into commercial products and services. The idea generation and conversion phase of the innovation value chain requires funding. Smith (2006:207) states that the development of innovation requires an expenditure of funds. This takes place prior to generating an equivalent intake of funds. There is subsequently a negative cash flow right through the innovation value chain before funds are generated and cash flow turns positive. The outflow of cash at this stage does not correspond with an inflow of sales. Figure 2.7 summarises the flow of funding throughout the innovation value chain.

Figure 2.7: Funding streams in relation to the innovation value chain



Source: Smith (2006:208).

From Figure 2.6 it is clear that there are various kinds of funding that are available. These depend on how far the new product or service is from commercialisation.

2.7.2.1 Bootstrapping

Timmons and Spinelli (2009:378) describe bootstrapping to be an effort to minimise resources or the cost thereof throughout the innovation value chain. It involves attempting to accomplish more with minimum expenditure in order to pursue the opportunity. The entrepreneur focuses

on finding methods to avoid external funding through cost-cutting, ingenuity and creativity (Barringer & Ireland, 2008:287). Bootstrapping results in the acquisition of resources for free or much less than one would expect to pay.

Personal financing and the use of family and friends forms part of bootstrapping as the 'bootstrapper' uses creative ways of receiving funds without the use of banks (Smith, 2006:210). Friends and family may offer delayed compensation, investments and sometimes financial gifts.

Bootstrapping often occurs at the idea generation stage in the innovation value chain. The funds acquired from bootstrapping, as well as friends and family, is used in the early stage of the new product or service for first models and as proof of concepts (Smith, 2006:212). The various idea generators taking part in this initial phase of the value chain may also provide finances in getting the idea into the conversion stage.

2.7.2.2 Government funding

There have been a number of government-funded schemes that have been designed to finance innovation around the globe. These schemes aim to develop new marketable technologies that have commercial feasibility (Smith, 2006:213).

In South Africa, receiving funding is a major stumbling block when attempting to commercialise innovations. However, the government has in the past years, increased the availability of funding mechanisms in order to overcome this hurdle (van der Merwe, 2013). There are three role-players within the government sector that aim to provide funding for new inventions and business ventures, namely the Technology Innovation Agency (TIA), Industrial Development Corporation (IDC) and the Department of Trade and Industry (DTI).

TIA is a government funded agency which aims to stimulate technological innovation in South Africa. The agency uses South Africa's innovation industries to develop new industries and in essence diversify the economy (Anon, 2014b). TIA provides both non-financial and financial support to various role-players within the triple-helix of South Africa.

The IDC is a self-funded but government-owned entity. Its development funds aim to enable the conversion of inventions and technology developed in South Africa into commercial products (van der Merwe, 2013). They are particularly interested in high-impact and labour intensive technologies that potentially lead to the creation of new industries.

South Africa's DTI also finances innovation. The DTI has launched an online selection and application portal for various funding initiatives therefore making it easier for entrepreneurs to obtain funding (van der Merwe, 2013).

The government serves as a significant contributor to South Africa's increasing venture capital environment. It is the role of the entrepreneur to ensure that they apply for the various funding opportunities the government has on offer.

2.7.2.3 Angel investors

Barringer and Ireland (2008:287) define angel investors as individuals investing their own capital in the new business or new products and services. These individuals are normally high in net worth, well-educated and have previously succeeded as entrepreneurs. Angel investors seek more than capital returns but are often particularly interested in the growth of the new product or services as well. Because they do not form part of recognised associations and aren't clearly visible in markets, they are seen as informal investors (Smith, 2006:215).

Angel investors are varied and have a broad range of interests in new business opportunities. Investors may be interested as a result of their entrepreneurial mind-set, and intention to maximise their wealth (Smith, 2006:216). Established businesses may also form part of angel investors as they invest in unquoted businesses or products. This is referred to as corporate venturing.

It is clear that angel investors play quite an invaluable role in the innovation value chain. This is because of their willingness to make relatively small investments into new products and services that don't necessarily require a great deal of money such as those of venture capitalists. They are often anonymous and are paired up with entrepreneurs through networking and referrals.

2.7.2.4 Venture capital

Venture capital arose due to new businesses' inability to find access to long-term risk capital. Smith (2006:218) explains that venture capital is loaned from acknowledged investors. The venture capitalists obtain capital from wealthy individuals, foreign investors, university grants, pension funds and other similar sources of funding. Through these partnerships the role of the venture capitalists is evaluating the risks and growth of the new product or service and ensuring that their respective partner would make a capital gain when choosing to withdraw their funds at a later stage (Smith, 2006:219).

2.7.2.5 Commercial banks

Commercial banks serve as debt funders whereas the previously-mentioned sources of funding serve as equity funders. With commercial banks, none of the business or new product's ownership is surrendered and any interest payments on the loan are tax deductible rather than dividends being paid out. Although this is the case, banks are not seen as the most viable and practical source of funding a new product or service simply because they need to be repaid in full and also impose particularly strict conditions on their investment (Barringer & Ireland, 2008:296).

Commercial banks play a role at a later stage in the new products or services' life cycle. It is only once the product or service has been commercialised that entrepreneurs should consider commercial funding as banks are a significant source of credit for small businesses.

Barringer and Ireland (2008:296) further mentions that commercial banks take an interest in businesses that have audited financials, low leverage, healthy balance sheets and high cash flow. This may not necessarily be the case for new businesses and new products.

In summary, it is important to consider the various funding instruments during the innovation value chain. Neglecting the need for funding could potentially lead to discontinuing the process of commercialising the ideas generated. It is vital that entrepreneurs identify mechanisms in which their new ideas will be financed.

2.7.3 Intellectual property

Intellectual property is referred to by the World Intellectual Property Organisation (WIPO, 2012) as any creation born of human intellect with value in the marketplace. It is articulated as an invention, literature, artistic works as well as names, symbols and images used in commerce. When creating new products and services, it's imperative that entrepreneurs determine what IP to protect. When doing so the entrepreneur should determine if the IP is directly linked to its competitive advantage and if protecting that IP will increase its value in the marketplace (Barringer & Ireland, 2008:349).

Intellectual property rights make it possible for the entrepreneur to benefit from their originality and inventiveness and prohibits others from exploiting their inventions. There are three main types of IP protection namely copyright, patents and trademarks (Shim & Siegal, 2000:85). Copyright allows a writer to decide how their work is used and to benefit from its profitability. Smith (2006:143) adds that copyright follows automatically after creating new work. On the other hand, patents are granted by the government to the entrepreneur, rewarding them for

their invention and ensuring them exclusive right to the patent. WIPO (2012:9) describes a trademark as any graphically representable sign used for identification and the differentiation of a new invention and product from others that are similar. These methods of IP protection are to be looked into when commercialising new innovations.

In the innovation value chain, it is important that due diligence is completed on new partners and solution providers participating in the Open Innovation process at any of the three phases. Timmons and Spinelli (2009:459) explain that due diligence is the process of authenticating the potential partners' credibility. It involves verifying the new partners and solution providers' backgrounds, and facts, the reputations of the key contributors and staff involved, investigating the technical competencies of the new idea, prototype or product, and confirming market estimates and proprietary rights.

During the concept definition, prototyping and feasibility steps of the idea conversion phase, it is important to ensure that the IP of the various parties is protected. If the IP rights of the external party (whether an entrepreneur, scientist, start-up business, association, supplier or consumer) are already available, disclosure of the solution is less stressful (Gans & Stern, 2003:338). This implies that disclosing the solution will not reduce the owner's ability to profit from it. A business's competitive advantage may possibly decrease, and future planned products could be blemished (Marais & Schutte, 2010:106). A business disclosing its ideas or inviting other businesses into its innovation process is often seen as a weakness (Gaskell, 2013).

Intellectual property protection occurs in various places within the innovation value chain. When new inventions and new useful business processes and improvements are brought about, patents are to be registered therefore giving the inventor exclusive rights to the new invention. The marketing department also needs to consider IP protection of new slogans, names, brochures, logos and jingles through trademarks and copyright. The various agreements and processes such as contractual forms, PowerPoint slides, new methodologies, employee handbooks and training materials are also to be protected through copyright and trade secrets. Other administrative and informative systems should also be protected. These include website designs, computer software and codes, as well as internet domain names (Barringer & Ireland, 2008:351).

Throughout the innovation value chain, the idea generator and owner of the prototype may choose to sell their IP or license it to the business wishing to commercialise the new product or service.

2.8 SUMMARY

For developing countries to attain industrial and economic growth, entrepreneurship and innovation should be at the forefront for the country's priorities. This is because there is a direct relationship between the level of early-stage entrepreneurial activity and per capita income across a range of economies. Understanding the perspectives of entrepreneurship is vital.

Entrepreneurship is best explained from a behavioural perspective and an economic perspective. This means that entrepreneurship is not only a mind-set and organisational behaviour but is also the driving force to economic development and growth through innovation. Entrepreneurship and innovation are complementary in that innovation is a key function of entrepreneurship. Innovation is the creation of something new and the ability to bring about change. Innovation may occur within an existing business as part of intrapreneurship, outside the business and across various industries. There are different types of innovation that a business may employ, namely radical innovation, incremental innovation, product innovation or process innovation.

Entrepreneurship through innovation however does not happen overnight but instead is an extensive process. This process in taking ideas to market through commercialisation is referred to as the innovation value chain. Although the innovation value chain may differ from business to business, it is a sequential three-phase process starting from idea generation, idea conversion and then idea diffusion. Within these three phases are various activities which need to be undertaken.

During the first phase ideas are generated through the various sources of innovation and are screened and selected according to set. Through Open Innovation ideas may be obtained from external role players. The second phase involves defining the concepts in order to develop prototypes which serve as tools that will be used to analyse the business model. In this phase joint technology and product development takes place through Open Innovation. In the last phase, prototypes are tested and further developed. These prototypes are then manufactured and later launched into the market. With Open Innovation, equipment for manufacturing may be shared and products may be co-branded for increased access into new markets. Commercialisation is the main objective of the innovation value chain. It refers to successfully converting an idea into an invention (and later into an innovation) by introducing the product into the market. Open Innovation accelerators such as The Innovation Hub Open Innovation Solution Exchange, has the capabilities of ensuring the increase in commercialisation through ensuring collaboration in various parts of the innovation value chain.

It is also imperative that the phases within the innovation value chain are supported. The various marketing components such as considering the target market, building the brand and how the new innovation will be introduced to the market should be taken into consideration. The entrepreneur, as well as the business seeking the solution, should consider the different sources of innovation funding. These include the economic principle (bootstrapping), government funders, angel investors, venture capitalists and commercial banks.

Lastly, another supporting component of the innovation value chain that should be considered is the protection of any intangible product of human intellect with value in the marketplace. This is referred to as IP and is vital as it rewards the inventor for his/her new technology, providing him/her with exclusive rights to the new technology and therefore protecting it from exploitation.

Chapter 3

OPEN INNOVATION AND OPEN INNOVATION ACCELERATORS

3.1 INTRODUCTION

In today's globally competitive environment, innovation has become the key measure of a business's sustainability (Manceau *et al.*, 2011:4). Businesses are required to increasingly innovate in order to obtain a competitive advantage. In turn, government, universities, research institutions and even individuals, have become attracted to forming industry partnerships in the hope of monetising their research (Huston & Sakkab, 2006:2).

The above implies that businesses and various role players have become less confidential with their innovation practices and have leaned towards the idea of leveraging each other's innovation assets. This form of mass collaboration has brought about Open Innovation which is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively.

Businesses across all industries are embracing Open Innovation in order to maintain their competitive advantage, maintain more effective product development management, and essentially to meet consumer needs (Shurrab & El Bouassami, 2013). Open Innovation therefore plays a significant role in the economy as it stimulates entrepreneurship through commercialisation.

With Open Innovation becoming a progressive business practice, it is essential to understand the development of Open Innovation and determine the aspects of Open Innovation.

Although Open Innovation is widely spoken of, very little is known about the intermediaries that help entrepreneurs in commercialising their ideas. Businesses are often inadequate and have limited experience on how to successfully manage Open Innovation activities; they therefore often depend on the support of intermediary services. These intermediaries are known as Open Innovation accelerators (OIA). Figure 3.1 provides a brief synopsis of Chapter 3.

Figure 3.1: Synopsis of Chapter 3



3.2 THE BIRTH OF OPEN INNOVATION

Since the early 1990s, innovation has become a catchword in the corporate world. Innovation is defined as any development that brings about or creates change. Much of modern society is based on the innovations of the past (Mourkogiannis, 2006). Finding new and better ways of doing things became the essence of what constitutes an innovation (Hofstrand, 2006). The term also means applying improved solutions to unarticulated or existing market needs. Innovation has, therefore, generally been deemed the exclusive territory of R&D (Hattori & Wycoff, 2002:26). This is because the success of a business often lies in the innovation process of its R&D department.

Research and development therefore meant the investment in generating a business' own ideas, which would then be developed, manufactured, marketed, distributed and serviced internally. This was seen as the core of a business's competitive advantage, since the business discovered preeminent ideas and commercialised its innovations. Innovating within the boundaries of the business, in turn, allowed the business to reap most of the profits. This was done through controlling IP in order to prevent competitors from exploiting it (Chesbrough, 2003).

Throughout the years, this closed innovation model, which centred on the notion that innovation must primarily reside from within the borders of the business, worked quite well according to Huston and Sakkab (2006:2). However, in recent times, a number of dynamics have worn the foundations of closed innovation. Businesses find difficulty in controlling their patented ideas and expertise. This is due to the increasing number of knowledge-employees and the increasing private venture capital used in starting small business in order to increase commercialisation (Chesbrough, 2003). In hopes of maintaining progress that closed innovation has made in previous years, businesses are strenuously attempting to reinforce R&D departments with acquisitions, licensing, alliances and even selective innovation outsourcing (Huston & Sakkab, 2006:2). This attempt, unfortunately, illuminates the short-

comings of closed innovation in sustaining high levels of top-line competitive advantage and growth (Huston & Sakkab, 2006:2). This is because innovation has, with time, become a part of the core business process.

Innovation is vital to the success and growth of businesses in the 21st century (Anon, 2009:2), as evidenced by the fact that SMMEs are being increasingly founded by innovative solutions. Government, universities and research institutions are inclined to form industry partnerships in hope of monetising their research and/or sell their IP (Huston & Sakkab, 2006:2). This perspective implies what previous innovation practices would consider outrageous; no longer should a business confine its IP, but instead find methods to profit from others' use of similar technology. This could be accomplished through licensing agreements, joint ventures and other arrangements, such as incubation, business support services and consultations (Chesbrough, 2003).

Businesses have become less confidential with their innovation practices, leaning towards the idea of leveraging each other's innovations assets, such as their products, people and even IP, which has led to the revolution of "Open Innovation", as coined by Chesbrough in 2002.

Since its inauguration in 2002, Open Innovation has gone through three substantial phases. The first can be seen as the collecting of external ideas into a business's own innovation processes. The second involves developing new business ventures, as a result of collaborations with businesses, thereby making their unused technologies available and finding a path between collaboration and competition. The last phase involves creating new business models from opening the process to allow co-creation and customer communities to drive the business (Bry, 2011). These phases summarise Open Innovation as the breaking of boundaries within the traditional work space and looking for innovations outside the business.

3.3 DEFINITION OF OPEN INNOVATION

Open Innovation is defined as the use of purposive inflows and outflows of knowledge in order to accelerate internal innovation, and expand the markets for external use of innovation, respectively (Chesbrough, 2003: xxiv). Open Innovation suggests that a business should not confine its discovered knowledge to its internal market mediums alone, nor should internal pathways necessarily be limited to bringing only the business's internal knowledge to market (Chesbrough, 2003). It is a form of mass collaboration, used to connect the various role players within the triple-helix in hope of leveraging their innovation capabilities (Piller & Diener, 2013:6).

Traditionally, businesses develop their technology and products internally, resulting in innovation relying solely on internal resources, according to Mortara *et al.* (2009:12). Open Innovation eradicates these boundaries and allows businesses to share and incorporate resources with partner organisations and internal business units. It is a process intended to hasten innovation through collaboration, involving businesses becoming less dependent on internal ideas and instead working with other businesses to foster innovation (Anon, 2009:1).

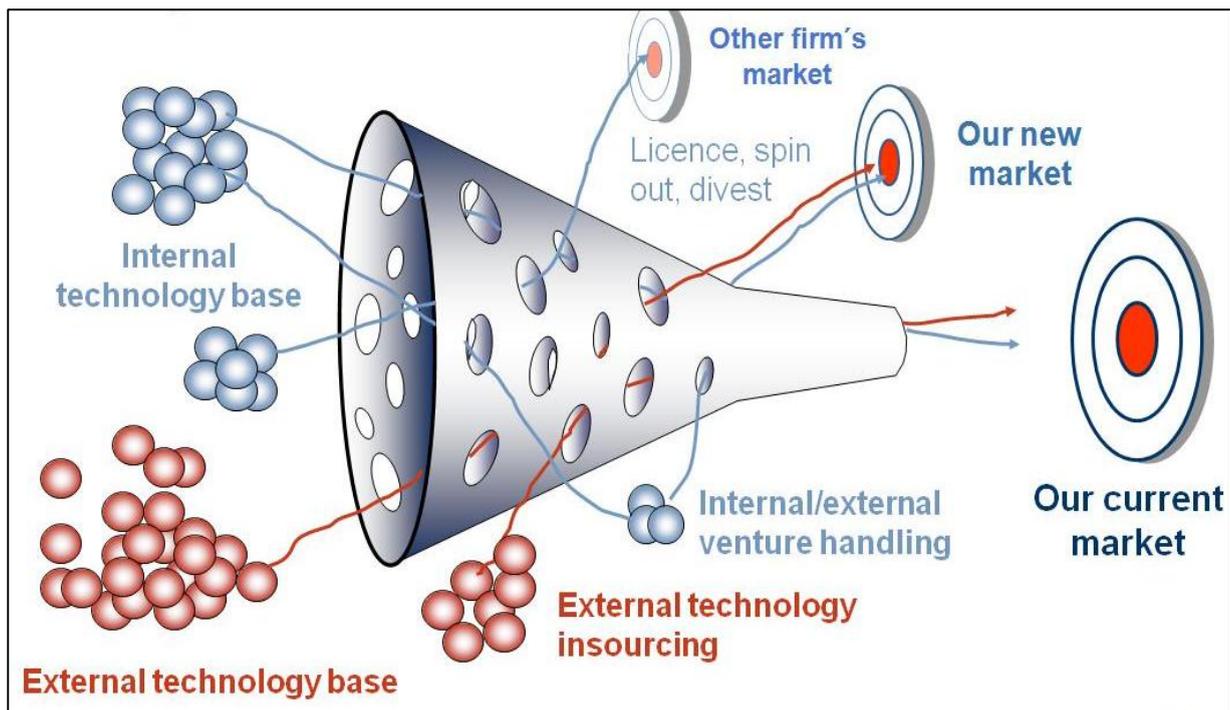
Piller (2011:8) summarises Open Innovation as the method of increasing the productivity of technical problems solving through external research. Open Innovation is the formal discipline of leveraging discoveries that would, in normal instances, not have been utilised as input for the innovation process (Piller, 2011:11). With Open Innovation, businesses' boundaries become 'leaky' therefore enabling the harmonisation and amalgamation of resources between the business and external collaborators (Mortara *et al.*, 2009:12).

Essentially, Open Innovation is the practice of merging a business's internal assets and resources, with those outside the business, in order to acquire the best value from existing information and available information (Anon, 2013b). Open Innovation can therefore be outbound or inbound. Chesbrough and Crowther (2006:229) define two types of Open Innovation that businesses may employ, namely inbound Open Innovation and outbound Open Innovation.

- **Outbound Open Innovation** is referred to as commercialising technological knowledge exclusively, or in addition to its internal application. It depicts the outward transfer of technology in open utilisation processes (Lichtenthaler, 2009:318). With this type of Open Innovation, businesses seek for external organisations with business models that are suited to commercialise a technology exclusively, or in addition to its internal application (Chesbrough & Crowther, 2006:229). This situation can arise, for instance, when the business does not have the ability to realise sufficient revenue in its own market, or when the technology is a spin-off, which cannot be used for the core business (von Nell & Lichtenthaler, 2011:133).
- **Inbound Open Innovation** refers to the practice of leveraging the innovations of others, in order to support the sourcing and acquisition of external ideas and knowledge into the innovative process (Chesbrough & Crowther, 2006:229). With inbound Open Innovation, businesses screen the industry in order to in-source technology and knowledge over and above their own research and development (Spithoven *et al.*, 2009:2).

Open Innovation has therefore compelled a shift from somewhat unsystematic and experimental approaches, to a manageable end-to-end process. It is the methodical and structured endeavour linked to the organisational structure, processes, behaviour and tools that businesses are utilising to encourage collaboration (Manceau *et al.*, 2011:5). Figure 3.2 summarises Open Innovation and demonstrates both outbound and inbound innovation used to accelerate internal innovation, and expand the markets for external use of innovation.

Figure 3.2: Open Innovation



Source: Chesbrough (2003).

Figure 3.2 concludes that Open Innovation consequently means that a business's internal intellectual property can be made public and that valuable technology, ideas, knowledge or discoveries coming from outside can be introduced into the business's innovation process (Marais & Schutte, 2010:104). The next section serves to discuss Open Innovation as a process within a business's functions.

3.4 OPEN INNOVATION PROCESS

Open Innovation entails three core processes; outside-in processes, inside-out processes and coupled processes. Not all businesses select the same core process, as each business chooses a core process that best suits its strategic objectives. Businesses may also choose to merge the processes, in order to work in alliances with complementary companies during the collaborative innovation process (Gassmann & Enkel, 2004:6).

3.4.1 Outside-in Open Innovation process

Outside-in Open Innovation, as a core process, involves collaborating with suppliers and customers and integrating any external knowledge gained. In an attempt to increase their innovation capacity, businesses develop and augment their own knowledge base through integrating suppliers, customers and external knowledge sources. (Gassmann & Enkel, 2004:7).

Businesses focusing on outside-in as their core process for Open Innovation, are mostly from low technology industries expecting spill-overs from higher technology industries (Gassmann & Enkel, 2004:10). This market is characterised by rapid change and driven by technological development. Outside-in businesses are often small or medium in size, acting as knowledge brokers or knowledge creators for bigger businesses. Recently, businesses with a high modularity in products offered, and high knowledge intensity, gain competitive advantage by choosing the outside-in process. This is because their need for knowledge cannot be satisfied by only using their internal abilities (Gassmann & Enkel, 2004:10). Businesses may successfully integrate internal resources with the critical resources of customers or suppliers when making use of outside-in Open Innovation. These activities could include in-licensing and buying of patents, earlier supplier integration, customer co-development and external knowledge integration (Gassmann & Enkel, 2004:10). By possessing the necessary competence and supplier management capabilities, businesses can extend new product development activities across organisational boundaries (Fritsch & Lukas, 2001:302).

3.4.2 Inside-out Open Innovation process

Basic research-driven businesses, with wide applications, tend to use inside-out Open Innovation processes as part of their strategy. Inside-out, as a core process, involves externalising the business's innovation and knowledge in order to commercialise ideas more rapidly than the business is able to through internal development (Gassmann & Enkel, 2004:10). In addition to commercialising ideas outside the business's own market or industry, channelling ideas or knowledge to the external environment can be used through outsourcing. However, Open Innovation should not be mistaken for outsourcing. Outsourcing occurs when a business contracts another to provide services (Anon, 2014c). The outsourced service provider must understand the supported business's model and in essence take responsibility for the innovation it supports (Reimers, 2006:34).

With inside-out processes, businesses gain insights by means of opening their boundaries and increasing their advantage by allowing ideas to flow outwards; as a result fixed costs of

R&D are decreased, and risks are shared (Gassmann & Enkel, 2004:11). It depicts the outward transfer of technology in open operation processes (Lichtenthaler, 2009:318). This occurs when parts of the development process is outsourced. This may involve the selling of intellectual property, as well as applying the technology across multiple industries.

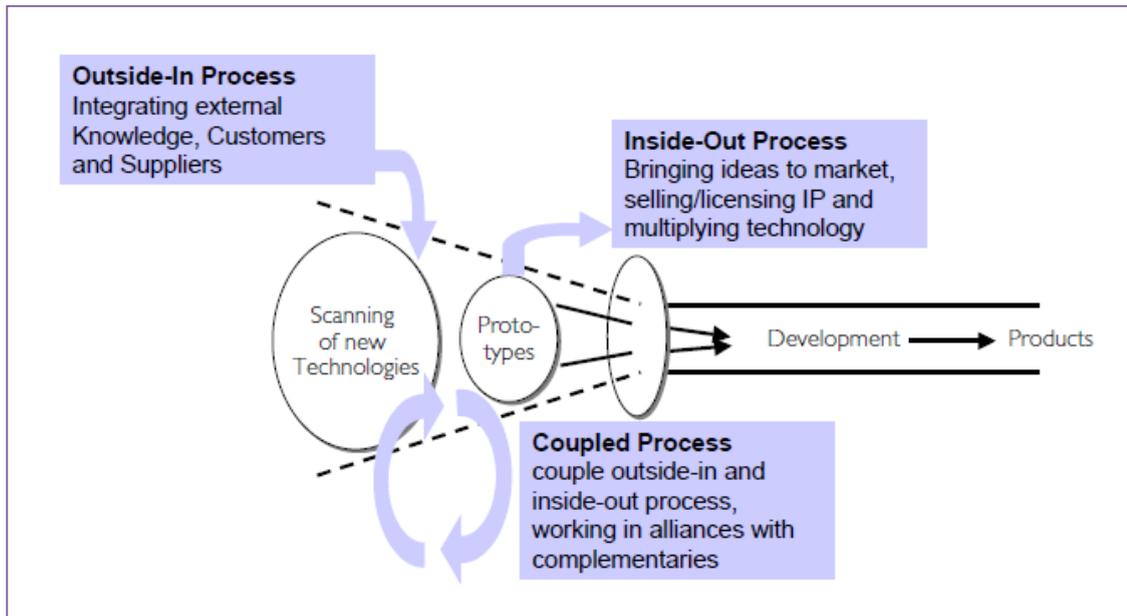
3.4.3 Coupled Open Innovation process

The coupled Open Innovation process integrates both inside-out and outside-in processes. This means coupled Open Innovation processes not only bring in external knowledge, but also bring ideas to various markets (Gassmann & Enkel, 2004:12).

Coupled Open Innovation processes are often used when businesses have the ability to increase returns through multiplying their exploitations. Collaboration amongst these businesses is vital when bringing in external knowledge and taking internal ideas to markets outside the business. Collaboration may vary, but mostly refers to the joint development of knowledge through strategic partnerships, with role players within the triple-helix (Gassmann & Enkel, 2004:12). Although collaboration has benefits, such as reduced risk and competitive advantages, it results in more time being spent in development, therefore slowing the process (Gassmann & Enkel, 2004:12).

With coupled Open Innovation processes, alliances with complementary partners are mostly formulated. The right balance of give and take is a critical success factor for businesses working in these strategic alliances or joint ventures. The ability to incorporate external knowledge into a business's own knowledge and technology, and to externalise it with the intention of enabling the partner, is vital in using collaborative innovation processes (Gassmann & Enkel, 2004:13). The core Open Innovation processes are summarised as follows.

Figure 3.3: Three types of Open Innovation processes



Source: Gassmann and Enkel (2004:7).

3.5 BENEFITS AND CHALLENGES OF OPEN INNOVATION

Open Innovation has a factual influence on a business's innovation performance (Manceau *et al.*, 2011:9). These influences either pose as challenges or benefits to the business. The challenges and benefits of Open Innovation are discussed in this section.

3.5.1 Advantages of Open Innovation

- *Intellectual property protection:* Although setting legal agreements involve complex administrative procedures, clarity on each partner's IP rights is primed. This, therefore, leads to increased protection for new innovations (Manceau *et al.*, 2011:9).
- *The use of various triple-helix role players:* With Open Innovation, ideas are developed to everyone's satisfaction (Kaluwa, 2012). Ideas, knowledge and technology are derived from government, the private sector, academia and the overall community. A business's suppliers, retailers, development and trade partners, and even competitors, form part of the Open Innovation process, through idea generation, funding and commercialisation. Venture capital businesses, as well as individual entrepreneurs, are also utilised when seeking ideas and technology. No source is off-limits with Open Innovation (Huston & Sakkab, 2006:4). It is an ideal way to address sustainability projects through involving the triple-helix, and therefore accomplishing breakthroughs with more sustainable innovations (Manceau *et al.*, 2011:9).

- *Focused research:* Problems needing specific solutions are clearly defined, along with specific targets. This assists in knowing exactly what innovations to look for and where the focus should be. With Open Innovation, it is not merely about generating external ideas but ideas generated have a degree of success. Prototypes, working products and/or technologies with consumer interest are considered. These then answer the specified problem and, in essence, provide the desired solution (Huston & Sakkab, 2006:4).
- *Enhanced innovativeness:* Inventions are entrenched in an economy of quantity. As innovations and innovation capabilities both externally and internally increase, so do the chances of increased success rates (Manceau *et al.*, 2011:10). Research and development productivity increases, resulting in an increased innovation success rate (Marais & Schutte, 2010:105).
- *Access to new markets:* Working in partnerships increases the number of ideas, technologies and knowledge a business has access to. It also creates access to competencies and skills, which a business might not necessarily possess. Taking advantage of these concepts, through finding links with the various partners, essentially leads to new markets being created, as well as access to markets within other industries (Anon, 2009:1).

The core advantage of Open Innovation is therefore the increased capability of collaboration in all business functions. Since with Open Innovation there is no source that is off-limits, ideas, knowledge and technology from various sectors increase. As technologies increase, new markets are reached and created. With Open Innovation emphasis on IP is made priority due to the increased intensity of mass collaboration.

3.5.2 Disadvantages of Open Innovation

- *Finding creative methods of exploiting internal innovation:* This challenge often refers to how best the business can use its internal R&D competences to its maximum advantage. A variety of approaches are needed in order for the business to maximize its returns on internal innovation (West & Gallagher, 2006:321).
- *Sharing intellectual property:* The prospect of revealing a business's intellectual property, which is not intended for sharing, results in quite a few challenges. Drafting a legal framework around intellectual property management may emanate as an additional and time-consuming expense to Open Innovation (Anon, 2013c). A business's competitive advantage may possibly decrease, and future planned products could be blemished

(Marais & Schutte, 2010:106). A business disclosing its ideas or inviting other businesses into its innovation process is often seen as a weakness (Gaskell, 2013).

- *Open Innovation is mistaken for outsourcing innovation:* Open Innovation is often mistaken for the contracting of external parties to develop innovations for the business. However, outsourcing innovation centres more on transferring the work to low-cost service providers, whereas Open Innovation serves to capitalize on internal capabilities (Huston & Sakkab, 2006:3).
- *Time consumption:* When adopting the Open Innovation model, many businesses fail to consider the processes that needs to be put in place when implementing such a strategy. Insufficient attention is given to the internal phase of Open Innovation. Larger degrees of discussions and collaborations are needed as the ideas, reworkings and evolutions are unravelled (Bird, 2010). Open Innovation is therefore far more labour-intensive than anticipated and thus require substantial time investment (Anon, 2013c).
- *Collaboration:* Open Innovation, at its core, is based on collaborative relationships (Slowinski & Sagal, 2010:38). Encouraging parties within the business to commit is an unstated challenge, since the business often assumes that the source of the external innovation will be continuing with its production within the business (West & Gallagher, 2006:323). This lack of internal commitment hinders the success of Open Innovation. Other challenges with collaboration include the cognitive, cultural, institutional and organisational differences between the collaborating businesses (van de Vrande *et al.*, 2009:427). Problems with the contract agreements, and lacking resources for development, as well as free-riding behaviour, all pose as challenges to collaborating when adopting Open Innovation (van de Vrande *et al.*, 2009:427).
- *Insufficient consumer understanding:* It is vital for the business to implement the ideas and technology being generated to the satisfaction of the consumers (Kaluwa, 2012). Ideas, knowledge and technology require a profound understanding of consumer needs. Open Innovation provides limited insight into consumers' needs, particularly unarticulated needs (Bird, 2010).
- *Incorporating Open Innovation into internal development:* In order to benefit from Open Innovation, businesses actually need to identify these innovations, maintain skills in understanding these innovations, and be able to combine them with the business's internal innovation and specific needs (West & Gallagher, 2006:322). Often external knowledge and technology is identified, but not incorporated in the business's overall strategy.

The disadvantages of Open Innovation lie in its involvement in a business's key functions right through the innovation process (Anon, 2009:1). Open Innovation is characterised by its participation in the different stages of the innovation process and not just R&D (Mortara *et al.*, 2009:12). While businesses have their own innovation process and R&D departments, they are still inadequate and have limited experience on how to successfully manage Open Innovation activities. This is due to the fact that acquiring external ideas and sharing internal intellectual property does not epitomise the core strategy of most businesses (Lichtenthaler & Ernst, 2008a).

In hopes of overcoming the challenges experienced with Open Innovation, businesses often depend on the support of intermediary services (Nambisan & Sawhney, 2007). Intermediaries play a major role in the Open Innovation procedures and are involved in an estimated 20% of all technology transactions. With outbound Open Innovation, the potential solution to a specific problem is owned by the business, and that business attempts to externally commercialise its solution (Lichtenthaler & Ernst, 2008b). With inbound Open Innovation, a business attempts to acquire external technology, due to its inability to solve a specific problem.

Very little is known of the intermediaries that aid in accelerating ideas to market and/or businesses in commercialising their ideas. These intermediaries are known as Open Innovation accelerators (OIA). The various OIA and functions of these OIA, in connecting solution seekers and solution providers, are explained below.

3.6 OPEN INNOVATION ACCELERATORS (OIA)

An Open Innovation accelerator, as defined by Howells (2006:720), is an organization or body, acting as an agent or broker in any facet of the innovation process. These service providers support businesses in executing Open Innovation projects and can be from private or public sectors. Open Innovation accelerators either run the Open Innovation project on behalf of their clients (thereby providing a solution to a given task), or aid their clients in building their own Open Innovation proficiencies (Piller & Diener, 2013:4).

Open Innovation accelerators are seen as facilitators in transferring technology and knowledge across people, businesses and various industries. The more these facilitators are acquainted with the various industries and organisations from different geographic areas, the more acumen into the technologies available and technologies needed they receive and are able to provide (Howells, 2006:715).

In order to assist in implementing its Open Innovation process, OIAs need to have an understanding of the business's specific problem and the business's technology. Having an

understanding of these issues will enable potential innovators, within a different background, to understand the root of the problem (von Nell & Lichtenthaler, 2011:135). Certain businesses may prefer to remain anonymous, since they may not want competitors to discern their innovation efforts. Each OIA follows its own unique approach in managing issues concerning the business's identities (Chesbrough, 2006).

The role that the OIA plays often depends on the form of Open Innovation model adopted by the business. There are various Open Innovation models that businesses may take on, namely idea competitions, customer immersion, and innovation networks.

3.6.1 Open Innovation techniques

When implementing Open Innovation on behalf of the various businesses or entities, OIAs use various Open Innovation techniques.

3.6.1.1 Idea competitions

With this technique, ideas are suggested at a competitive level, and successful entries are given monetary awards and/or other types of incentives decided upon by the business taking on the idea. The selection and adoption of the idea depends upon the envisioned objective of the idea competition (Marais & Schutte, 2010:108).

When using this technique, a number of aspects need to be considered. Firstly, the OIA's ability to evaluate the ideas entered into the competition and select winners, as well obtain insights from other ideas is vital. The second requirement is that all intellectual property rights are communicated with entrants from the onset. It is imperative that entrants understand the ownership of the intellectual property once the idea has been adopted by the business (Marais & Schutte, 2010:109). In order for the idea competition to be successful, the reward scheme, as well as the competition needs must be clearly indicated and well marketed by the accelerator.

The South African based OIA, Idea Bounty, uses this technique when implementing Open Innovation (Anon, 2014d). Idea Bounty connects various businesses with ideas in the market. Businesses post their instructions, and innovators are encouraged to submit their ideas and solutions to the brief. The success of the idea competitions depends upon the businesses' brief. In the case Idea Bounty, a secure channel for innovators to offer their solutions to creative briefs is provided. When the best answer to the solution is found, a cash reward is given to the innovator (Anon, 2014d). In this case, all copyright, trademarks and any other intellectual property belong exclusively to the business adopting the idea.

Idea competitions, in essence, gain a large capacity of low-cost ideas, whilst simultaneously gaining insights into the various needs and wants of the end-users (Marais & Schutte, 2010:109).

3.6.1.2 Consumer immersion

This Open Innovation model is often used at the end of the innovation process and product development life cycle. It is a technique whereby the requirements and expectations consumers have regarding the products, are exploited. This happens through extreme consumer-product interactions, facilitated by the OIA (Marais & Schutte, 2010:110).

The aim of this technique is to immerse the business with the world of the consumer, in hopes of gaining true insight into their real-life needs and wants. Open Innovation accelerators identify a number of lead product users and general consumers, combine expert voices for forward-thinking and mainstream consumer viewpoints, in an overall effort to help act on timeworn notions and identify new product ideas (Anon, 2014e).

Since feedback from the consumer is vital, when OIA's use consumer immersion, it is important to lessen the communication barriers between them and the consumer. In order to increase the consumer immersion experience, businesses working with the OIA need to ensure that their prototypes are well-defined and developed. Consumer immersion creates an early awareness of the product and could result in earlier demand for the product, as well as reaching breakeven point earlier than anticipated (Marais & Schutte, 2010:110).

An international OIA, Consumer Eyes, provides consumer immersions tailored for the needs of each business. Output obtained from the consumer immersion is used as ideas stimuli, representing a strategic blueprint for the future of the product (Anon, 2014e). Consumer Eyes works closely with the business's innovation process team to assess these ideas stimuli in relation to the business's corporate competencies, its current product portfolio, the ideas' marketplace potential, and the overall technical feasibility of the ideas in the business. Once these limitations are evaluated and considerations are made, ideas with the most potential are selected (Anon, 2014e).

Consumer immersion, as an Open Innovation model, is therefore used mainly as part of product, concept or prototype testing (Marais & Schutte, 2010:111).

3.6.1.3 Open Innovation networks

This technique involves incorporating input from a network of contributors, in the form of solutions, to identified problems related to the business. An incentive is awarded to the problem solver (Marais & Schutte, 2010:112). When using innovation networks, solutions may range from government to private businesses, academia and research institutions, as well as venture capitalist and even individual entrepreneurs (Huston & Sakkab, 2006:4).

Unlike idea competitions, innovation networks are aimed at finding solutions to specific and technical problems experienced by the business. Innovation networks are often web-based platforms, thereby providing businesses with a community of problem solvers. By making use of web-based platforms, innovation networks are allowed to operate on a global scale and with a larger and wider range of communities, at a lower transactional cost (Piller & Diener, 2013:5).

Of the three Open Innovation models, innovation networks are the key drivers of Open Innovation. These web-based platforms assist in solving high cost and impenetrable problems, which are well defined by the business. Open Innovation accelerators aid businesses in identifying and clearly defining these highly-technical problems (Marais & Schutte, 2010:112). There are a number of well-known innovation networks used by top performing businesses around the globe such as Ninesigma and Innocentive.

Ninesigma is an OIA that connects businesses experiencing science and technology problems with external innovations (Anon, 2014f). These external innovations come from Ninesigma's community of universities, organisations, government, private labs and consultants that have developed solutions. Ninesigma creates a brief describing the problem, and then sends it to its innovation networks. Problem solvers submit non-confidential proposals back to Ninesigma, who then communicate the solution to the business with the specific problem. If the proposal is accepted by the business, Ninesigma connects the problem solver with that business (Huston & Sakkab, 2006:5).

In South Africa, The Innovation Hub, a science park in Pretoria, has piloted Africa's first innovation network; The Innovation Hub Open Innovation Solution Exchange. The Innovation Hub partnered with the City of Tshwane (CoT) and Research Institute for Innovation and Sustainability (RIIS), to inaugurate the Open Innovation Solution Exchange. The latter, which is similar to Ninesigma, is a web-based portal that connects solution providers to businesses or governmental entities seeking innovative solutions to solve problems or leverage opportunities (Anon, 2013).

The Innovation Hub is using Open Innovation as one of the methods to implement the Gauteng Employment, Growth and Development Strategy and the Gauteng Innovation and Knowledge Economy Strategy (GIKES). One of the aims of this strategy is to stimulate innovation and successful commercialisation.

3.6.2 The Innovation Hub Open Innovation Solution Exchange

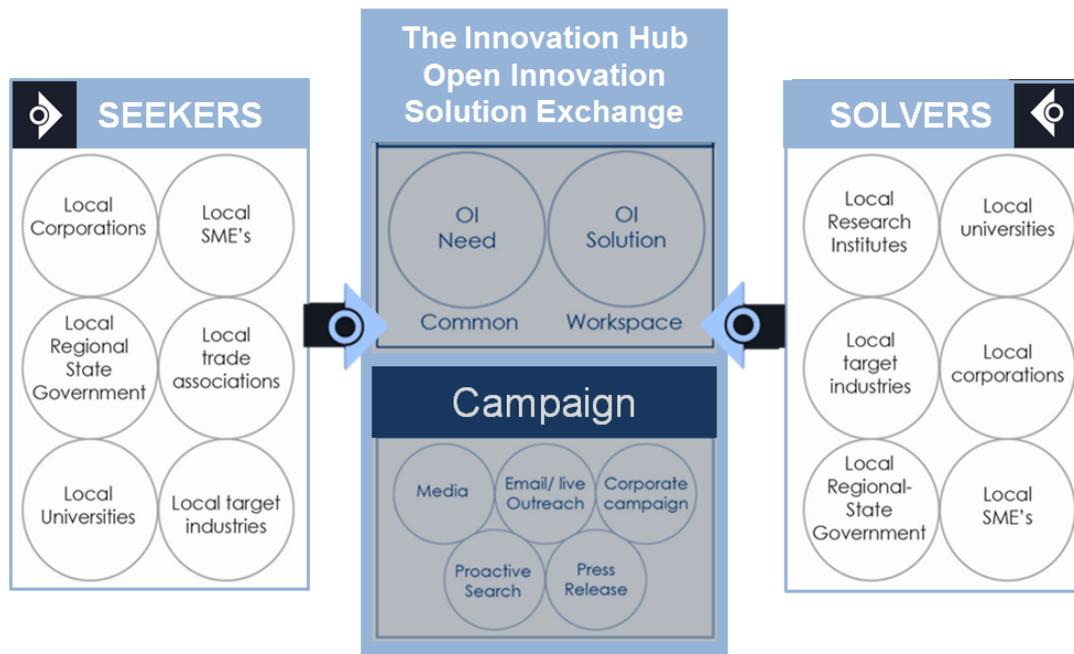
The Innovation Hub has taken the role of an Open Innovation Accelerator, by creating a web-based innovation network, which connects experts from various businesses, research scientists, SMME's and government with relevant R&D problems across the Gauteng province. The Innovation Hub Open Innovation Solution Exchange enables these businesses to reward scientific innovations through financial incentives or agreed partnerships. Businesses or governmental entities, known as seekers, can post specific problems, referred to as challenges, on the platform. These seekers offer rewards and then wait for other businesses, entrepreneurs or innovators (“solvers”) to offer solutions to those challenges.

The Open Innovation Solution Exchange encourages researchers, innovators, entrepreneurs, SMMEs and larger businesses, by submitting solutions, to respond to challenges posted on the platform. These parties are also permitted to display their inventions (The Innovation Hub, 2013:6). Figure 3.6 provides a conceptual framework of the platform and summarizes the stakeholders involved in the Open Innovation Solution Exchange into three groups, namely solution seekers, problem solvers and facilitators or accelerators.

This framework can be explained as follows:

- The OIA, (The Innovation Hub Solution Exchange) uses various marketing mediums in campaigning on the subject of the innovation-related challenges. This is done to attract local innovation seekers and solution providers to participate on the exchange. The OIA plays the facilitator, connecting the seeker with the solver. This is the common workplace in which a need meets its solution.
- The solution seekers post their challenges, either anonymously or named, making them visible to the innovation network community. Seekers may involve any department within organisations across the triple-helix, and are not limited to only R&D departments.
- Solution providers proactively register on the platform by answering to the various challenges and/or by submitting a technology that they would like to offer the market, and in doing so, highlight their business’s capabilities.

Figure 3.4: Conceptual framework of The Innovation Hub Solution Exchange



Source: The Innovation Hub (2013).

The businesses, individuals or organisations providing the solutions receive rewards, while the businesses seeking solutions pay a small fee for posting the challenges.

Through the platform, solution seekers are enabled to define a problem at the lowest level. This is done in order to prompt solutions from across different industries and by attracting the various innovators from those industries. The Innovation Hub facilitates and coordinates the solution review and selection process. However, this is not involved in the contractual negotiation, as these agreements take place between the seeker and the solver. This methodology of the Open Innovation Solution Exchange was built upon Ninesigma’s Open Innovation process (The Innovation Hub, 2013).

3.6.2.1 The Innovation Hub Solution Exchange C4 methodology

The FourC (C4) methodology is a logical process, used for implementing the front end of The Innovation Hub Open Innovation Solution Exchange. The “C4” represents challenge definition, connect, consider and commit. This methodology is benchmarked from Ninesigma and has proven to be the most effective and expedient in innovation networks for connecting seekers with high-quality solution providers. The methodology starts once the solution seeker has being identified.

Challenge definition

The first approach involves identifying a list of needs within the business, and structuring the needs in such a way that it creates a position for specific problems. This attracts solution providers from multiple industries outside a traditional network (Anon, 2014f). This is a non-confidential process, in which The Innovation Hub plays the foremost role in helping the solution seeker define the challenge.

Huston and Sakkab (2006:3) argues that, during this stage, it is imperative that the OIA ask the organisation seeking a solution what consumer needs will increase their product and brand growth. This is needed because often their researchers work on problems that are of interest to them, rather than those which lead to increased brand growth. Addressing the consumer need assists the process because these needs are then developed into specific problems. On the platform, the specific problems are referred to as challenges.

The challenge is a need expressing a technical problem coming from line, support or strategic business units. This challenge is defined by a selected team of experts familiar with the topic (Anon, 2013). When defining the challenge, it should be affiliated to the solution seeker's strategic objectives and, should a solution be found, is owned by the business willing to allocate a budget and other resources (The Innovation Hub, 2013:7).

Once defined, that challenge is documented into a summarised information document, referred to as a technology brief by Huston and Sakkab (2006:4). This brief is then posted onto the platform and used to form the second phase of the C4 methodology.

Connect

The connect phase of the C4 methodology involves stimulating the local innovation ecosystem, through marketing and campaigning. The challenge is promoted within networks of potential solution providers (Anon, 2013).

The connect phase is a hand-driven campaigning process by the OIA. During this phase, the campaign is managed, questions are handled and individuals or businesses register on the platform as possible solution solvers (The Innovation Hub, 2013:8).

Open Innovation accelerators are built on the involvement of a community and innovation networks. Through marketing the challenge and networking, solution seekers are connected to a variety of external possible solution providers that are often new and unknown to the seeker (Piller & Diener, 2013:5).

Connections are created through various marketing mediums, such as social media campaigns, press releases, email campaigns, through meetings, workshops as well as word-of-mouth. As a prerequisite for the next phase in the C4 methodology, possible solutions posted to the platform are also collected in this phase (The Innovation Hub, 2013:8). This connect phase can therefore be seen as a marketing function where challenges are introduced to the market in hope to attain solutions for consideration.

Consider

During the consideration phase, the proposed solutions are evaluated. This phase is referred to as “Evaluate”, according to Ninesigma’s methodology (Anon, 2014f). Open Innovation accelerator facilitators assist the solution seeker in evaluating the proposed solutions.

The solution’s descriptions, images and prototypes, if any, are sent to the seeker’s R&D teams, general managers and any stakeholder who would be involved with the commercialisation or use of the solution. Solutions are then screened through due diligence, information gathering, sampling and testing, scanning patents and meeting with laboratory managers amongst others (Huston & Sakkab 2006:6).

For The Innovation Hub Open Innovation Exchange, evaluation is done by following a dashboard approach testing what has been delivered alongside the defined need. This involves meeting with, final shortlisting and feedback to the selected solvers (Anon, 2013). Upon short listings and feedback from both solution seekers and providers, a commitment by the solution seeker has to be made. This takes place during the commitment phase (The Innovation Hub, 2013:8).

Commit

Unless it is required for facilitation, the OIA plays a distant role. Ninesigma refers to this stage as “Acquire”. Here, based on the seeker and provider’s specific needs, commercial viability of the solution provided is assessed. The commitment phase is a confidential process between the solution seeker and solver (Anon, 2014f).

Commitment is concluded through engaging with the various stakeholders involved in the innovation process, as well as the selected solution provider. This is because once the solution is considered, it is then developed into the business’s development pipeline; manufacturing, marketing, market research and other functions within the business that would require involvement (Huston & Sakkab 2006:7).

The Innovation Hub (2013:8) recognises this as a contracting process which is done through licensing, joint ventures, and product acquisition. Intellectual property needs are addressed, relationship criteria established, and finally, win-win agreements between the solution seekers and solver are negotiated.

It is clear that, although the platform is web-based, the majority of the tasks related to connecting the seeker with the solver are done by the OIA, namely The Innovation Hub project team. This hand-driven process is vital in assuring that the challenges find the right solutions. The project team has to then ensure that challenges are defined to their lowest level and campaigning needs are done aggressively. The evaluation and commitment to solutions is a collaborative effort carried out by the expert facilitators in the project team as well as the solution seeker's team.

When playing this role, The Innovation Hub aims to tackle service delivery issues in the Gauteng provincial government, and increase competitiveness of the private sector. For South Africa, the Open Innovation Solution Exchange is seen as a unique tool in improving innovation, job creation, competitiveness and economic growth (The Innovation Hub, 2013:4).

3.7 SUMMARY

As technology increases, global markets increase and essentially increase the competitiveness amongst businesses. More businesses across the globe are increasingly leaning towards methods of collaboration in order to gain a competitive advantage.

Collaboration with external parties is used to increase innovation within businesses. Businesses have therefore turned towards Open Innovation as a method of developing and further improving their innovation capabilities. Open Innovation is the practice of merging a business's internal assets and resources, with those outside the business, in order to acquire the best value from existing information and available information.

Open Innovation implies that businesses should not confine its learnt knowledge to its internal functions alone, nor should internal pathways necessarily be limited to bringing only the business's internal knowledge to market. It is significant that, before employing the model, a business first understand the advantages and disadvantages of Open Innovation. Although enhanced innovation capability, access to new markets and increased IP protection are some of the advantages offered by Open Innovation, the challenges and disadvantages of Open Innovation lie mostly in its involvement in a business's key functions.

Businesses are often inadequate and have limited experience on how to successfully manage Open Innovation activities; they therefore often depend on the support of intermediary services.

These intermediaries are known as Open Innovation accelerators and use various techniques in implementing Open Innovation for businesses. In South Africa, The Innovation Hub Open Innovation Solution Exchange has been piloted as an OIA. The latter connects solution solvers to businesses or governmental entities seeking innovative solutions to problems or attempting to leverage opportunities. This web-based platform has been used as one of the methods to implement the Gauteng Provincial Innovation Strategy and GIKES. One of the aims of this strategy is to stimulate innovation and successful commercialisation.

On this platform, a labour-intensive C4 methodology is driven. The methodology involves defining a challenge, creating awareness on the challenge, submitting solutions for the challenge, and thereafter deal-making between the challenge owner and solution provider. The research methodology used in investigating the various activities that take place on the Open Innovation this platform as well as the perceptions of participants on Open Innovation is discussed in detail in Chapter 4.

Chapter 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

Research is a practice in which the planning, collection and analysis of data occurs in order to make conclusions and recommendations regarding information that may have previously been unknown (McDaniel & Gates, 2013:4). The research methodology thus describes the proposed approach and intended method that will be used when planning, collecting and analysing the data for the research. The data can be gathered using various approaches and collection methods that accompany each of these approaches.

The stages in the research methodology involve reviewing the literature study, determining the research design, drafting the sampling plan, collecting and analysing the data in order to compile the research report (Creswell, 2013:8). The literature study indicates how various secondary data relate to one another and how this research connects with the previous research (Welman *et al.*, 2005:40). The research design is considered to achieve the research objectives set out and to control variance (Singh, 2007:63). In order to obtain adequate data about the perceptions of entrepreneurs, investors and government regarding the use of Open Innovation to accelerate commercialisation, a descriptive research design, employing a Quantitative method of primary data collection, was used. A complementary qualitative method of data collection was also used to provide a broader insight from the viewpoint of the Open Innovation intermediary.

The sampling plan is a process that involves selecting a segment of a population of interest, identifying a sampling frame and size, specifying the method of sampling and collecting the data. When collecting the data, research instruments are used in order to provide the researcher with the information needed for analysis (Berndt & Petzer, 2011:182).

A detailed data analysis was conducted to obtain results and conclude on the findings in order to make sufficient recommendations. Figure 4.1 provides a brief summary of the Chapter 4.

Figure 4.1: Synopsis of Chapter 4

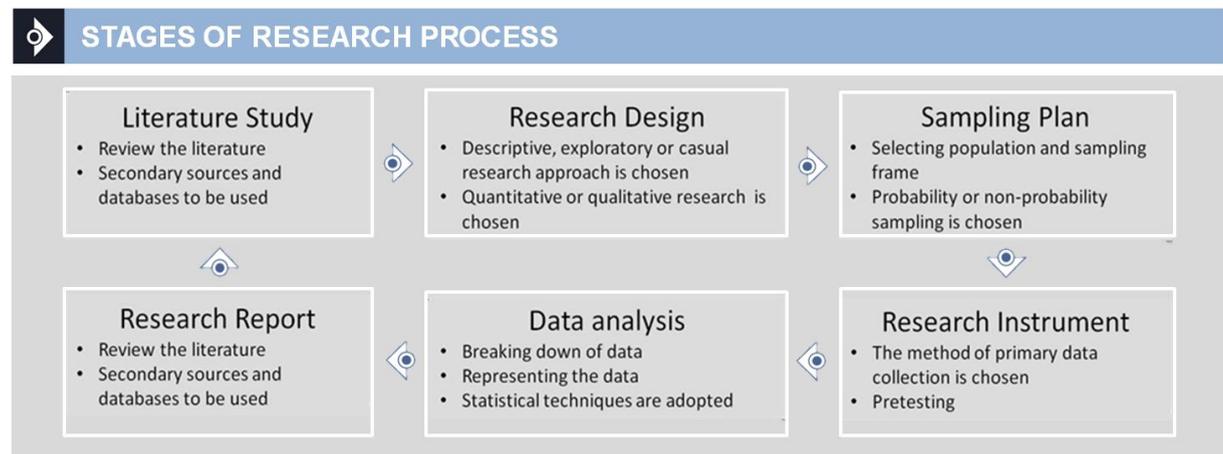


4.2 EMPIRICAL RESEARCH

Research normally takes place in five successive stages to scientifically investigate a research problem; this process is referred to as the empirical cycle (Welman *et al.*, 2005:14).

The steps in the empirical research cycle are illustrated in Figure 4.2. The steps involve defining the problem, determining the research design, drafting the sampling plan, collecting and analysing the data in order to compile the research report.

Figure 4.2: Stages of the research process



Source: Creswell (2013:8).

4.2.1 Literature study

The literature study aims to obtain significant research that has already been conducted, to provide a clear indication of the formulation of the research problem in this research. Previous research that has been conducted by external parties is referred to as secondary data (Berndt & Petzer, 2011:42). This data is used in compiling the literature study. Welman *et al.* (2005:40)

emphasis that the literature study points out how various secondary data relate to one another and how the proposed research connects with them.

In this research, secondary data, through definitions and theoretical foundations, have been obtained through an orderly approach of initially using electronic databases and subsequently gaining significant studies by scholars in the field of innovation, entrepreneurship and open innovation. This has been done through the use of relevant books, subject specific journals, websites, and accredited and scholarly journal articles. The databases from which these sources were found included NEXUS, SAePublications, Emerald, EbscoHost, SACat and ProQuest. Google Scholar, which is an electronic search engine providing scholarly literature, was also used. On NEXUS, completed and current registered research in South Africa was obtained while SAePublications and SACat provided a national catalogue of South African books and journals. Emerald and EbscoHost are global publishers linking research and practice through the provision of international journals. ProQuest was used to retrieve full text dissertations and theses from across the world. Primary literature sources such as local government publications and global comparative reports were also used.

Certain sources used in this research date back to 1934. The reason for this is because these primary sources reflect the origin of a specific concept (entrepreneurship and innovation) and are vital in understanding the full impact of what needs to be researched. These older sources included Schumpeter (1934), Drucker (1985) and Kuratko and Hodgetts (1995). These sources illustrated the origin of entrepreneurship and innovation.

4.2.2 Research design

The research design serves as the foundation and structure of the research. It helps answer questions regarding how the data will be collected and the manner in which the hypothesis will be tested (McDaniel & Gates, 2013:42). A research design is the plan, structure and strategy of the research, considered to obtain answers to research questions and to control variance (Singh, 2007:63). It refers to the specific method the researcher will use when collecting analysing and interpreting data (Stangor, 2011:13). The research design is a guideline that is followed when completing research. Using the research design as a guideline ensures that the research will be relevant to the problem and that it will use economical procedures (Churchill & Iacobucci, 2010:90). The research design depends on the research question and type of information the researcher is seeking. There are three common research designs namely exploratory, descriptive and causal (Kolb, 2008:5).

4.2.2.1 Exploratory research design

Exploratory research is used when the researcher seeks to find a problem or hypothesis that needs to be proven (Welman *et al.*, 2005:14). This research design is used when looking into an area that has not been studied. Tustin *et al.* (2005:84) explains that exploratory research designs are used for searching for insights into a general nature of a research. This research design is highly flexible, qualitative in nature and unstructured. Exploratory research design is constructed mostly through the use of secondary data (Cant, 2003:29). This is done by exploring previous studies as well as informally accessing knowledgeable individuals. Exploratory research is most applicable for subjects with limited and developing data (Coldwell & Herbst, 2004:36).

4.2.2.2 Causal research design

Berndt and Petzer (2011:32) state that causal research design is used to show whether a change in a variable will result in a change in another variable. Cant (2003:33) explains that a variable is a representation or concept taking a set of values. A variable is either dependent or independent. A variable is independent when the researcher has control over the concept. The variable is regarded as dependent when it is expected to be caused by an independent variable. With causal research, the researcher seeks to explain a certain phenomenon by examining its causes (Bryman & Bell, 2007:168). Causal research attempts to reveal relationships between two variables. This research design is used when a researcher is interested in experimenting outcomes. Unlike exploratory research causal research has substantial structure, a research problem and specific hypothesis to be tested (Coldwell & Herbst, 2004:36).

4.2.2.3 Descriptive research design

The descriptive research method is used to evaluate part of a population with certain characteristics (Coldwell & Herbst, 2004:36). It is defined as studies that are constructed to answer questions related to who, what, when and how of a subject. With descriptive research the frequency at which something occurs is investigated (Tustin *et al.*, 2005:86). Descriptive research aims to understand the manner in which things are through providing an exact depiction of some aspects of the marketing environment (Cant, 2008:33). This involves facets such as market potential of a product, its demographics and the attitudes of consumers.

Churchill and Iacobucci (2010:163) add that descriptive research design is used when the purpose is to estimate the proportion of people in a specified population who behave in a certain way, and to describe characteristics of certain groups in order to make certain

predictions. Instead of investigating the possibility of something happening, descriptive research design methods involve studying exactly what is happening (Dane, 2011:85).

For the purpose of this research, a descriptive research design was conducted employing quantitative and qualitative data gathering. The Quantitative data gathering was used to obtain adequate data about users of the Open Innovation platform, namely the perceptions of entrepreneurs, investors and government agencies. A complementary qualitative method of data collection was also used to provide a broader insight of the Open Innovation platform.

4.2.3 Method of data collection

Data may be collected from two distinct sources namely, primary data and secondary data. Secondary sources serve as analyses of data that has been found from primary data such as textbooks, journals, newspapers and biographies (Du Plooy, 2009:62). It is, in other words, information that is readily available.

For the purpose of this research, primary data was collected because the data gathered aimed to solve a specific research problem. Primary data can be collected through questionnaires, interviews and observations. When collecting primary data quantitative, qualitative or mixed research methods can be used. In this research, the data was collected primarily through the use of Quantitative research methods, while qualitative data was collected to compliment the quantitative information. A mixed-methods approach is therefore applied.

4.2.3.1 Mixed methods research

Mixed methods involve combining and integrating qualitative and quantitative research in a research (Creswell, 2014:14). Through mixing the research, a better and clearer understanding of the problem can be found.

It is important to note that the objective of mixed methods is not to replace the use of quantitative and qualitative research but instead to draw on their strengths and reduce their limitations in a research (Johnson & Onwuegbuzie, 2004:15). It is clear that with mixed methods, quantitative and qualitative research can be conducted at the same time (concurrent) or conducted one after the other (sequential). Additionally, the quantitative and qualitative research can be given equal emphasis or one approach can be given primary emphasis (Christensen *et al.*, 2011:382). Mixed-methods can therefore use sequential approaches, concurrent approaches or combination approaches (Greene, 2007:116). These approaches are further distinguished into embedded designs, transformative designs and multiphase designs (Creswell, 2014:221).

For this research, the researcher's primary aim was to collect Quantitative data while using a qualitative component to provide supporting information. This means that neither the integration of data nor the connection-across phases was utilised. The researcher collected both Quantitative and qualitative data simultaneously. This can be referred to as multi-methods research. Multi-methods research uses both Quantitative and qualitative research independent of each other rather than infusing one method with the other (Onwuegbuzie *et al.*, 2009:14). The type of multi-method research is referred to as a concurrent embedded strategy (Creswell, 2009:214).

A concurrent embedded multi-methods approach has a primary method that guides the project and a secondary method that provides a supporting role in the procedures. A QUAN/qual notation specifies qualitative methods are embedded in a quantitative design just as the capitalisation indicates a priority on quantitative research (Creswell, 2009:210)The researcher has collected qualitative data as part of a larger Quantitative research. The secondary method is embedded within the primary method by adhering to key parameters of the primary method (Greene, 2007:127). In this research, the embedded design was qualitative and was used to enhance and support the application of the Quantitative findings of the research. The embedding implies that the secondary method addresses a different question to that of the primary method and seeks information at a different level of analysis (Creswell & Clark, 2011:91). The qualitative data answered certain secondary objectives within this predominantly Quantitative research that cannot be quantified.

The embedded model of multi-methods is therefore used so that the researcher can gain broader perspectives as a result of using both Quantitative and qualitative research methods, rather than using Quantitative research alone (Creswell, 2009:214).

4.2.3.2 Quantitative research

Quantitative research involves collecting primary data from large numbers of respondents with the intent to project the results of a wider population (Tustin *et al.*, 2005:89). This method focuses on quantifying the research problem and testing objective theories by examining the relationship between variables (Creswell, 2009:4). The data is quantified through the use of statistical analysis and structural data collection methods (Malhotra, 2010:170). It tests variants and alternatives of the marketing mix using statistics, thereby creating significant segmentation. With Quantitative research the mean and standard deviations are imperative because they provide the variability of a distribution, as well as the arithmetic average of the scores (Bradley, 2010:290).

The behavioural patterns of various people, objects and happenings are recorded in a structured manner in order to obtain information about the research problem (Malhotra & Birks, 2006:242). The benefit of using Quantitative data is its ability to provide information that is specific to a particular research problem or project since parameters are set from scratch. Therefore, it becomes fundamental to check the boundaries for the specific research (Berndt & Petzer, 2011:134). There are different techniques that can be used when conducting Quantitative research. Quantitative research encompasses three vital techniques in descriptive research designs (Malhotra & Birks, 2006:224). The techniques used can be grouped into three categories: interviewer-administered questionnaires, self-administered questionnaires or computer-administered questionnaires.

Interviewer-administered surveys can be conducted through the use of in-home or in-office personal interviews, telephone interviewing and street interviews (Malhotra & Birks, 2006:675). In-home or in-office personal interviews allow for a great deal of flexibility and more information is attained as response rates are considerably high. With telephonic interviews, although respondents are not completely anonymous, they tend to be more comfortable during the interview as they are not intimidated by the physical presence of the interviewer. This increases the level of honesty during the interview (Shao, 2002:190). When conducting street interviews it is important to take into account the types of questions that will be asked (Berndt & Petzer, 2011:136). Interviewer-administered surveys require qualified interviewers, are time consuming and quite costly.

Unlike interviewer-administered surveys, self-administered and computer-administered surveys do not require engagement between the interviewer and respondents, as the respondent completes the survey him or herself. However, the participation of the respondents is often rather low (Shao, 2002:189). Computer-administered surveys are quick to distributed and have a high degree of reliability. These surveys are also low in cost and often allow for real-time data capturing (Berndt & Petzer, 2011:144).

For the purpose of this research, Quantitative research techniques were used as the primary research method. This allowed for the collection of data in order to achieve the objectives through empirical assessments that included numerical measurements and analytical approaches (Zikmund & Babin, 2013:99). Using Quantitative research helped in establishing the facts and figures relating to taking an idea into market through commercialisation. This method assisted in obtaining adequate data about the perceptions of entrepreneurs, investors and government (solution providers) on the use of Open Innovation to accelerate commercialisation.

4.2.3.3 Qualitative research

Qualitative research rejects practices and norms of the natural scientific model (Bryman & Bell, 2007:28). In other words, qualitative research represents the view of social reality as a constantly changing and emerging property of individuals' creation. Qualitative research is an inquiry approach and is used to explore and further understand a phenomenon. When using qualitative research, the researcher asks the respondents broad questions, collects their detailed views through words or imageries and then analyses the information (Creswell, 2013:204).

Qualitative research is ideally used in the description of small groups. It is also referred to as an approach rather than a set of techniques (Welman *et al.*, 2005:188). With qualitative research, the data is collected as descriptions of responses or as observations. Qualitative data is often not numerical since it involves techniques that aim to gain an understanding of the existence of attitudes and opinions (Du Plooy, 2009:203). It is important to note that the analysis of qualitative data begins during the collection of data and is adapted for each project (Bradley, 2010:230). Techniques used when conducting qualitative research are namely in-depth interviews, focus groups, grounded theory and observations.

In-depth interviews aim to address the research problem through one-on-one dialogues. Since the researcher and the respondent are alone, the latter receives no pressure from other individuals or group members (Bradley, 2010:234). Focus groups are interviews lead by a facilitator through the use of semi-structural and natural settings. The facilitator aims to obtain insights by listening to and conversing with the group (Malhotra, 2010:173). Grounded theory is a structured method of qualitative research. Malhotra (2010:189) states that in the case of grounded theory, each in-depth interview is adjusted based on aggregate findings from previous interviews. The purpose of grounded theory methods is to develop general concepts and theories. Observational methods are useful because they help realise respondents' behaviours that even they themselves cannot articulate (Churchill & Iacobucci, 2005:94).

For the purpose of this research, qualitative data was collected and analysed in order to provide a supportive role for the main Quantitative research. Qualitative data collection was therefore embedded within the Quantitative research. It was used in exploring, further understanding and providing an in-depth description of the importance of using Open Innovation in taking ideas to market.

Since the problem was clearly defined and the correct research design had been chosen, the next step in the research process involved selecting the elements from which the data would be collected. These elements have been indicated in the sampling plan.

4.3 SAMPLING PLAN

Sampling reflects the researcher's aim to gather information regarding characteristics or parameters of a certain population (Malhotra, 2010:370). The researcher may choose to study the entire population or select a particular group within the population. Studying the entire population is known as census (Tustin *et al.*, 2005:337). A census is most often used when the population being investigated is fairly small and a substantial amount of money and time is involved in conducting the research. Sampling is commonly used when conducting research. This is because there are lower costs associated with the methods used when sampling, as opposed to those involved with researching the entire population (Berndt and Petzer, 2011:166). It is important to understand the difference between using a sample and using a census to collect data.

For this research, data was collected from a sample rather than the entire population. This was because counting the entire population would have been very costly and in this case not possible. The time consumed when conducting a census could have rendered the data collected obsolete by the time the research was completed. Lastly, because a census required a large workforce which, in essence results in increased potential for non-sampling error, a sample was chosen on the basis of its ability to be more accurate (Churchill & Iacobucci, 2005:322).

When a population is being sampled, a sample plan is required. The sampling plan is a procedure used when choosing respondents from a set population. Sampling is used in collecting new data but it is also appropriate for historical research (Du Plooy, 2009:109). Sampling involves selecting a segment of a population of interest, identifying a sampling frame and size, specifying the method of sampling and collecting the data (Berndt and Petzer, 2011:26). The nature of sampling is represented as dealing with a subset of a population.

4.3.1 Population

The sampling process first began with defining the target population. Malhotra (2010:371) defines the target population as an anthology of elements possessing the information needed to solve a particular research problem. The population is a set of units from which the sample is selected (Bryman & Bell, 2007:182). It comprises of elements, extent, time and sampling units.

Elements are objects that possess the information that is desired; extent refers to the geographical boundaries of the research, while time is the period considered throughout the research. Sampling units have elements that are available for selection during the sampling process (Malhotra, 2010:371). Additionally, Berndt and Petzer (2011:171) emphasise that the population is the collection of elements that the researcher wants as it is the total group of people who could be asked to participate in the research. A conclusion is made about the population - it is the total elements that conform to designated specifications (Churchill & Iacobucci, 2005:322).

The Quantitative research population for this research was all individuals that have made use of Open Innovation platforms in South Africa, particularly the Open Innovation Solution Exchange. The Open Innovation Solution Exchange is an online platform that requires individuals that would like to participate in solving problems or in showcasing their technology, to register as members on the platform. These individuals may operate in academia, private sector or government. The sample was selected from members making use of the platform. This assisted in avoiding the population specification error. According to Tustin *et al.* (2005:340) a population specification error occurs when an unsuitable target population is selected for the research problem. The target population for the investigating Open Innovation platforms for accelerating commercialisation is defined in Table 4.1 as follows:

Table 4.1: Target population for the research

TARGET POPULATION	
Element (who)	Persons that make use of Open Innovation
Extent (where)	South Africa
Time (when)	October 2014 to June 2015
Sampling Unit (what)	Online membership portal and Open Innovation workshops

4.3.2 Sampling frame and unit

The second step in the sampling process involved identifying the sampling frame representing the elements in the target population. The sampling frame is a list of suitable sampling units for data collection (Churchill *et al.*, 2010:331). The sampling units were the population elements from which the sample was obtained. Finding a sampling frame that is correct, representative and recent is often challenging and expensive (Shiu *et al.*, 2009: 452). The challenge may be that information regarding each perspective sampling unit may be

inadequate, thus decreasing the probability of obtaining the correct sample. The researcher may also need to purchase lists of possible sampling units and this can be costly.

Feinberg *et al.* (2013:301) add that although sampling units may be the same as the population element, in more complex sampling procedures different sampling units may be used. This means that in a single-stage sample, sampling units and population elements are the same, while in a multi-stage sample the sampling unit differs in each stage of the sampling process.

For this research, the sampling frame comprised of individuals attending workshops on Open Innovation and challenge launches, as well as individuals making use of Open Innovation platforms. A list containing information about each perspective sampling unit was obtained from the Open Innovation platform and at the workshops (attendee registration lists). In this case, this entire list was referred to as the sampling frame. The platform requires that members register when making use of its services. Each registered member on the platform and at workshops served as the sampling unit for this research. Each sampling unit's basic information and contact details was obtained from the list.

4.3.3 Sampling methods

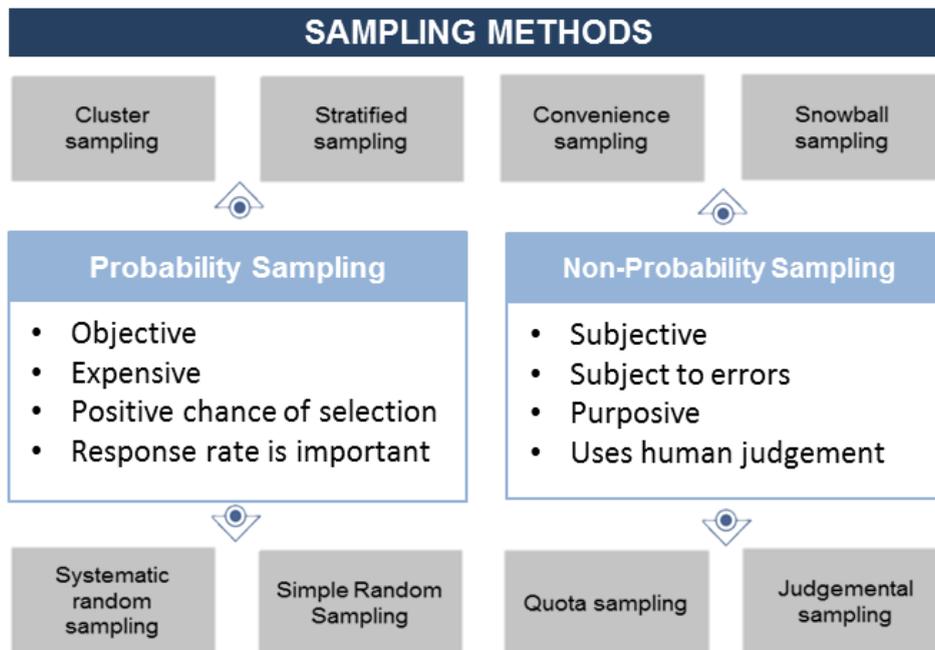
The third step in the sampling process involved implementing the correct sampling method throughout the research. Different sampling methods are used when using a sample for data collection, these methods are divided into two main categories namely probability sampling and non-probability samples (McQuarrie, 2006:95). According to Shiu *et al.* (2009:469), probability and non-probability samples are also referred to as random and non-random sampling respectively. The main probability and non-probability sampling methods are summarised in Figure 4.3.

4.3.3.1 Probability Sampling

Probability sampling is used when each member of the target population has a known "nonzero" chance of being counted in the sample (Churchill *et al.*, 2010:333). Although each population element has a known chance of being selected this chance is not necessarily equal for all elements. This sampling method therefore relies on random selection (Feinberg *et al.*, 2013:304). With probability sampling, the guidelines for selecting the population elements to be studied are determined at the onset of the research. This is done to ensure that the sampling units are selected in an unbiased manner and that the sample represents the target population adequately (Shiu *et al.*, 2009: 470).

Also, the potential sample may be pre-specified, although it does not necessarily have the exact same likelihood of being selected (Malhotra, 2010:377). There are four main probability sampling methods namely, simple random, systematic, cluster and stratified sampling. These are described below.

Figure 4.3: Summary of various sampling methods



Source: Parasuraman *et al.* (2007:338)

Simple random sampling provides a known and equivalent chance of any element being chosen regardless of the size of the sample (Bradley, 2010:161). This method allows the researcher to acquire unbiased data regarding the population’s characteristics. However, since simple random sampling requires that all sampling units be identified, it is quite difficult to retrieve a complete and precise listing of the population elements (Shiu *et al.*, 2009: 472).

Systematic random sampling involves the selection of a random starting point. From that point onwards every elements is selected in equal and pre-set intervals (Bradley, 2010:161). Unlike simple random sampling, systemic sampling is less costly because the random numbers selected do not need to match each individual sampling element (Malhotra, 2010:383). This is an easier way to draw a sample whilst guaranteeing randomness.

Stratified random sampling comprises of dividing the targeted population into different groups. These groups are referred to as strata. Samples, referred to as stratum, are then selected from the strata (Shiu *et al.*, 2009: 472). Stratified sampling is used when aiming to

achieve more detailed estimates rather than simple and systematic sampling (Feinberg *et al.*, 2013:336). It is challenging but imperative to determine the right basis for conducting stratified random sampling.

Cluster sampling is similar to stratified sampling. However, with cluster sampling the target population is firstly separated into subpopulations that are collectively exhaustive and mutually exclusive. From then on, a sample is selected from these clusters through the use of simple random sampling or a census (Bradley, 2010:163). If a cluster is selected but does not represent the target population, even once the simple random sampling or census is completed the results will not stand for the population (Shiu *et al.*, 2009:478).

4.3.3.2 Non-probability Sampling

Since there is no manner in which to estimate the likelihood of a target population being selected, non-probability sampling relies on personal judgement when selecting a sample (Churchill *et al.*, 2010:333). Non-probability sampling, in other words, does not guarantee a known chance or equal likelihood of any population element being selected for participation (Feinberg *et al.*, 2013:304). Since the researcher intentionally selects the elements that will be sampled, there is not much objectivity when evaluating the sampling results (Malhotra, 2010:376). The assessments therefore do not project the entire population statistically as the results are restricted to the respondents who have provided the data during the sampling process (Shiu *et al.*, 2009:470). There are four non-probability sampling techniques namely quota, judgement, convenience and snowballing sampling.

Convenience sampling is conducted in the most suitable areas for the researcher. The respondents selected, as well as their location is therefore subjective (Burns & Bush, 2014:254). The use of convenience sampling offers the advantage of saved time and costs as respondents are easily available, although there is a possibility that they are not appropriate for the research (Bradley, 2010:167).

Judgemental sampling is used when the researcher selects criteria based on personal judgement. This personal judgement is guided by the sampling element's representation of the population (McDaniel & Gates, 2001:348). Since the sampling elements are subjectively and intentionally selected, judgmental sampling is most ideal for small samples rather than large sampling (Berndt & Petzer, 2011:174).

Quota sampling is the use of pre-specified control variables when selecting a sample. Selecting these variables from each population segment is based on the researcher's judgement (Parasuraman *et al.*, 2007:345). The variables are usually demographic in nature

and are measured against the target population (Feinberg *et al.*, 2013:305). Quota sampling is therefore a combination of convenience and judgemental sampling.

Snowball sampling is often referred to as referral sampling since it requires respondents to provide details regarding other prospective respondents (Burns & Bush, 2014:254). This method of sampling is often used when there are an inadequate number of anticipated respondents. Malhotra (2010:381) adds that although the selection of the initial sample is random, the final sample is a non-probability sample. This is because respondents selected have been referred to by respondents with similar characteristics.

For the purpose of this research, a non-probability sampling method was utilised. Convenience sampling was used when gathering quantitative data. Convenience sampling enabled a large number of respondents to be given self-administered questionnaires in a relatively short space of time, specifically during workshops (Shiu *et al.*, 2009: 480). The sampling unit that was easily available and accessible was selected. All registered members onto the Open Innovation platform were emailed the questionnaire as this was the most convenient for the researcher too.

4.3.3.3 Non-sampling errors

Since this research will be conducted through a non-probability convenience sampling technique, sampling errors cannot be calculated as there is no known chance for a particular sampling element in the target population being selected. Although this is the case, other forms of errors may occur. These errors are known as non-sampling errors (Churchill & Iacobucci, 2005:378).

Non-sampling errors involve any kind of bias that may result from mistakes made by the researcher at any stage in the research process. There is no statistical procedure available to assess the impact of non-sampling errors on the quality of the data collected (Shiu *et al.*, 2009:456). This is also because non-sampling errors are related to the accuracy of the data while sampling errors are related to the representativeness of the sample to the target population.

For the purpose of this research, the two types of non-sampling error, namely sample design error and measurement error were avoided. The various sample design errors such as sampling frame error, population specification error and selection error were looked into and avoided. Errors concerning measurement were also looked into. These errors included research instrument errors, data collection errors and respondent errors.

Sampling frame errors result when the elements in the sample frame have been duplicated and when excluded or foreign elements have been included (Tustin *et al.*, 2005:377). For this research, the sampling frame consisted of respondents who had made use of Open Innovation during the course of the research. This ensured that one sampling frame was used and not duplicated. Data was gathered from only the respondents within the sampling frame. Respondents who have already provided data through answering the questionnaire were requested not to complete it a second time when such an opportunity arose. The sampling frame error was therefore circumvented since the sampling frame was correct, complete and not out-dated.

Ensuring that the sampling frame error had been ruled out then resulted in the prevention of a population specification error. Berndt and Petzer (2011:149) state that the population specification error occurs when a target population has been wrongly defined. The population of this research has been clearly and precisely defined in section 4.3.1.

All respondents in the sampling frame, i.e. those that attend the workshops and those who have registered on the Open Innovation platform, were provided the questionnaire. This means that the selection error was avoided because no one was unnecessarily excluded from the sample (Berndt & Petzer, 2011:149). The selection error was reduced by also ensuring that respondents at the workshops completed the questionnaire and returned it to the researcher before the end of the workshops.

A research instrument error occurs when there is no clear understanding of the objective of the research and when the questionnaire is subjectively designed (Tustin *et al.*, 2005:377). To reduce this error, the problem statement founding this research was clearly understood by the researcher and therefore resulted in well-defined objectives for the research. The questionnaire was impartially designed, ensuring that it did not influence the respondent's answers. To further reduce research instrument errors, the questionnaire was pre-tested on a small set of individuals.

Interviewer errors were considered when conducting this research. Tustin *et al.* (2005:378) mentions that interviewer cheating and bias occurs when the interviewer fabricates the data by either completing the questionnaire on behalf of the respondents or by discarding data that is not consistent with his or her views. In this research, the interviewer error was reduced by ensuring that respondents completed questionnaires and submitted them at workshops during the time allocated. Questionnaires completed online could not be edited or discarded once the respondent had completed it.

Data capturing errors occur when mistakes are made with regard to coding the responses. The error occurs when data captured does not reflect the data supplied in the questionnaire (Berndt & Petzer, 2011:151). To reduce this error, completed questionnaires were sent to the North-West University's statistical department where qualified data analysts capture the data using the trusted software programme, SPSS.

Tustin *et al.* (2005:378) mentions that errors could also result from respondent's unwillingness or incapability to provide the interviewer or questionnaire with truthful answers. Berndt and Petzer (2011:151) add that this error is due to the respondents' fear of judgement or they may do it for their own personal gain. This error is referred to as respondent error. To reduce respondent bias, respondents were informed before completing the questionnaire that their answers are confidential. To ensure their confidentiality the questionnaire allows for anonymity.

4.3.4 Sampling size

Specifying the sample size was the fourth step in the sampling process. The sample size reflects the actual number of elements that are included in the research (Malhotra, 2010:374). The research objective along with the size and nature of the population has an influence on the size of the sample. Bradley (2010:173) adds that it is imperative that the size of the sample is agreed upon before commencing the fieldwork.

Specifying the sample size required that the sampling method be firstly selected. The sampling method chosen for this research was non-probability sampling. With non-probability sampling, the sample size does not directly relate to how close the sample's statistic is to the population's value (Burns & Bush, 2014:283). Sample size formulas and calculations did not need to be used or made when specifying the sample size during the sampling plan. Constructing the sampling distribution of the statistic in question was not possible since the tools used for statistical inference were not implemented (Churchill & Iacobucci, 2005:354).

The specification of the sampling size was a subjective judgement made by the researcher. According to Shiu *et al.* (2009:462) a researcher's personal judgement is often based on past studies, experiences, availability of resources, industry standards and intuition. The researcher also compared the benefits of obtaining the desired data against the costs associated with gathering that data (Burns & Bush, 2014:283). Since non-probability sampling was used for this research, when deciding the size of the sample the researcher made use of personal judgement and advice given by the study leader.

The researcher's past experiences and involvement with Open Innovation platforms has formed the bases of specifying the sample size. The South African innovation industry standards and best practices have been considered, as well as the costs associated with gathering the data. The data was gathered at Open Innovation workshops held in Gauteng Province, South Africa. This means that the actual size of the sample was obtained as attendees to these workshops were recorded in the attendance register. Questionnaires were handed out as part of the workshop program. This guaranteed close to a high response rate since the questionnaires were collected immediately once they were completed. Individuals that registered onto Open Innovation platform but do not attend the workshops were also sent the questionnaire through email. They responded by filling the questionnaire in online.

4.3.5 Specify sampling plan

The next step in the sampling process involved determining how the methods, techniques and decisions made in the sampling process thus far would be implemented (Berndt & Petzer, 2011:177). In this step, an operational plan on how the sample was drawn and created was developed. Tustin *et al.* (2005:373) emphasises the importance of developing a sampling operational plan, adding that failure to do so could essentially threaten the entire sampling process. Figure 4.4 illustrates the sampling plan for this research.

Figure 4.4: Quantitative sampling operational plan



- Participants selected for pretesting are sampled through the use of convenience sampling.
- The researcher identifies platform members who are easiest to contact and will respond the quickest.

3. COLLECTION OF DATA: WORKSHOPS

1. Arrive punctually on agreed workshop dates with all the research instruments that need to be handed out and introduce the research to workshop attendees.
2. Provide attendees with a clear explanation of the purpose of the study and assure them of the strict confidentiality with which the data provided will be treated.
3. Hand out questionnaires and ensure that respondents complete the entire research instrument once the workshop has been conducted.
4. Collect all completed questionnaires thanking the workshop attendees for their participation.

- Workshop dates
 15 November 2014: Tech Auction at Innovation Festival hosted by TIH
 2-3 February 2015: Innovation Bridge hosted by Department of Science and Technology
 26 May 2015: Innov8 Challenge Launch hosted by TIH

4. COLLECTION OF DATA: EMAILING MEMBERS

1. Contact TIH database managers and owners via email, telephone or appointment.
2. Request their approval to send questionnaires to online members through email.
3. Once approved, provide TIH with a cover letter for the body of the email clearly explaining the purpose of the study and assuring confidentiality of data provided.
4. Ensure recipients are thanked in advance on the email so that they understand their inputs are valued.
5. Ensure that all completed questionnaires are saved correctly and will be available for access as the data analysis process commences.

- The email provides recipients with a link on which the questionnaire may be filled.

5. FOLLOW UP

1. Check all questionnaires for completeness and correctness.
2. Decide whether more data may be needed.
3. Schedule a date with TIH on during which the researcher will debrief them, informing them of the amount of data collected.
4. If more data is needed, determine the dates of further upcoming workshops.
5. Once all the needed data is collected. Thank TIH for their continued support with the data collection and sampling process.

6. CONCLUDE THE SAMPLING PROCESS

1. Consolidate all the questionnaires completed from online and from workshops into a complete batch.
2. Contact the North West University statistical sciences department in advance to arrange a specific date on which the data can be captured.
3. Once the data is captured, review the data in preparation for data analysis.
4. Thank the department for their research support.
5. Start the data analysis process (See section... and chapter 5).

4.3.6 Sampling for qualitative research

Using an embedded multi-method research design for this research means that qualitative techniques were implemented within this research's primary research methodology - Quantitative research. This indicates that qualitative research follows and adheres to the parameters of the Quantitative research for this research (Greene, 2007:127). Therefore since non-probability sampling was conducted for this research, the same applied to the qualitative component. However, with qualitative data collection, respondents are purposefully selected to gain an in-depth understanding rather than to make generalisations of the results (Patton, 2002:230). This method of sampling is referred to as purposeful/purposive sampling.

Purposive sampling is generally associated with small, in-depth studies based on gathering data focused on exploring and interpreting perceptions (Mathews & Ross, 2010:167). The logic and strength of purposive sampling lies in the selection of 'information-rich' respondents for an in-depth research. The respondents are those from which the researcher can learn about issues that have central importance in supporting the Quantitative results (Patton, 2002:230). The respondents have therefore illuminated the questions under research.

Since non-probability sampling was used, it was not necessary to use or make sample size formulas and calculations when specifying the sample size during the sampling plan (see section 4.3.4). Unlike, the primary research method used for this research, the qualitative research component did not attempt to create a sample that is statistically representative of the population; there are no rules for sample size (Mathews & Ross, 2010:167). The validity and meaningfulness generated from the qualitative component had more to do with the information richness of respondents selected than the sample size (Patton, 2002:245). Different sampling sizes are common with multi-methods because Quantitative and qualitative data is gathered for different purposes (Creswell *et al.*, 2008:74).

Participants for the qualitative component of this research were purposefully selected from the population. These respondents had an in-depth understanding of Open Innovation in the South African context, the Open Innovation platform and components needed in accelerating ideas (solutions posted onto the platform) into commercialised entities. The participants were involved in both the design and management of the Open Innovation platform or had extensive knowledge on supporting mechanisms for taking ideas to market through the use of Open Innovation. These respondents had not necessarily registered on the platform nor attended workshops as participants but instead were key stakeholders in the success of the platform and workshops held on Open Innovation. Figure 4.5 represents the key stakeholders of the Open Innovation Platform.

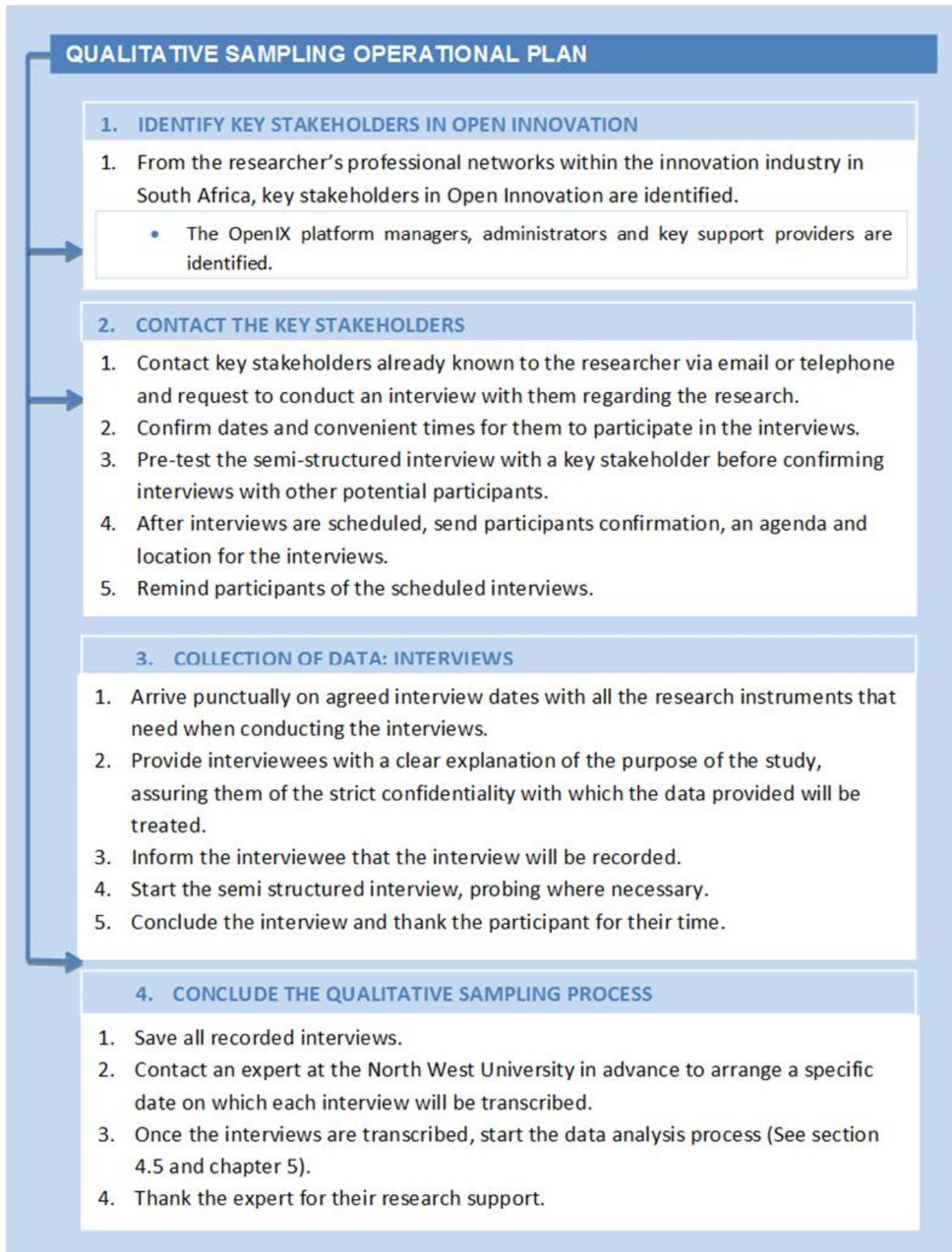
Figure 4.5: Stakeholders of the Open Innovation platform



Source: Own Compilation.

The execution of both sampling operational plans for the qualitative and Quantitative components of the research occurred simultaneously, as represented in Figure 4.6. However, data collection may have occurred on different dates and at different locations since respondents first confirmed their availability for interviews.

Figure 4.6: Qualitative sampling operation plan



4.3.7 Selecting the sample

The last step in the sampling process entailed the actual gathering of data from the sample. Drawing the sample occurred as the specified sampling operating plan was implemented. The sample was selected during steps 3 and 4 in the Quantitative sampling operation plan and step 4 in the qualitative sampling operational plan. Both Quantitative and qualitative sampling occurred concurrently and were not dependent upon each other. When drawing the data, the researcher ensured that non-sampling errors detailed in section 4.3.3 did not occur.

4.4 RESEARCH INSTRUMENT: QUANTITATIVE RESEARCH

The purpose of research instruments is to provide the researcher with the information needed for analysis (Berndt & Petzer, 2011:182). The research instrument should have the ability to translate the information required into a set of definite questions that respondents will need to answer. The research instruments must be able to persuade respondents to want to participate in the research whilst minimising response error (Malhotra, 2010:335).

Bradley (2010:187) defines a questionnaire as a valuable instrument containing two or more questions having clearly selected vocabulary. It is also significant to note that questionnaires typically have more statements than they do questions. This occurs as the researcher seeks to investigate the extent to which respondents have a particular attitude (De Vos *et al.*, 2012:186).

The research instrument for this research was a self-administered questionnaire. The use of questionnaires as the research instrument helps gather thoughts, attitudes and evidences about the topic being researched (McDaniel & Gates, 2013:107). The researcher distributed the questionnaires to the respondents, allowing them to complete it on their own. Although this was the case, the researcher was easily reachable if respondents incurred any problems. The questionnaire was designed in a manner that provided maximum clarity so that the respondents needed no assistance.

Two types of self-administered questionnaires were used, namely an Internet questionnaire, and a delivery and collection questionnaire. The internet questionnaire is sent electronically using emails, intranet or webpages, while the delivery and collection questionnaire is delivered by hand and collected at a later stage (Saunders *et al.*, 2012:420). Table 4.2 provides an overall description as to why two types of questionnaires were used for this research.

Table 4.2: Attributes of having an Internet questionnaires as well as a delivery and collection questionnaire

CHARACTERISTIC	INTERNET QUESTIONNAIRE	DELIVERY AND COLLECTION QUESTIONNAIRE
Size of sample	Large and can be geographically dispersed. In this research, online membership amount to 745 and members are from South Africa.	Depends on number of fieldworkers. In this research, sample size depends on workshop attendees.
Population's character	Computer-literate individuals who can be contacted by email and have access to the internet.	In this research, literate individuals who attend scholarly and business oriented workshops.
Researcher's participation	None - Emails are sent to the database on behalf of the researcher.	Hand out and collect questionnaires while enhancing respondent participation.
Financial resource implications	Subscription to online survey software and charge on webpage design.	Traveling to workshops, photocopying questionnaires and data capturing.
Likely response rate	15% or lower	100%
Time taken to complete collection	2-8 weeks from distribution and follow up emails.	Dependent on the number and dates of workshops.
Confidence that the right person has responded	High. Only Open Innovation platform members are emailed.	High. Attendees to Open Innovation workshops are invited and originated from the triple-helix
Feasible length of questionnaire	2-8 pages A4 pages with minimised scrolling down. For this research 2 webpages are used.	2-8 A4 pages. For this research a single A4 page is used. The page is divided into 4 A3 pages printed on both sides.
Distortion of respondent's answers	Low. Results are captured as respondent completes questionnaire.	May be distorted as respondents consult one another during the completion of the questionnaire.

Source: Saunders *et al.* (2012:421).

From the above table it is concluded that the choice of the Internet questionnaire and delivery and collection questionnaire was greatly influenced by the characteristics of the respondents, the size of the sample, the researcher's financial resources and the expected response rate from respondents.

4.4.1 Aligning the literature study with the questionnaire

The information needed for the research determined the design of each question. Researchers should have a clear understanding on what information they need to obtain before the nature of the questionnaire is selected (Saunders *et al.*, 2012:431). This means that the questionnaire needed to be aligned with the problem statement, the research objectives, the literature study, as well as decisions made on the design of the sample frame. Feinberg *et al.* (2013:268) adds that the roles and the character of the questionnaire are influenced by the research design and the sampling plan. The questionnaire therefore needed to be comprehensible to the sampling element without needing additional intervention.

The central concepts and constructs of the research, which are likely to be established in the literature study, determine the structure of each question (De Vos *et al.*, 2012:191). Therefore, in order to measure a concept, it was essential to first find its practical applications from the literature. Grinnel and Unrau (2011:341) emphasise that a clear conception of the research problem and its operationalised components provide direction for questions. Operationalising the concepts into practical proportions of measurement was vital.

De Vos *et al.* (2012:191) provide clear guidelines on how this can be achieved. The key concepts of the research need to be clearly defined, after which the elements regarding each key concept should be listed. Elements from key concepts are operation definitions of the concept and originate from literature definitions in the research. Upon listing these operational elements, their indicators need to be provided. Indicators are statements outlining how each operational element is observed in reality. These indicators then form the format that is to be used in the questionnaire. As a result, each question reflects the conception of the research problem and thus represents the information need. Questions that are unrelated to the specific information needed are discarded (Feinberg *et al.*, 2013:268).

The concepts, operational elements and indicators for this research have been summarised in Table 4.3.

Table 4.3: Theory of the research found in the research instrument

THEORETICAL CONCEPT	OPERATIONAL ELEMENT OF CONCEPT	REPRESENTATION IN QUESTIONNAIRE
Entrepreneurship	An opportunist behaviour that influences the economy through innovation.	Section B Questions: 2; 7; 8; 22
Innovation	The creation of new technology.	Section B Question 3; 4; 5; 9; 10; 18
Innovation value chain	The process of taking ideas and changing them into commercial products or services.	Section B Question 12; 13; 14; 15; 17
Accelerating commercialisation	Marketing, funding and IP help innovation value chain activities occur more swiftly therefore fostering commercialisation.	Section B Question 19; 20; 21; 23; 24; 46; 47; 48; 49
Open Innovation	Open Innovation presents access to other people's IP, the use of triple-helix players, access to new markets. Its challenges include IP leakage, it's mistaken for outsourcing innovation, its time consuming, and there is an insufficient understanding and a lack of stakeholder buy-in of Open Innovation.	Section B Question 26; 28; 29; 31; 34
Collaboration	Working external and internal parties of a business to achieve a specific goal or solve a problem.	Section B Question 11; 39; 40
Open Innovation accelerator	Define the challenge Connect to the market Consider solutions Commitment to partnerships	Section B 25; 30; 32; 35; 38; 41; 43; 44; 45

4.4.2 Designing the format of the questions

After the content of the questions had been developed and analysed, the types of questions for the questionnaires were determined. Questions can either be structure or unstructured. Unstructured questions are open-ended questions requiring the respondents to provide their opinions in their own words, whereas structured questions indicate only a specific set of response alternatives (Malhotra, 2010:348). For this research, structured questions were

formulated. Structured questions are further categorised into multiple-choice questions, dichotomous questions and scaled-response questions (McDaniel & Gates, 2013:253).

Multiple-choice questions provide respondents with a list of pre-established answers and require that they choose an applicable answer from the list (McDaniel & Gates, 2013:253). With multiple-choice questions the researcher is able to limit the responses to three or more options that he or she requires, instead of unstructured and various answers from respondents (Feinberg *et al.*, 2013:268). For this research, three questions were multiple-choice questions. The questions identified demographic variables regarding the respondents' core business focus, sector and highest level of education.

Dichotomous questions provide respondents with only two possibilities, therefore requiring only one of the two answers (De Vos *et al.*, 2012:198). Dichotomous questions are the easiest to code, analyse and report since variables will only have two possible states. Questions may also include a neutral alternative. An example of dichotomous questions could be "yes", "no" or "I don't know" (Feinberg *et al.*, 2013:278). For this research, four questions were dichotomous. The questions required either a "yes" or a "no" from respondents. Dichotomous questions were chosen because they did not seek to capture the intensity of the respondent perception on the question instead aimed to capture two alternatives.

Scaled-response questions provide respondents with a list of choices that are designed to capture the intensity of their feelings towards a certain question (McDaniel & Gates, 2013:255). Scaled-response questions create a range at which measure objects can be measured (Bradley, 2010:197). For this research, Likert-style questions were used. Saunders *et al.* (2012:436) explains that Likert-style questions use a four, five, six or seven point rating scale on which they measure the extent to which respondents strong agree or strongly disagree with statements. A five-point Likert-scale was used to construct the questions. Forty-five questions were Likert-scale, requesting that respondents indicate the extent to which they agreed or disagreed with the statements.

4.4.3 Choosing the wording of the questions

After deciding on the type of questionnaire and the format of the questions, the researcher focused on the wording of the questions. When wording each question, a number of considerations were made specifically the clarity of each question, and bias toward the respondent and the respondent's ability and willingness to participate in the research (McDaniel & Gates, 2013:257).

For this research, the questions were structured so as to have the same meaning for all respondents, with ambiguous vocabulary being avoided. In addition, reasonable terminology was used throughout the questionnaire. The sample frame consisted of individuals that have made use of Open Innovation in South Africa during the past two years. This has indicated to the researcher that respondents have a somewhat professional business vocabulary. The researcher therefore ensured that all words were aligned with the vocabulary level of the respondents. The questions developed were specific and asked independently. This aimed to ensure that no generalisation was made when the respondent filled in the questionnaire and that none of the questions were double-barrelled. Double-barrelled questions combine two or more attitudinal objects in one question (Feinberg *et al.*, 2013:281).

When drafting the questions, leading and biasing questions were circumvented by ensuring neutrality and objectivity. Leading questions ultimately provide the answer by giving the respondent clues to answering the questions or making respondents answer a certain way, whereas biasing questions are emotionally coloured words or phrases proposing a feeling of approval or disapproval (Feinberg *et al.*, 2013:281).

4.4.4 The sequence of the questionnaire

For this research, a screening question was not used because the sample elements were already predetermined and known i.e. specific workshops and Open Innovation platform database. McDaniel and Gates (2013:258) explain that the objective of screening questions is to identify the target respondents. The designed questionnaire only consisted of two sections that corresponded with the research objectives set out for this research.

Section A: Demographic variables were measured in section A. The questions asked were regarding the sector in which the respondent operates, their highest level of education and the primary focus of their business. Section A contained close-ended multiple-choice questions.

Section B: In this section, the perceptions respondents hold regarding entrepreneurship, the innovation value chain and Open Innovation were measured. The first forty-five questions in section B were close-ended five-point Likert-scale questions while the last four questions were dichotomous questions.

The questionnaire was structured logically with more general questions asked in the beginning in order for respondents to familiarise themselves with the research and its concepts. As respondents started understanding the nature of the questionnaire and in order to build momentum and commitment to finishing the questionnaire, more curiosity-building questions were asked. These questions were contained in section B. As scaled-response questions

emerge it is essential that respondents understand the response classifications (McDaniel & Gates, 2013:260). The researcher ensured that respondents had a clear understanding of how to answer each section by stating the following: “*Indicate the extent to which you agree with the following statements on a scale of one (strongly disagree) to five (strongly agree). Indicate ‘yes’ or ‘no’ regarding the following statements.*” Questions that respondents may have perceived as sensitive were positioned at the end. These questions related to protecting IP and requesting funding for technology.

Saunders *et al.* (2012:446) states that the overall layout of a questionnaire should refrain from appearing too long while at the same time being eye-catching so that respondents are encouraged to complete it at face value. For the data collection of this research, the questionnaire was originally four A4 size pages but was then printed back-to-back in booklet form on a single A4 paper and then reduced to four A5 size pages. See appendix A. The questionnaires contained the host of the workshop’s branding. Questionnaires handed out during the Innovation Festival workshop included the festival’s logo on the top right-hand side of the front page of the questionnaire. Online questionnaires were drafted from layout templates provided by *SurveyMonkey*, an online survey tool.

4.4.5 Explaining the purpose of the questionnaire

Self-administered questionnaires ought to include a cover letter or email introduction letter explaining the purpose of conducting the questionnaire (Saunders *et al.*, 2012:446). The cover letter explained the questionnaire to the respondents, providing them with a clear context of the research. De Vos *et al.* (2012:193) emphasises that the cover letter should include relevant and credible information regarding the research and the researcher, in order to motivate respondents to complete the questionnaire. A clear explanation of the reasons for the research was given also indicating as to why they were selected as part of the research.

The cover letter in this research explained that the questionnaire formed part of research submitted in part of the fulfilment of a Master’s degree in Entrepreneurship at the North-West University. Basic information about the researcher and the study leader was provided along with a brief description on the context of the research. A summary of the sections in the questionnaire was provided, also indicating the expected time it would take to complete the questionnaire and how best to complete it. The cover letter also emphasised the anonymity and confidentiality of the responses, stating that only overall results were to be compiled and used. At the end of the cover letter, respondents were thanked in advance for their participation.

4.4.6 Pre-testing the questionnaire

In order to improve the questionnaire, a pilot test was conducted. According to Malhotra (2010: 354) distributing the questionnaire to a small fraction of the respondents will assist in finding and removing any potential problems. This is referred to as pre-testing.

The questionnaire was pre-tested by distributing it to five Open Innovation platform users. The researcher was already aware of the stakeholders of the Open Innovation Solution Exchange run by The Innovation Hub. Feedback regarding the questionnaire was provided at a scheduled feedback meeting during which concerns regarding the questionnaire were pointed out. Only a few corrections needed to be made. Once the questionnaire was corrected, it was then discussed with the Statistical Consultation Services of the North-West University (Potchefstroom Campus) to ensure that the questions asked would indeed assist in accomplishing the objectives of the research. The questionnaire was further analysed to ensure that it adhered with the code of ethics formulated by the North-West University.

Table 4.4: Questionnaires collected

QUESTIONNAIRES COLLECTED	TOTAL
Workshop 1: 17 November 2014 (Innovation Festival: Tech-Auction)	16
Workshop 2: 3 February 2015 (Innovation Bridge: Technology showcase exhibition)	9
Workshop 3: 26 May 2015 (Innov8: Collaboration in Action by OpenIX)	38
Online questionnaires (18 March 2015 – 30 June 2015)	129
	192

4.5 RESEARCH INSTRUMENT: QUALITATIVE RESEARCH

Unlike research instruments used for Quantitative research, qualitative research instruments involve the collection, analysis and interpretation of data by observing what is being done or being said (Burns & Bush, 2010:202). With qualitative methods, the research instrument is in the format of semi or unstructured interviews and the researcher as they are the means through which the data is gathered (Mathews & Ross, 2010:181). For the complementary qualitative research component, data was collected through semi-structured interviews.

4.5.1 Semi-structured interviews

According to Mathews and Ross (2010:226) semi-structured interviews are often used as part of a research design that includes interviewing a small number of people who are specifically

selected because of their opinions and in hopes of collecting detailed information from them. In contrast to questionnaires, semi-structured interviews are more flexible and adaptable to the respondents needs. They are a series of open-ended questions based on the topic areas the researcher wants to cover. In a semi-structured interview, the researcher asks a series of open-ended questions, with accompanying queries that probe for more detailed and contextual data (Piercy, 2004:1). The open-ended nature of the question defines the topic under investigation but provides opportunities for both interviewer (researcher) and interviewee (respondent) to discuss some topics in more detail. Since the researcher prepares the questions ahead of time, semi-structured interviews allow the researcher to prompt or encourage the interviewee particularly if he/she is looking for more information or find what they are saying interesting (Zikmund *et al.*, 2013: 150).

For the purpose of this research, the semi-structured interviews involved open-ended questions which needed to be answered by the respondents (Berndt & Petzer, 2011:46). The researcher served as the primary research instrument since the researcher herself asked the questions and enabled the research respondents (interviewees) to give their answers. The interviews can be conducted one-to-one, telephonically or in a focus group setting. For this research, interviews were conducted on a one-on-one basis.

4.5.2 One-on-one interviews

According to Zikmund *et al.* (2013:149) an in-depth interview is a one-on-one interview between the researcher and the research respondent. This type of interview allows the researcher control over the questioning. The quality of the information obtained during the interview is largely depended on the interviewer. Mathews and Ross (2010:231) add that the researcher should approach each interview with a naive curiosity, use neutral probes and be prepared for various surprises such as disturbances, the recorder turning off and what information the respondents might give.

4.5.3 Development of the interview questions

For this research, all interviewees were asked similar questions that corresponded with the operational elements of the theoretical concepts which had been identified from the literature study. Table 4.5 provides a summary of theoretical concepts used in the research instrument for qualitative research. From these theoretical concepts, open-ended questions that offered the respondents the opportunity to respond in their own words while expressing their own personal perceptive were developed. The researcher asked opinion and knowledge questions. Opinion questions were aimed at understanding the cognitive and interpretive processes of

key stakeholders of the Open Innovation platform. Their opinions and judgements about their experience and issues on the platform were asked. Knowledge questions were asked to inquire about the respondents' factual information regarding the Open Innovation platform. Questions were asked in past, present and future tenses. Past tense questions related to how the platform had been run and what challenges and opportunities had been presented, while present and future questions were asked regarding potentially new objectives for the platform, potential commercialisation opportunities, partnerships and other developments (Patton, 2002:350).

Table 4.5: Questions asked in semi-structured interview

THEORETICAL CONCEPT	INTERVIEW QUESTION
Open Innovation Accelerator	How do you identify/define a new challenge? How do you measure your success?
Challenges and opportunities	Do you ensure that the identified solution is incorporated into the challenge owner's overall business strategy? If so, How? The website states that solutions are shared within a protected environment. What kind of measures are in place to ensure that Intellectual Property is protected? How do you identify the potential customers, research partners and solution seekers? Do you facilitate the partnerships between the technology offers and their identified partners?
Open Innovation	Do you feel the OI platform has contributed towards the strategic objectives of the GGDA and GIKES? How has the platform done so? Explain the extent of involvement of each role player you have partnered with.
Accelerating commercialisation	How do you market the challenges to potential solution providers? What are your evaluation criteria and what informs it?

4.5.4 Recording the interviews

Silverman (2013:208) stresses that all interviews, no matter the style of interviewing used, should be recorded. For this research, interviews were recorded using a digital tape recorder. Recording the interview allowed the researcher to fully engage in and concentrate on the interview. Using a tape recorder does not eliminate the need to take notes but allows the researcher to take more strategic notes (Patton 2002:383).

4.5.5 Transcribing the interviews

Before interviews were submitted for transcription, the researcher checked the tape to ensure it functioned properly. Thereafter, the researcher went through notes to uncover any ambiguity or uncertainty. The recordings from the interviews were then transcribed by an expert at the North-West University. Key outcomes from the interviews were identified by the researcher during the data analysis phase and therefore reported on qualitatively in support of the overall Quantitative research.

4.5.6 Pre-testing the interview

Conducting a pilot test helps discover what the respondents think is important about the research topic and find out how they use language to discuss the research topic (Mathews & Ross, 2010:222). Through pre-testing, any misinterpretations, poor answers and insights into the interview process such as not having sufficient time were obtained. Silverman (2013:208) notes that pre-testing allows the researcher to practice interviewing and help find what will be substantial data from respondents. For this qualitative component of the research, the pre-testing was done to help develop interview schedules and questions accordingly. The times allocated for each interview was spent wisely as respondents did not have much time. Pre-testing helped appropriate the average length of interviews and arrange questions in order of significance. A meeting with one of the respondents was set up for pre-testing. Feedback regarding the questions was provided to the researcher and changes were implemented accordingly.

4.6 DATA ANALYSIS

Once the sampling plan was concluded, all questionnaires had been collected and interviews were conducted and transcribed. The next step for researcher was to convert all the data into a format that permits for a detailed data analysis. The data therefore needed to be prepared for data entry. According to De Vos *et al.* (2012:252) data preparation involves the validation and editing of collected data and thereafter coding the data. For data collected through Quantitative methods, data analysis takes place though a five-step procedure as described by McDaniel and Gates (2013:326). The researcher followed these steps when conducting the data analysis.

4.6.1 Data validation and editing

The first step was to ascertain if each questionnaire was completed as specified in the cover letter. Validation seeks to detect any fraud or inability to follow the questionnaire's key

instructions (McDaniel & Gates, 2013:326). For this research, the researcher ensured that the completion and collection of questionnaires at workshops and through *SurveyMonkey* were administered effectively through validation. After checking for validity, mistakes made by the respondents were checked through editing. Editing enforces a relatively increased quality standard on the raw data through inspecting and correcting each questionnaire where necessary (Churchill & Iacobucci, 2010:350). The necessity of editing occurred when answers were incomplete, obviously incorrect or reflected disinterest. The researcher's decision on how to handle such questionnaires depended on the severity of problem. Validation and editing was thus an integral step when processing data. Validation was done by the researcher and repeated by the Statistical Consultation Services of the North-West University.

4.6.2 Data coding

Once the data was validated and edited where necessary, the next step entailed coding the data. A majority of data types are recorded using numerical codes that enable the entering of data quickly and reduces mistakes (Saunders *et al.*, 2012:482). Grouping and assigning numeric codes to responses of each question is referred to as coding (McDaniel & Gates, 2013:331). For this research, close-ended questions were pre-coded, meaning that they had numeric codes assigned to the various responses in the questionnaire. With coding, the data collected was transformed into symbols that were used for data entry. A code sheet containing general instructions that indicated how each item of data was coded was prepared for a more simplified data entry process (Churchill & Iacobucci, 2010:350).

4.6.3 Data entry

After validating, editing and coding the data, the third step commenced - data entry. According to De Vos *et al.* (2012:253) there are various ways on entering data and these depend on the data collection methods selected. Data entry is the process of converting the information on to an electronic format (McDaniel & Gates, 2013:333). For this research, data entry was completed by the researcher and the Statistical Consultation Services of the North-West University. The data was entered into a software system that was programmed for intelligent entry.

4.6.4 Logical cleaning of data

By this step, all data gathered from the questionnaires had been captured and needed to be processed. Logical data cleaning is the final computerised error checking before data is processed to tabulation and statistical analysis of the results (McDaniel & Gates, 2013:334). Statistical Package for the Social Sciences (SPSS) version 20 by IBM program was used for

statistical processing. SPSS also accepts instructions to check for logical errors in the data, providing information regarding the particular error and how many times it may have occurred. Once this process was complete, the computer data was ready for tabulation and statistical analysis.

4.6.5 Tabulation and statistical analysis

In this final step, the number of cases that fell into various categories was counted. This is known as tabulation and can take the form of one-way tabulations or cross tabulations (Churchill & Iacobucci, 2010:352). Both one-way and cross tables were used for this research. One-way tables reflect the number of respondents choosing a particular answer in the questionnaire, while cross tables examine the responses to one question relative to responses to other questions. During the statistical analysis, characteristics about large sets of data were revealed through various calculations. The statistical methods used for this research are detailed in the subsequent sections.

4.6.6 Statistical methods and techniques used for Quantitative research

Data capturing through tabulation was then plotted onto graphs showing the frequency at which a score occurs. This is referred to as frequency distribution. With frequency distribution, the data is organised into classes and shows the number of observations from the data set falling into each class (Aaker *et al.*, 2013:408). In other words, it is an ordered range of all values for a specific variable. Field (2012:19) defines frequency distribution as a graph plotting the values of observation on a horizontal axis; with a bar showing how many times each value has occurred in the data set. The visual graph representation of frequency distribution is known as a histogram. Histograms display all the intervals in a distribution while examining the shape of the distribution for a lack of symmetry (called skew), pointiness (called kurtosis) and the modern pattern (Cooper & Schindler, 2014:408). Frequency distributions can be calculated at the centre or dispersion of a distribution; these are known as descriptive statistics (Field, 2012:20).

When deciding on which statistical technique to use, the researcher determined whether the answers required related to describing the sample or to making conclusions about the entire population (Feinberg *et al.*, 2013:393). The statistical methods are classified into two categories, namely descriptive and inferential statistics (Gravetter & Wallnau, 2009:5).

4.6.6.1 Descriptive statistics

Descriptive statistics serve to provide concise measures of data found in all the elements of a sample (Feinberg *et al.*, 2013:396). These statistical techniques summarise, organise and simplify data. Descriptive statistics measure central tendency, dispersion and shape requiring that the data be collected using either interval or scaled questions (Aaker *et al.*, 2013:409). With descriptive statistics the researcher calculated where the centre of the frequency distribution lay. This is known as central tendency. The researcher also quantified the spread of scores in the data, known as dispersion.

Measures of central tendency: Central tendency is the number of estimates of the centre of a variable's values (De Vos *et al.*, 2012:258). When computing central tendency, three measures are used throughout the statistical practice namely, the median, the mode and the mean (Aaker *et al.*, 2013:409). The median is computed for all type of data. Median is a common measure for central tendency. It is the middle value when the data is arranged in order of magnitude. Thus exactly half of the values lie above and half are below the median (Feinberg *et al.*, 2013:396). Nominal data is best measured through computing the mode. The mode is determined by finding the value of the most occurring frequency (McDaniel & Gates, 2013:343). It therefore describes a variable with distinctly high rates of incidence. De Vos *et al.* (2012:258) add that when two modes occur or more than two the distribution is bimodal or multimodal respectively.

When measuring the central tendency of interval or ratio data the mean was computed. The mean is the sum of the values for all observations of a variable divided by the number of observations (McDaniel & Gates, 2013:343). It is simply the average score and unlike the mode and median, every score was used. The mean is the most stable in different samples (Field, 2012:24). The mean as a measure of central tendency was used for the research. The mean is summarized in the following formula:

$$X = \frac{\sum_{i=1}^h f_i x_i}{n}$$

Equation 4.1: Mean

Measuring the central tendency did not provide enough information to adequately summarise the distribution of a variable. The proportion of responses needed to be captured by measuring dispersion.

Measure of dispersion: Measuring dispersion involves attempting to quantify the spread of scores in the data (Field, 2012:24). The range of the distribution of each variable was therefore measured. When computing the dispersion, three measures were used throughout statistical practice namely range, standard deviation and variance (McDaniel & Gates, 2013:344). The range was calculated by taking the largest score and subtracting it from the smallest score. The range is highly affected by extreme scores and was therefore not as reliable as variance and standard deviation (Field, 2012:24).

For this research, variance and standard deviation were determined. De Vos *et al.* (2012:261) summarises variance as the average of the distances of individual scores from the mean and standard deviation as the average spread of the scores from the mean. Simply put, the variance was the sum of squares divided by the number of observations. It is therefore the average error between the mean and the observations made (Field, 2012:27). Standard deviation ensured that this average error is in the same units as the original measure; it was therefore the square root of the variance (McDaniel & Gates, 2013:344). Standard deviation is the most suitable measure of dispersion for interval data. Computing the standard deviation and the variance was done using the following formula:

$$S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$$

Equation 4.2: Standard deviation

The variance was calculated by removing the square root from the formula for standard deviation. The sum of squares, variance and standard deviation are all measures of the dispersion of data around the mean. The smaller the standard deviation, the closer the data points are to the mean, while the larger the standard deviation the further away the data from the mean (Field, 2012:27).

Measuring central tendency and dispersion helped the researcher describe and summarise the data in simple and understandable methods. Once this was complete, the researcher needed to be able to project characteristics from the sample to the entire population through inferential statistics (Zikmund *et al.*, 2013:410).

4.6.6.2 Inferential statistics

Welman *et al.* (2005:236) explains that inferential statistics are concerned with inferences that are made about population indices, on the basis of the corresponding indices obtained from the sampling elements. These statistics are therefore used to generalise from a sample to the

entire population, making conclusions that therefore extend beyond the immediate data. Interval data is tested through the z-test or the t-test while nominal data is tested using the chi-square test (Feinberg *et al.*, 2013:408). For this research, ANOVA and chi-square test were used to make generalisations about the population.

Chi-square test: Cooper and Schindler (2014:408) describes this non-parametric test as one testing significant differences between observed distribution of data and the expected distribution based on null hypothesis. It is used when elements are grouped into two or more nominal categories. Zikmund *et al.* (2013:517) adds that this test is most applicable for testing hypotheses regarding frequencies arranged in a frequency table. The chi-square test thus compares what is hypothesised in a population with what is observed in a sample (Feinberg *et al.*, 2013:408). For this research, the Chi-Squared test was used to determine the association between two nominal variables. The SPSS program calculated the chi-square statistic automatically using the following formula:

$$x^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}$$

Equation 4.3: Chi-Square test

Analysis of variance (ANOVA): The sample *t*-test can be seen as a special case of ANOVA in which the independent variable has two levels. When more levels are present, the *t*-test is not appropriate. In this case ANOVA is appropriate. According to (Zikmund *et al.*, 2013:542) the ANOVA investigates the effects of one variable on an ‘interval-scaled’ dependent variable. It is a hypothesis technique determining whether there are statistically significant differences in means between groups. The ANOVA technique assumes that there is normal distribution of the dependant variable; that variances are the same for each group and that sampling elements are spilt into groups but are not paired in any way (Elliott & Woodward, 2007:152).

For this research, the One-way ANOVA technique was used when determining whether two means of independent groups are the same or have significant differences. The total amount of variation within the data was found by calculating the difference between each data and the total mean. These differences were squared and added together to provide the total sum of squares (Field, 2012:436). The ANOVA technique is summarised in the following equation:

$$SS_T = \sum_{i=1}^n (x_i - \bar{x})^2$$

Equation 4.4: ANOVA test

4.6.7 Effect sizes

McDaniel and Gates (2013:346) indicate that it is possible for numbers to be different mathematically but not significantly in a statistical sense. This means that if the difference is large enough to be unlikely to have occurred as a result of chance, then the difference is statistically significant. Statistical significance takes place when the odds against an occurrence by chance are lower than a certain probability (Burns & Burns, 2008:167).

In order to determine whether groupings or treatments differ statistically and significantly the p -value was used in this research. The significance level in tests is known as the p -value (Tolmie *et al.*, 2011:117). The highest probability generally accepted as statistical significance is $p=0.05$, called the 5% level of significance (Burns & Burns, 2008:168). The p -value is, in other words, the probability of obtaining results more than or as extreme as the ones observed, given that the null hypothesis is true (Elliott & Woodward, 2007:152).

Effect sizes indicate whether there are practically significant differences between the means of groups. In order to interpret effect sizes, Cohen's d -value must be used to interpret results. A d -value = 0.2 has a small effect, a d -value = 0.5 has a medium effect and a $d \geq 0.8$ has a large effect. The large effect size indicates a finding that is of practical significance, a medium effect size indicates a finding that could be substantial and a small effect size indicates that there is no difference and therefore the answers are the same (Cohen, 1988:223).

4.6.8 Factor analysis

Factor analyses indicate whether one group is significantly different from another or test hypotheses. It is a multivariate technique of statistically identifying a reduced number of factors from a large number of measured variables (Zikmund *et al.*, 2013:595). Factor analysis is a data reduction technique that summarises data by using a smaller set of components or factors. In reducing the number of variables, the factor analysis procedure attempts to make the remaining variables meaningful and easy to work with and retain as much of the information as possible (Aaker *et al.*, 2013:519). When a research instrument contains multiple correlated measures that measure a common underlying construct, factor analysis becomes beneficial (Churchill & Iacobucci, 2010:506). Factor analyses are divided into two types namely exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Exploratory factor analysis is performed when the researcher has no expectations of the number or nature of the variables. It allows the researcher to explore the main dimensions to

generate a theory or model from a relatively large set of latent constructs often represented by a set of items (William *et al.*, 2010:2). For this research, the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of sphericity were used to examine the appropriateness of factor analysis.

The Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy calculates the degree of common variance among variables whilst Bartlett's Test of sphericity indicates whether a correlation matrix is significantly different from an identity matrix (Field, 2013:685). The linear combination of variables chosen to capture the essence of data is known as a factor. Factors are linked to variables by regression coefficients known as factor loadings; these are correlations between the factors and the variables (Aaker *et al.*, 2013:523). In determining the number of factors to retain, approaches based on eigenvalues and percentage of variance accounted for, were used in this research. Eigenvalues represent the amount of variance in the original variables that is associated with a factor while the percentage of variance is the total variance attributed to each factor (Malhotra, 2010:638 & Pallant, 2010:184). Once the number of factors were identified and retained through EFA, the factors were named (Churchill & Iacobucci, 2010:501). A confirmatory factor analysis was then conducted to test the fit of the factors retained from the EFA.

Confirmatory factor analysis was an appropriate instrument for assessing construct validity as it provides a test of how well the researcher's theory about the factors fits with actual observations (Zikmund & Babin, 2013:595). The CFA aims to confirm theoretical predictions by testing whether specified sets of constructs influence responses as predicted (Burns & Burns, 2008:443). In this research, CFA was conducted to test the fit of the seven factors retained from the EFA in AMOS.

Researchers use numerous goodness-of-fit indicators when assessing a model namely the Normed Fit Index (NFI), Non-Normed Fit Index (NNFI, also known as TLI), Incremental Fit Index (IFI), Comparative Fit Index (CFI), and root mean square error of approximation (RMSEA) (Schreiber *et al.*, 2006:327). For this research, the chi-square statistic, the Root Mean Square Error Approximation (RMSEA) and the Comparative Fit Index (CFI) were used. Aaker *et al.*,(2013:428) explains that the chi-square statistic is employed as a test of goodness-of-fit when the researcher needs to know the statistical significance between frequency distribution and a theoretical frequency distribution. An RMSEA should be below 0.08 in order to indicate good fit with theory while a comparative fit index (CFI) with a value equal to 0.95 is recognized as being indicative of a good fit (Hu & Bentler, 1999:22).

4.6.9 Reliability and validity

In order to ensure that the research provided accurate, coherent and timely information the quality of the data was measured. Data quality is measured in terms of validity and reliability. McDaniel and Gates (2013:121) briefly define validity as the degree to which a measure reveals a characteristic of interest while reliability is the consistency with which a measure produces the same results with similar populations.

4.6.9.1 Reliability of Quantitative data

The ability to replicate findings as a result of consistency and stability is referred to by Burns and Burns (2008:410) as reliability. When a measurement scale produces consistent results over a period of time it is seen as reliable. Reliable instruments produce stable measures at different times and under different conditions (McDaniel & Gates, 2013:215). Reliability can be assessed in three ways namely test re-test, equivalent forms and internal consistency. Test re-test is a technique whereby the same test is administered to the same subjects on two separate occasions under similar condition but with a time interval between (Tolmie *et al.*, 2011:146). Results may change from the first measurement to the second. To counter the flaws in the test re-test techniques, equivalent forms are designed to test reliability by giving each subject two distinct forms believed to be equivalent and comparing the results (Feinberg *et al.*, 2013:132).

For this research internal consistency reliability was measured. The internal consistency reliability assessed the ability to produce similar results when using different samples during the same time period. Reliability in essence indicates internal consistency. Internal consistency measures homogeneity (Zikmund *et al.*, 2013:302).

Cronbach's alpha coefficient: When taking half of the measurement items from a scale and correlating the results found with the other half of the measurement items, the reliability is dependent on how the measurement items were split (McDaniel & Gates, 2013:217). This means that different splits in essence result in different correlations. This should not be the case. In order to overcome this predicament the Cronbach's alpha technique is used for this research. Tolmie *et al.* (2011:148) explains that the Cronbach's alpha coefficient is based on the average inter-item correlation. It involves computing the average reliability coefficient estimates for all possible ways of splitting a set of items in half (McDaniel & Gates, 2013:217). Cronbach's alpha value that is between 0.70 and 0.80 indicates good reliability, while a Cronbach's alpha value below 0.60 indicates poor reliability (Zikmund *et al.*, 2013:302). The statistical software, SPSS, was used to compute the alpha coefficient.

For this research, Cronbach's alpha coefficients were used to determine the statistical reliability regarding constructs that consist of more than one item. For single items, Cronbach's alpha coefficients could not be calculated. Validity then needed to be determined.

4.6.9.2 Validity of Quantitative data

Validity is defined as the extent to which a measurement set measures the construct it intends to measure (Pallant, 2010:7). It refers to whether an instrument measures that which it was designed to measure; it is the evidence that a research allows correct inferences about the questions it aimed to answer (Field, 2012:12). The validity of a test is concerned with what the test measures and how well it does so. Valid tests measure what was supposed to be measured. Achieving validity is complex as it the accuracy of measuring an intended concept (Zikmund *et al.*, 2013:303). There are four basic approaches to establishing validity namely face validity, criterion validity, content validity and construct validity (Burns & Burns, 2008:428). Face validity is a subjective agreement between the researcher and professors that the scale logically reflects what it is intended to, while criterion validity examines the ability of an instrument to predict a variable that is designated in criterion (McDaniel & Gates, 2013:219). For this research, construct validity and content validity were used.

Construct validity: According to Burns and Burns (2008:430) construct validity entails relating a theoretical concept to a specific measuring device. This implies that there should be a correlation between the data gathered and theories about the concept. It involves having accepting the theoretical rationale that underlies the obtained measurements (Feinberg *et al.*, 2013:130). For this research, the construct validity was determined through completing a confirmatory factor analyses (CFA). Kaiser-Meyer-Olkin's measure of sample adequacy was used to determine whether a factor analysis is appropriate. Kaiser-Meyer-Olkin's sample adequacy measure tests the extent to which there are isolated correlations between variables (Tolmie *et al.*, 2011:173). It therefore assessed the unevenness of relationships between variables in the analysis.

Content validity: This is the extent to which a measure covers the domain of interest ensuring that items capture the entire scope of the research without going beyond what is being measured (Zikmund *et al.*, 2013:304). For this research, content validity was determined through expert judgement of scholarly study leaders and supervisors. This is because content validity relies mostly on subjective judgements by experts with regard to the appropriateness of the measurement (Feinberg *et al.*, 2013:131).

4.6.9.3 Reliability of qualitative data

Two issues contribute the reliability of qualitative data, namely its dependability and its confirmability. Dependability refers to whether the process of the research is consistent, and reasonably stable over a period of time and across researchers and methods (Miles *et al.*, 2014:312). Confirmability, on the other hand, refers to the neutrality and freedom from researcher unacknowledged biases (Morse *et al.*, 2002:11).

Dependability: For the qualitative component of this research, dependability was ensured by collecting the data across a full range of appropriate settings, times and respondents as set out in the literature. According to Mathews and Ross (2010:11) dependability implies that all data is included and that no data is lost through unreliable voice recorders or inaccurate transcribers. Bias and deceit was avoided because the transcription of the interviews were done by an expert in the field and also evaluated by the researcher to ensure accuracy. The decisions made from the literature were verified by the study leader (Morse *et al.*, 2002:9). To ensure the reliability of the interview questions, the study leader (an expert in the field) and the researcher evaluated the questions and reached a consensus (Kruger & Gericke, 2004:44).

Confirmability: The confirmability is assured when the methods and procedures of the qualitative component are described explicitly and in detail to make sure that a complete picture is given (Miles *et al.*, 2013:311). For this research, a clear sequence of how the data was collected, processed, analysed and concluded was followed and detailed in this chapter. The research's data can be made available for re-analysis by institutional review board regulations and other researchers (Miles *et al.*, 2013:312). To confirm the originality of the qualitative results, direct quotations were used from the discussions so that recurring themes from different interviews can be seen. The researcher also acknowledged any limitations of the investigation and the potential effects thereof (Shenton, 2004:73).

4.6.9.4 Validity of qualitative data

With qualitative data, validity refers to the credibility and transferability of the researcher's interpretations. Credibility contributes to the true value of the research; in quantitative research this is often referred to as content validity (Shenton, 2004:65). Transferability, on the other hand, contributes to the generalisation of the research.

Credibility: According to Mathew and Ross (2010:12), the credibility of the research is tested by the transparency of the analysis and the interpretation of the data. For this research, credibility was ensured by including descriptions that are rich in context and meaningful,

therefore enabling a second-hand presence for other readers. The literature research confirmed the purpose of the research and was utilised to formulate the interview questions and verify the data (Kruger & Gericke, 2004:44). The data presented was linked to categories of previous and emerging theory from the literature study. Findings were made clear, coherent and systematically unified (Miles *et al.*, 2013:313).

Transferability: Transferability measures how the results or findings are relevant to a wider population or a different case (Mathew & Ross, 2010:12). Although this is the case, the generalisation of data was not the purpose of the qualitative component of this research. It is the application value of the research that promotes transferability (Shenton, 2004:64). The purpose of the data obtained from the interviews was to provide a different perspective of the Open Innovation platform. Therefore the information provided cannot be applied to different cases but could serve as a guideline for such cases. The data was discussed based on appropriate direct quotations. Results were confirmed and intensive content analysis was done. The recurring themes confirmed the fullness and trustworthiness of the data in similar contexts for this research.

The concepts of validity and reliability can be easily confused. One should note that although reliability is necessary when conducting research, it is not a sufficient condition for validity simply because reliable scales may not be valid (Zikmund *et al.*, 2013:305). Reliability is concerned with the accuracy and stability of a measure while validity, on the other hand, is concerned with the appropriateness of the measure to assess the construct its aims to measure (Burns & Burns, 2008:443).

4.6.10 Method used for analysing qualitative data

All semi-structured interviews were recorded and transcribed for analysis. When analysing qualitative component of this research, a content analysis method was utilised. Content analysis involves systematically categorising responses with the aim to identify overall trends and patterns (Vaismoradi *et al.*, 2013:400). The aim of content analysis is to obtain a condensed and broad description of the phenomenon, and the outcome of the analysis is concepts or categories that describe the phenomenon (Elo & Kyngäs, 2008:108). Content analysis thus served to determine the characteristics of the transcribed document's content by examine who says what, to whom and with what effect (Bloor & Wood, 2006:58).

Inductive content analysis is used for cases about which no previous research has been conducted (Elo & Kyngäs, 2008:109). Therefore, the qualitative data of this research procedure underwent a content analysis process that concerned deriving categories from the

qualitative data, but not according to previously defined structures or previous knowledge (Elo & Kyngäs, 2008:110).

4.7 TRIANGULATION

According to Johnson and Onwuegbuzie (2004:22) triangulation refers to seeking convergence and corroboration of results from the multi-methods and designs used when studying the same phenomenon. When the different methods are used to assess the research problem and the results substantiate each other, the truthfulness of the findings is enhanced (Greene, 2007:43). The researcher therefore utilises qualitative and quantitative research methods in order to reach similar conclusions (Berndt & Petzer, 2011:50).

However, the data collected through Quantitative and qualitative research may also not be compared. Instead they reside alongside or complementary to one another much like two different pictures providing an overall assessment of the problem (Creswell, 2009:214). This occurs when the researcher assesses different research questions or different levels in an organisation. For this research, no triangulation occurred since the researcher's primary aim was to collect Quantitative data while the use a qualitative component was to provide supporting information. This means that neither the integration of data nor the connection across phases was utilised.

4.8 RESEARCH REPORT

Once the results have been investigated, the main findings were interpreted. The main findings summarised the results for the questions on the questionnaire in order to arrive at conclusions. Conclusions and recommendations made are detailed in Chapter 6. Conclusions are generalisations that will satisfy the research objectives while recommendations are research focused suggestions that will be applied from the conclusions made (McDaniel & Gates, 2013:397).

4.9 SUMMARY

The research methodology used for this research takes place in five successive stages. The stages in this research methodology involve (1) reviewing the literature study, (2) determining the research design, (3) drafting the sampling plan, (4) collecting the data and (5) analysing the data in order to compile the research report.

When investigating Open Innovation platforms to accelerate commercialisation, primary and secondary data is compiled. Secondary data found in the literature study was obtained by

initially using electronic databases and afterwards gaining significant studies by scholars in the field of innovation, entrepreneurship and open innovation. Books, subject specific journals, websites and accredited and scholarly journal articles were used. Descriptive research designs are used in order to employ quantitative methods of primary data collection. Multi-methods are used for data collection as both quantitative and qualitative methods are used. The researcher's primary aim was to collect Quantitative data and use a qualitative component to provide supportive information. Quantitative research was the primary research method utilised while qualitative research was secondary and adheres to the key parameters of the primary research.

The sampling plan for this research involved selecting a segment of a population of interest, identifying a sampling frame and size, specifying the method of sampling and collecting the data through research instruments. The population for this research were individuals who have used Open Innovation in South Africa. The sample size was determined by the number of respondents who attend prescribed Open Innovation workshops, as well as members on the Open Innovation online platform. Non-probability convenience sampling is used when executing the sampling operational plan. The research instrument used for quantitative data was a self-administered questionnaires containing close-ended multiple choice, dichotomous and Likert-scale questions, while the research instrument used for qualitative research is the researcher through open-ended, semi-structured, one-on-one interviews.

Data from quantitative research is analysed using SPSS version twenty by IBM program. When determining whether the means of two or more than two independent groups are the same or have significant differences, the One-way ANOVA technique will be used. The Chi-Squared test was be used when determining the association between two nominal variables. Content validity was determined through expert judgement of scholarly study leaders and supervisors, while construct validity was measured by using the confirmatory factor analyses. Kaiser-Meyer-Ohlin's measure of sample adequacy was used to determine whether a factor analysis was appropriate. Cronbach's alpha coefficient coefficients were calculated to determine the statistical reliability regarding constructs that consist of more than one item. The qualitative data of this research procedure underwent a content analysis process that concerns deriving categories from the qualitative data, but not according to previously defined structures or previous knowledge. In order to determine the truthfulness of the data collected qualitatively, the credibility, transferability, confirmability and dependability of the data was described.

Results obtained through the selected research methodology were interpreted and summaries into main findings. The next chapter presents a discussion of the results obtained in the research.

CHAPTER 5

EMPIRICAL RESEARCH: PRESENTATION AND DISCUSSION OF FINDINGS AND RESULTS

5.1 INTRODUCTION

The empirical process of this research was detailed in the previous chapter and provided an indication of the method of data collection that has been implemented. The statistical analysis of the Quantitative data and the narrative description of the qualitative data are reported in this chapter. The findings from the primary data collection conducted through questionnaires and interviews is reported, explained and interpreted in order to make conclusions.

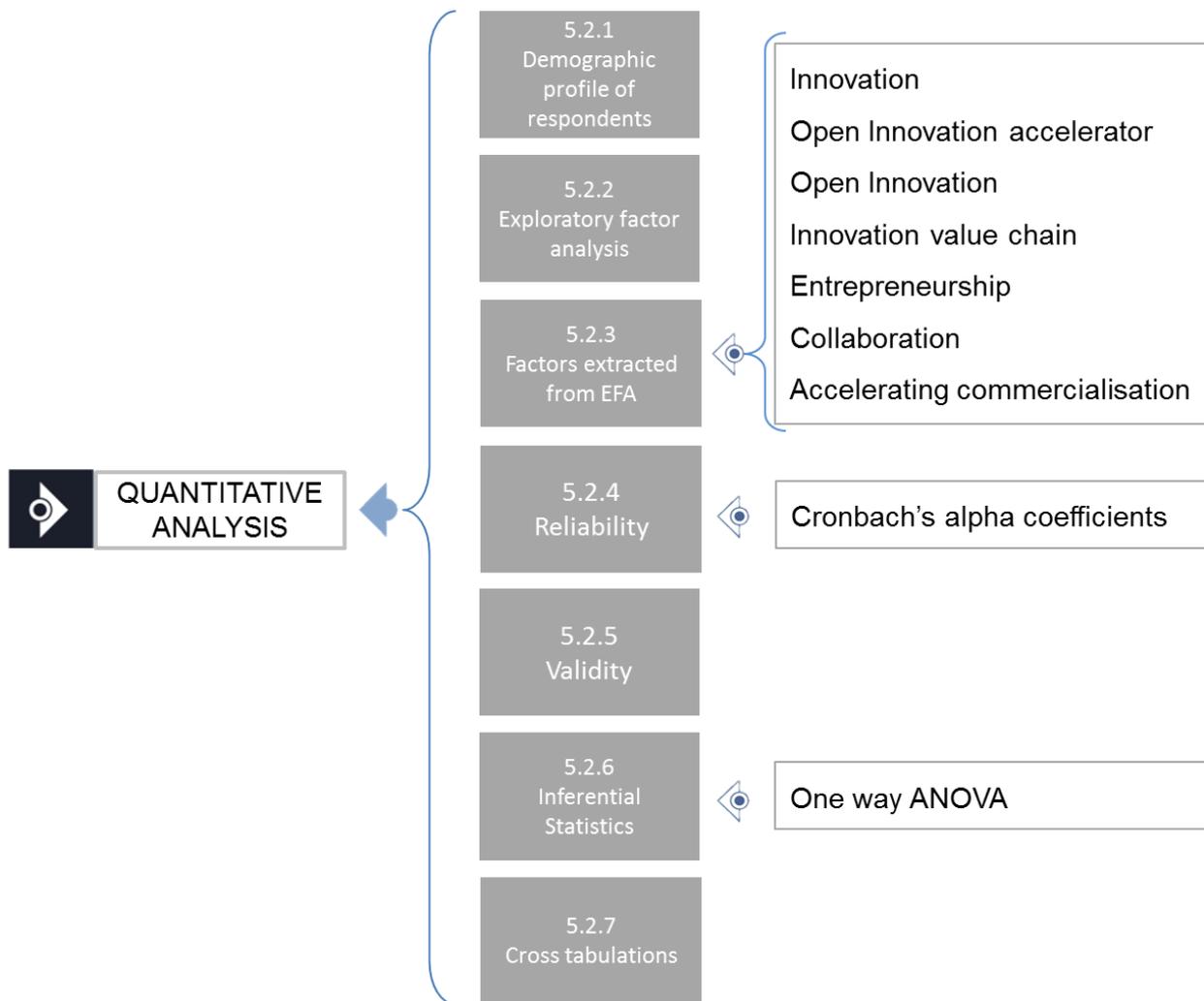
Quantitative analysis is conducted and discussed, explaining the demographic information gathered and evaluating the results obtained from the statistical methods used. These methods also investigate the reliability and validity of the research as well as the statistical and practical significances of the factors extracted through analysis using SPSS.

The results of the qualitative part of this research commence after the Quantitative analysis is completed. The qualitative data was gathered through semi-structured interviews and from the transcribed interviews. Three themes namely Open Innovation accelerator, accelerating commercialisation and Open Innovation were identified and findings from these themes are discussed.

5.2 QUANTITATIVE ANALYSIS

The Quantitative data analysis made use of SPSS version 21 and AMOS version 20. The first phase of the data analysis identified the items component loading through exploratory factor analysis (EFA) in SPSS 21, which was then followed by a confirmatory factor analysis in AMOS 20. This section presents the statistical findings from the analyses. All statistical tests were done at 5% level of significance. Figure 5.1 provides a synopsis of the Quantitative analysis.

Figure 5.1: Synopsis of Quantitative analysis



5.2.1 Demographic profile of respondents

The demographic profile of the respondents is shown in Table 5.1. A total number of 192 respondents completed the questionnaire. During the course of this chapter the symbol 'F' will be used as the abbreviation for frequency and the symbol '%' will be used to refer to percentage.

Table 5.1: Demographic profile of respondents

	Variables	F	%
Sector	Academia	29	15.3
	Government	65	34.2
	Private sector	89	46.8
Highest Qualification	Grade 12	25	13.2
	Diploma or Degree	61	32.1
	Post-graduate degree	96	50.5
Business Focus	Manufacturing	24	12.6
	Retail and wholesale trade	3	1.6
	Agriculture, forestry and fishing	6	3.2
	Food products and beverages	6	3.2
	Transport and travel	6	3.2
	Oil and gas, mining and quarrying	7	3.7
	Pharmaceutical and biotech	8	4.2
	Healthcare and medical technology	11	5.8
	Information technology	47	24.7
	Finance and insurance	4	2.1
	Marketing and media	12	6.3
	Other services	21	11.1

Table 5.1 indicates that the sample consisted of respondents from academia, government and private sector. Most of the respondents originated from the private sector (46.8%) while only 34.2 % of the respondents represented the government. The academic sector had the least number of respondents (15.3%). The majority of respondents obtained a post-graduate degree (50.5%) whilst only 32.1% and 13.2 % of the respondents obtained diploma or degree and Grade 12 respectively. Regarding the business focus, 24.7% of the respondents operate in organisations and businesses whose main focus is Information Technology.

Main finding 1: The majority of respondents (50.5%) have a post-graduate degree and are from the private sector (46.8%) working in businesses that focus mainly on information technology (24.7).

5.2.2 Exploratory factor analysis

The objective of conducting an EFA was to identify the variables structure that explained each of the specified underlying items of using Open Innovation to accelerate commercialisation. There are two main tests that the researcher should use in order to assess the suitability of the respondent data for factor analysis. These tests include Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of sphericity (William *et al.*, 2010:5). The KMO statistic shows a discrepancy between 0 and 1. When the value is 0 this indicates diffusion in the pattern of correlations and that factor analysis is therefore inappropriate. Where the KMO value is close to 1, this indicates that the patterns of correlations are relatively compact and therefore a factor analysis will produce reliable factors (Field, 2013:684). When conducting the EFA for this research it was found that the KMO measure of sampling accuracy was **0.92**. Bartlett's Test of sphericity indicates the significant difference between a correlation matrix and an identity matrix (Field, 2013:685). The EFA for this research was considered suitable since Bartlett's test of sphericity value was **0.000**.

The EFA was conducted to reduce the number of variables and to examine the relationship between variables. Principal component analysis extraction method and direct oblimin rotation were employed to extract the factors with eigenvalues greater than 1.0 in SPSS 21.

Main Finding 2: The results of the EFA conducted on Section B of the research instrument realised a KMO statistic of 0.92 and Bartlett's test value of 0.000. This supports the appropriateness and adequacy of conducting factor analysis.

5.2.3 Factors extracted from EFA

Once factors were identified, they were then named. Table 5.2 presents the names of the extracted factors from the EFA along with their corresponding eigenvalues and percentage variance explained. Eigenvalues equal to or greater than one, indicate the number of factors retained (Malhotra, 2010:638).

Seven factors were extracted. The extracted factors accounted for about 68.1% of total variance with:

- Innovation explaining 39.4% of the variance
- Open Innovation accelerator explaining 10.91% of the variance
- Open Innovation explaining a variance of 3.52%
- Innovation value chain explaining 3.15%

- Entrepreneurship explaining a variance of 2.77%
- Collaboration explaining a variance of 2.54% and
- Accelerating commercialisation a variance of 2.42%

Table 5.2: Results of exploratory factor analysis (EFA)

Respondents		
Factor	Eigenvalues	Percentage of variance explained
Innovation	15.80	39.49%
Open Innovation Accelerator	4.36	10.91%
Open Innovation	1.41	3.52%
Innovation Value Chain	1.26	3.15%
Entrepreneurship	1.11	2.77%
Collaboration	1.02	2.54%
Accelerating commercialisation	0.97	2.42%

Moreover, the respondents' overall perceptions regarding each factor are reported in Tables 5.3 to 5.9 that follow. The standard deviation represents data where the results are very close in value to the mean (+1).

Table 5.3: Innovation factor

No.	Questionnaire statement	Factor loadings
3	I create opportunities with the aim to achieve them.	0.460
4	I change the way my product or service is created and delivered to meet the needs of new clients.	0.607
5	I use existing products or services for a new or different application.	0.687
9	I am determined to fill a gap in the market.	0.421
10	I renew, improve or grow my product or service range.	0.591
18	I attempt to accomplish more with minimum expenditure.	0.385
	Mean	4.30
	Standard deviation	0.755

The *Innovation* factor contained six statements that measure the respondents' perception of innovation. The statements related to creating opportunities with the aim to achieve them; changing the way products and services are created; using products and services for different applications, filling a gap in the market; renewing product and service range as well as accomplishing more with minimum expenditure.

Table 5.3 depicts the descriptive statistics obtained for measuring the general perception of respondents towards *innovation*. For the factor *innovation*, a mean of **4.30** with a low standard deviation of **0.755** was obtained. The mean for innovation indicates a tendency to lean more towards the extremely high end of the Likert scale, above 3.

Main Finding 3: Respondents have particularly similar views regarding innovation. They create and pursue opportunities with the aim to fill a gap in the market; Respondents do so by aiming to accomplish more with minimum expenditure.

Table 5.4: Open Innovation accelerator factor

No.	Questionnaire statement	Factor loadings
25	Open innovation platforms such as OpenIX provide an efficient way of understanding other organisations' problems and proposing solutions.	0.811
30	The Open Innovation platforms such as OpenIX expose me to opportunities on a global scale.	0.822
32	Through Open Innovation platforms such as OpenIX, I am able to leverage external recourses or share ideas in a protected environment.	0.692
35	Open Innovation platforms such as OpenIX help my business identify new business opportunities.	0.844
38	Open Innovation platforms like OpenIX broaden my business focus into different sectors/industries.	0.828
41	Open Innovation platforms such as OpenIX create opportunities for joint access into new markets.	0.865
43	Open innovation platforms such as OpenIX enable my business to solve problems in other companies.	0.768
44	Working in partnerships helps gains access to new markets.	0.414
45	Open Innovation platforms such as OpenIX provide personalised support to find suitable innovation partners.	0.801
	Mean	3.67
	Standard deviation	0.898

The factor on the *Open Innovation accelerator* contained nine statements that measure the respondents' perception on Open Innovation platforms in South Africa. Statements were regarding Open Innovation platforms such as the opportunity to compete on a global scale, sharing ideas in a protected environment and working in partnerships to gain access into new markets.

Table 5.4 illustrates the mean and standard deviation obtained from the nine statements measuring the general perception of respondents towards Open Innovation accelerators. A mean of **3.67** and a low standard deviation of **0.898** were confirmed for the factor *Open Innovation accelerator*. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3.

Main Finding 4: Respondents have a similar opinion on Open Innovation platforms in South Africa. They believe that Open Innovation accelerators provide opportunities to understand other businesses' problems, and to compete on a global scale and across different industries and markets whilst also providing personalised support to find suitable innovation partners.

Table 5.5: Open Innovation factor

No.	Questionnaire statement	Factor loadings
26	I share and incorporate internal assets and resources with partner organisations and business outside my own.	0.537
28	Commitment to using my solution to solve a problem on OpenIX or other OI platforms has been made.	0.527
29	Sharing the business knowledge and technology has allowed us to leverage other people's IP.	0.649
31	There is internal commitment to collaborate from stakeholders within the other business.	0.586
34	The business invests extensive time into participating with external partners.	0.542
	Mean	3.45
	Standard deviation	0.854

The factor on the *Open Innovation* contained five statements that measure the respondents' participation in Open Innovation. Statements were related to sharing internal assets with partner organisations; commitment to using various solutions to solve problems posted on Open Innovation platforms; investing extensive time into participating with external partners and sharing business knowledge to leverage others' IP related to the factor *Open Innovation*.

Table 5.5 illustrates the descriptive statistics obtained from the five statements measuring the general perception of respondents towards Open Innovation. A mean of **3.45** and a low standard deviation of **0.854** were confirmed for the factor *Open Innovation*. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3.

Main finding 5: Respondents somewhat agree with statements regarding Open Innovation. Respondents incorporate internal assets and resources with businesses outside their own to a certain degree, spending extensive time into participating with external partners and therefore leverage on other businesses' IP.

Table 5.6: Innovation value chain factor

No.	Questionnaire statement	Factor loadings
12	I analyse the processes by which the new invention will be manufactured.	0.660
13	I investigate whether prototypes fit with the overall business model.	0.782
14	My prototypes demonstrate the functionality of the future service or product.	0.764
15	I test if the performance of the new product is what the end-user requires.	0.635
17	I investigate the technical competencies of the new product.	0.572
	Mean	4.05
	Standard deviation	0.840

The factor on the *innovation value chain* contained five statements that measure the respondents' perception on following the process of the value chain. The statements related to the analysis of processes used to manufacture a new invention; investigating whether prototypes fit with the overall business model and demonstrate the functionality of the future product or service; testing the performance of new products and investigating the technical competencies of the new product.

Table 5.6 illustrates the mean and standard deviation obtained from the five statements measuring the general perception of respondents towards the innovation value chain. A mean of **4.05** and a low standard deviation of **0.840** were confirmed for the factor *innovation value chain*. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3.

Main Finding 6: Respondents have similar perceptions on the innovation value chain. Respondents investigate the fit of prototypes with their overall business models; test if new products meet the end-users' requires and determined how their innovations will be manufactured.

Table 5.7: Entrepreneurship factor

No.	Questionnaire statement	Factor loadings
2	I consider how I can increase the country's economy.	0.636
7	I have the ability to scan business environments.	0.428
8	I take calculated to higher risks.	0.636
22	My intellectual property is directly linked to the new products competitive advantage.	0.382
	Mean	4.08
	Standard deviation	0.804

The factor on *entrepreneurship* contained four statements that measure the respondents' perception. The statements related to whether respondents consider themselves able to increase the country's economy, if they have the ability to scan business environment; if they take calculated risks and whether intellectual property is directly linked to new products competitive advantage.

Table 5.9 illustrates descriptive statistics obtained from the four statements measuring the general perception of respondents towards the entrepreneurship. A mean of **4.08** and a low standard deviation of **0.804** were confirmed for the factor *entrepreneurship*. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3

Main finding 7: Respondents share similar views regarding entrepreneurship. They have the ability to scan business environments, take calculated to higher risks and believe their IP creates a competitive advantage.

Table 5.8: Collaboration factor

No.	Questionnaire statement	Factor loadings
11	I engage in the market through meeting with business partners, consumers and industry communities.	0.457
39	Ideas, knowledge and technology from government, private sector, academia and the community are considered.	0.783
40	The business clearly defines problems needing specific solutions.	0.565

Mean	4.06
Standard deviation	0.794

The factor on the *collaboration* contained three statements that measure the respondents' willingness to collaborate. Statements concerned engaging in the market through meeting with business partners, customers and industry communities; considering ideas, knowledge and technology from the triple-helix; and clearly defining the business' problems that need solutions.

Table 5.8 indicates the mean and standard deviation obtained for the four statements measuring the general perception of respondents on *collaboration*. From the information on this table, a mean of **4.06** and a low standard deviation of **0.794** were confirmed for the factor *collaboration*. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3.

Main finding 8: Respondents mostly agreed with statements concerning collaboration. Respondents clearly define their specific problems and meet with business partners, customers and industry communities. They consider ideas, knowledge and technology from government, private sector and academia.

Table 5.9: Accelerating commercialisation factor

No.	Questionnaire statement	Factor loadings
19	The marketing campaigns differentiate the product from potential competition.	0.481
20	I have good understanding of the market the product will be/is launched into.	0.432
21	I always authenticate new partners' credibility.	0.381
23	I have marketing campaigns in place that appeal to the targeted market.	0.783
24	The business seeks to apply new technologies across multiple industries.	0.460
	Mean	3.90
	Standard deviation	0.747

The factor on *accelerating commercialisation* realised five statements that measure the respondents' perception on accelerating commercialisation. The statements relate to creating marketing campaigns that differentiate products or services from competition; understanding

the market in which the new product or service will be launched into; authenticating new partners' credibility; and applying new technology across multiple industries.

Table 5.9 indicates the means and standard deviations obtained for the five individual statements measuring the general perception of respondents on *accelerating commercialisation*. A mean of **3.90** and a low standard deviation of **0.747** were confirmed for the factor collaboration. This mean indicates a tendency to lean more towards the higher end of the Likert scale, above 3.

Main Finding 9: Respondents have similar perceptions regarding accelerating commercialisation. They create marketing campaigns that differentiate products or services from competition, understand the market in which new products or services will be launched into and apply new technology across multiple industries. Respondents authenticate new partners' credibility.

5.2.4 Reliability

Cronbach's alpha is a statistical procedure utilised under the EFA to examine the items for the extracted component structure of the variables. In order to confirm the reliability of the practical meaning, Cronbach's alpha coefficients were extracted.

According to Zikmund and Babin (2010:334), Cronbach's alpha coefficients that equal or exceed 0.70 indicate a high level of reliability, whereas a Cronbach's alpha coefficients lower than 0.60 indicates poor reliability. In this research the Cronbach's alpha coefficients were calculated in order to determine internal consistency reliability of all scales measuring perceptions Entrepreneurship, Innovation and Open Innovation. The reliability of all the measurement scales used, are reported in Table 5.10.

Table 5.10: Cronbach's alpha coefficients associated with factor analysis

Factor	Item	Cronbach's alpha coefficients
Innovation	3, 4, 5, 9, 10, 18.	0.888
Open Innovation accelerator	25, 30, 32, 35, 38, 41, 43, 44, 45.	0.937
Open Innovation	26, 28, 29, 31, 34.	0.783
Innovation value chain	12, 13, 14, 15, 17.	0.885
Entrepreneurship	2, 7, 8, 22.	0.786
Collaboration	11, 39, 40.	0.775
Accelerating commercialisation	19, 20, 21, 23, 24.	0.781

Table 5.10 indicates the items comprising each factor and the realised Cronbach's Alpha coefficients for each factor. Cronbach's alpha coefficient for each factor is larger than 0.70, indicating a high level of reliability between items in the measuring instrument (Section B of questionnaire) for entrepreneurship, innovation and Open Innovation.

Main finding 10: The seven factors that measure entrepreneurship, innovation and Open innovation identified through the EFA are highly reliable to measure respondents' perceptions of using Open Innovation to accelerate commercialisation in this research.

5.2.5 Validity

In order to test the validity of the structure, a confirmatory factor analysis (CFA) was conducted to test the fit of the seven factors retained from the EFA in AMOS.

The fit of the model was evaluated using three of the various goodness-of-fit indices: the chi-square statistic, the Root Mean Square Error Approximation (RMSEA) and the Comparative Fit Index (CFI). An exceptional ratio of the chi-square divided by its degrees of freedom should range 2 to 5. An RMSEA below .08, indicates good fit. For the comparative fit index (CFI), a value of =0.95 is recognized as being indicative of a good fit (Hu & Bentler, 1999:22).

The results indicated that the data fits the structural equation model relatively well. The ratio of the chi-square divided by its degrees of freedom obtained for the SEM was **1.724**, which suggests an appropriate fit. The model produced an acceptable CFI = **0.90** and a RMSEA = **0.06**, with a 90% confidence interval of [**0.056**; **0.068**].

Main Finding 11: The confirmatory factor analysis clearly showed that the factors identified through the exploratory factor analysis, Innovation, Open Innovation, Open Innovation accelerators, entrepreneurship, the innovation value chain, collaboration and accelerating commercialisation are valid to measure respondents' perceptions on using an Open Innovation platform to accelerate commercialisation.

Main Finding 12: The CFI and RMSEA results indicate that the factors identified reveal a relatively good fit with theory.

5.2.6 Inferential statistics

Analysis of Variance (ANOVA) tests were conducted to determine whether the identified factors were significantly different amongst variables of interest to this research, namely sector, level of education and business focus. The results of the ANOVA tests are reported in Tables 5.11, 5.12 and 5.13, respectively.

As mentioned in Chapter 4 the ANOVA investigates the effects of one variable on an 'interval-scaled' dependent variable (Zikmund *et al.*, 2013:542). If there is a difference that is large enough to unlikely have occurred due to chance or sampling error, then the difference is statistically significant (McDaniel & Gates, 2005:455). A p-value is the exact probability of getting a computed test statistic that is due to chance. If the p-value is relatively small, so will the probability that the observed result occurred by chance be (McDaniel & Gates, 2005:487). In this research, a 0.05 level of significance ($p \leq 0.05$) is used for statistical significance (Ellis & Steyn, 2003:51). Additionally, in this research, p-values reflect completeness.

Effect sizes indicate whether there are practically significant differences between the means of groups in this research. In order to interpret effect sizes Cohen's d-value must be used to interpret results. A d-value = 0.2 has a small effect, a d-value = 0.5 has a medium effect and a $d \geq 0.8$ has a large effect. The large effect size indicates a finding that is of practical significance, a medium effect size indicates a finding that could be substantial and a small effect size indicates that there is no difference and therefore the answers are the same (Cohen, 1988:223).

Table 5.11: Results of ANOVA tests regarding respondents' sector

Factor	Group	N	mean	Standard deviation	p-value
Innovation	Academia	29	4.20	0.662	0.362
	Government	64	4.27	0.910	
	Private sector	89	4.39	0.618	
Open Innovation accelerator	Academia	29	3.71	0.945	0.790
	Government	64	3.60	1.00	
	Private sector	87	3.69	0.804	
Open Innovation	Academia	29	3.32	0.830	0.649
	Government	64	3.43	0.968	
	Private sector	87	3.49	0.793	
Innovation value chain	Academia	29	4.06	0.771	0.489
	Government	64	3.97	0.963	
	Private sector	88	4.14	0.759	
Entrepreneurship	Academia	29	4.19	0.666	0.608
	Government	64	4.03	1.00	
	Private sector	89	4.13	0.630	

Factor	Group	N	mean	Standard deviation	p-value
Collaboration	Academia	29	4.10	0.643	0.567
	Government	64	3.99	0.918	
	Private sector	88	4.13	0.731	
Accelerating commercialisation	Academia	29	3.81	0.770	0.575
	Government	64	3.90	0.857	
	Private sector	88	3.97	0.634	

Table 5.11 indicates that a p -value of:

- 0.362 was obtained for innovation
- 0.790 was obtained for Open Innovation accelerators
- 0.649 was obtained for Open Innovation
- 0.489 was obtained for the innovation value chain.
- 0.608 was obtained for entrepreneurship
- 0.567 was obtained for collaboration
- 0.575 was obtained for accelerating commercialisation

A p -value smaller than 0.05 is considered to be sufficient evidence that the result was statistically significant (Ellis & Steyn, 2003:51). There is therefore no statistically significant difference amongst academia, government and private sector. As a result Cohen's effect size (d-values) was not reported since there is no practical significance amongst sectors regarding all seven factors.

Main finding 13: Respondents from academia, government and private sector do not differ (statistically and practically) in views regarding innovation, Open Innovation, Open Innovation accelerators, entrepreneurship, the innovation value chain, collaboration and accelerating commercialisation.

Table 5.12: Results of ANOVA tests regarding level of education

Factor	Group	N	Mean	Standard deviation	p-value
Innovation	Grade 12	25	4.44	0.783	0.549
	Diploma/Degree	61	4.24	0.946	
	Post-graduate degree	96	4.30	0.615	
Open Innovation accelerator	Grade 12	25	3.75	0.986	0.555
	Diploma/Degree	60	3.72	0.970	
	Post-graduate degree	95	3.59	0.847	
Open Innovation	Grade 12	25	3.32	0.945	0.463
	Diploma/Degree	60	3.54	0.980	
	Post-graduate degree	95	3.40	0.745	
Innovation value chain	Grade 12	25	4.16	0.980	0.567
	Diploma/Degree	60	4.08	0.991	
	Post-graduate degree	96	3.98	0.680	
Entrepreneurship	Grade 12	25	4.21	0.914	0.586
	Diploma/Degree	61	4.02	0.941	
	Post-graduate degree	96	4.08	0.653	
Collaboration	Grade 12	25	4.19	0.788	0.492
	Diploma/Degree	60	4.11	0.910	
	Post-graduate degree	96	4.00	0.717	
Accelerating commercialisation	Grade 12	25	4.07	0.800	0.379
	Diploma/Degree	60	3.90	0.898	
	Post-graduate degree	96	3.84	0.624	

The p-values in Table 5.12 are reflected for completeness. It is shown that a p-value of:

- 0.549 was obtained for Innovation
- 0.555 was obtained for Open Innovation accelerators
- 0.463 was obtained for Open Innovation
- 0.567 was obtained for the innovation value chain
- 0.586 was obtained for entrepreneurship
- 0.492 was obtained for Collaboration
- 0.379 was obtained for accelerating commercialisation

There is therefore no statistically significant difference between the respondents qualifications ($p \geq 0.05$ indicates no significance). As a result Cohen's effect size value is not reported.

Main finding 14: Respondents' level of education does not influence their view on the seven factors. There are no significant differences (practically and statistically) across all factors with respect to the qualification the respondents have.

Table 5.13: Results of ANOVA tests regarding respondents' sector

Factor	Group	N	Mean	Standard deviation	p-value
Innovation	Manufacturing	24	3.92	1.05	0.289
	Retail and wholesale trade	3	4.54	0.650	
	Agriculture, forestry and fishing	6	4.47	0.499	
	Food products and beverages	6	4.40	0.616	
	Transport and travel	6	4.14	0.400	
	Oil and gas, mining and quarrying	7	4.50	0.727	
	Pharmaceutical and biotech	7	4.57	0.286	
	Healthcare and medical technology	11	4.64	0.306	
	Information technology	47	4.41	0.780	
	Finance and insurance	4	4.42	0.481	
	Marketing and media	12	4.35	0.584	
	Other services	21	4.23	0.438	
Open Innovation accelerator	Manufacturing	24	3.38	1.01	0.243
	Retail and wholesale trade	3	3.82	0.898	
	Agriculture, forestry and fishing	6	3.78	1.18	
	Food products and beverages	5	3.07	0.822	
	Transport and travel	6	3.69	0.590	
	Oil and gas, mining and quarrying	7	3.58	0.881	
	Pharmaceutical and biotech	7	3.70	0.650	
	Healthcare and medical technology	11	4.07	0.615	
	Information technology	47	3.77	0.775	
	Finance and insurance	4	3.09	1.47	
	Marketing and media	12	4.15	0.794	
	Other services	21	3.79	0.877	

Open Innovation	Manufacturing	24	3.19	1.08	0.674
	Retail and wholesale trade	3	3.08	1.01	
	Agriculture, forestry and fishing	6	3.59	1.04	
	Food products and beverages	5	3.18	0.478	
	Transport and travel	6	3.47	0.379	
	Oil and gas, mining and quarrying	7	3.50	0.885	
	Pharmaceutical and biotech	7	3.41	0.396	
	Healthcare and medical technology	11	3.87	0.758	
	Information technology	47	3.47	0.851	
	Finance and insurance	4	3.09	0.480	
	Marketing and media	12	3.76	1.02	
	Other services	21	3.53	0.832	
Innovation value chain	Manufacturing	24	3.99	1.11	0.238
	Retail and wholesale trade	3	4.20	0.917	
	Agriculture, forestry and fishing	6	4.40	0.830	
	Food products and beverages	6	3.67	0.755	
	Transport and travel	6	3.58	0.706	
	Oil and gas, mining and quarrying	7	4.25	0.846	
	Pharmaceutical and biotech	7	4.17	0.423	
	Healthcare and medical technology	11	4.49	0.509	
	Information technology	47	4.23	0.761	
	Finance and insurance	4	4.00	0.993	
	Marketing and media	12	3.70	0.859	
	Other services	21	3.9	0.476	
Entrepreneurship	Manufacturing	24	3.87	1.04	0.096
	Retail and wholesale trade	3	4.42	0.804	
	Agriculture, forestry and fishing	6	4.49	0.607	
	Food products and beverages	6	3.92	0.540	
	Transport and travel	6	3.44	0.941	
	Oil and gas, mining and quarrying	7	4.36	0.988	
	Pharmaceutical and biotech	7	4.39	0.349	
	Healthcare and medical technology	11	4.66	0.422	
	Information technology	47	4.10	0.787	
	Finance and insurance	4	4.38	0.595	
	Marketing and media	12	4.04	0.706	
	Other services	21	4.22	0.455	

Collaboration	Manufacturing	24	3.83	1.02	0.601
	Retail and wholesale trade	3	4.00	0.667	
	Agriculture, forestry and fishing	6	4.50	0.279	
	Food products and beverages	6	3.78	0.750	
	Transport and travel	6	3.89	0.344	
	Oil and gas, mining and quarrying	7	4.14	0.716	
	Pharmaceutical and biotech	7	4.33	0.430	
	Healthcare and medical technology	11	4.36	0.482	
	Information technology	47	4.11	0.823	
	Finance and insurance	4	4.25	0.833	
	Marketing and media	12	4.22	0.657	
	Other services	21	4.16	0.501	
Accelerating commercialisation	Manufacturing	24	3.70	1.02	0.677
	Retail and wholesale trade	3	4.47	0.503	
	Agriculture, forestry and fishing	6	4.10	0.518	
	Food products and beverages	6	3.60	0.310	
	Transport and travel	6	3.98	0.449	
	Oil and gas, mining and quarrying	7	4.06	0.854	
	Pharmaceutical and biotech	7	4.03	0.390	
	Healthcare and medical technology	11	4.13	0.621	
	Information technology	47	3.91	0.791	
	Finance and insurance	4	3.95	0.998	
	Marketing and media	12	4.17	.0676	
	Other services	21	4.08	0.538	

Table 5.13 indicates that a p-value of;

- 0.289 was obtained for innovation
- 0.243 was obtained for Open Innovation accelerators
- 0.674 was obtained for Open Innovation
- 0.238 was obtained for the innovation value chain
- 0.096 was obtained for entrepreneurship
- 0.601 was obtained for collaboration
- 0.677 was obtained for accelerating commercialisation

There is therefore no statistically significant difference between the respondents business focus ($p \geq 0.05$ indicates no significance). As a result Cohen's effect size value is not reported. There is no practical significance between qualifications regarding innovation.

Main finding 15: Respondents from various business focuses do not differ in views regarding Innovation, Open Innovation, Open Innovation accelerators, entrepreneurship, the innovation value chain, collaboration and accelerating commercialisation.

5.2.7 Cross tabulations

Cross tabulations, based on the chi-square test, were carried out for questions 46-49 so as to establish the association between the questions and the variables of interest. Where statistical difference exists, the Cramer's V ($w \leq 1$) is calculated as it measures the strength of association between two categorical variables (Field, 2013:740). The following tables (Table 5.14 – Table 5.17) provide the frequencies regarding the results obtained and present the results of demographics of the entire sample.

Table 5.14: Summary of results from question 46 - 49

Statements		F	%
Angel investors have financed my innovation.	Yes	15	7,9
	No	172	90,5
I have protected my IP by registering for a patent and/or trademark.	Yes	94	49,5
	No	94	49,5
I have applied for funding from government schemes e.g. TIA, DTI IDC.	Yes	91	47,9
	No	97	51,1
I have approached commercial banks for funding.	Yes	42	22,1
	No	146	76,8

From Table 5.14, it is determined that 90.5% of respondents' innovation was not financed by angel investors, while only 7.9% of the respondents received funding from angel investors. Exactly half of the respondents have protected their IP by registering for a patent or trademark while the other half has not done so. Only 47.9% of the respondents have applied for funding from government schemes while the rest (51.1%) have not applied. The majority of the respondents have not approach commercial banks for funding whereas 22.1% have done so.

Main Finding 16: A majority of respondents (90.5 % and 76.8% respectively) are not funded by angel investors or commercial banks. However, close to half (47.9%) of the respondents have applied for funding from government agencies.

Main finding 17: Respondents (49.5 %) who have protected their IP by registering for a patent or/and trademark are equal to respondents (49.5%) who have not done so.

Table 5.15: Cross tabulation of variables of interest and whether angel investors have financed respondents' innovation.

Variable of interest		Angel investors have financed my innovation	
		Yes	No
Sector	Chi-square = 0.145	15 (8.3%)	166 (91.7%)
	Cramer's V = 0.146		
Academia		1 (3.4%)	28 (96.3%)
Government		3 (4.8%)	60 (95.2%)
Private sector		11 (12.4%)	78 (87.6%)
Level of Education	Chi-square = 0.500	15 (8.3%)	166 (91.7%)
	Cramer's V = 0.087		
Matric		1 (4%)	24 (96%)
Diploma or degree		4 (6.7%)	56(93.3%)
Post-graduate degree		10 (10.4%)	86 (89.6%)
Business focus	Chi-square = 0.621	13 (8.5%)	140 (91.5%)
	Cramer's V = 0.243		
Manufacturing		1 (4.2%)	23 (95.8%)
Retail and wholesale trade		0	3 (100%)
Agriculture, forestry and fishing		0	6 (100%)
Food products and beverages		0	6 (100%)
Transport and travel		1 (16.7%)	5 (83.3%)
Oil and gas, mining and quarrying		1 (14.3%)	6 (85.7%)
Pharmaceutical and biotech		0	7 (100%)
Healthcare and medical technology		1 (9.1%)	10 (90.9%)
Information technology		7 (15.2%)	39 (84.8%)
Finance and insurance		1 (25%)	3 (75%)
Marketing and media		0	12 (100%)
Other services		1 (4.8%)	20 (95.2%)

Table 5.15 indicates that only 3.4% and 4.8% of respondents from academia and government respectively, have been financed by angel investors. Merely 12.4% of respondents from private sector have been financed by angel investors. Statistical analysis was conducted by

means of a Chi-square test to determine whether an association exists between these variables. A p-value of **0.145** was realised indicating no statistical significant association between the respondents' sector regarding whether angel investors had financed their innovations.

Main finding 18: The majority of respondents (91.7%) in each sector have not been financed through angel investors. With regards to this, no significant differences exist amongst respondents' sector.

Also from Table 5.15, it is determined that only 4% and 6.7% of respondents who have completed matric and those who have completed a diploma or degree, respectively, have been financed by angel investors. Only 10.4 % of the respondents who have obtained a post-graduate degree have been financed by angel investors. The Chi-square test indicated no statistical significant (**p=0.500**) association between the respondents' level of education regarding whether angel investors had financed their innovations.

Main finding 19: A majority of respondents (91.7%), regardless of their highest level of education, have not obtained financing for their innovation through angel investments.

None of the respondents from marketing and media, pharmaceutical and biotech, food products and beverages, retail and wholesale trade, as well as agriculture, forestry and fishing has been financed by angel investors. Just 4.2% and 4.8% of respondents from manufacturing and other services, respectively, have been financed by angel investors. Close to 10% of respondents whose main business focus is healthcare and medical technology have been financed by angel investors (9.1%), while 14.3% of respondents from businesses focusing on oil, gas, mining and quarrying have been financed by angel investors. Only 15.2% and 16.7% of businesses that focus on information technology as well as businesses focusing on transport and travel have received funding from angel investors respectively. A quarter of the respondents (25%) with businesses focused mainly on finance and insurance have been financed by angel investors. From the statistical analysis conducted using the Chi-squared test, it was confirmed that no significant differences (**p=0.621**) exists between respondents' business focus and whether angel investors have financed their innovations

Main finding 20: A large percentage of respondents (91.5%) have not received finance for innovation from angel investors, irrespective of their business focus.

Main finding 21: With regards to whether angel investors have financed respondents' innovations, no significant differences exist amongst respondents' sector, level of education and business focus.

Table 5.16: Cross tabulation of variables of interest and whether respondents have protected their IP by registering for a patent and/or trademark

Variable of interest		I have protected my IP by registering for a patent and/or trademark.	
		Yes	No
Sector	Chi-square = 0.063	91 (50%)	91 (50%)
	Cramer's V = 0.174		
Academia		20 (69%)	9 (31%)
Government		32 (50%)	32 (50%)
Private sector		39 (43.8%)	50 (56.2%)
Level of Education	Chi-square = 0.394	88 (48.6%)	93 (51.4%)
	Cramer's V = 0.102		
Matric		9 (36%)	16 (64%)
Diploma or degree		30 (50%)	30 (50%)
Post-graduate degree		49 (51%)	47 (49%)
Business focus	Chi-square = 0.343	79 (51.6%)	74 (48.4%)
	Cramer's V = 0.283		
Manufacturing		15 (62.5%)	9 (37.5%)
Retail and wholesale trade		1 (33.3%)	2 (66.7%)
Agriculture, forestry and fishing		3 (50%)	3 (50%)
Food products and beverages		2 (33.3%)	4 (66.7%)
Transport and travel		4 (66.7%)	2 (33.3%)
Oil and gas, mining and quarrying		3 (42.9%)	4 (57.1%)
Pharmaceutical and biotech		4 (57.1%)	3 (42.9%)
Healthcare and medical technology		6 (54.5%)	5 (45.5%)
Information technology		17 (37%)	29 (63%)
Finance and insurance		2 (50%)	2 (50%)
Marketing and media		6 (50%)	6 (50%)
Other services		16 (76.2%)	5 (23.8%)

From the information in Table 5.16, it can be seen that 69% of the respondents in academia have protected their IP by registering a patent and/or trademark and 56.2% of respondents from private sector have done the same. Exactly 50% of respondents from government have protected their IP by registering a patent and/or trademark. Through the Chi-square test, it was

determined that no association exists between these variables since a probability of $p=0.063$ was confirmed.

Main finding 22: The number of respondents (50%) in each sector who have registered for a patent and/or trademark is relatively equal to the number of respondents (50%) who have not done so.

This table also indicates that 36% of the respondents with matric have protected their IP by registering a patent and/or trademark compared to 51% of respondents with a post-graduate degree that have done the same. Exactly 50% of respondents with a diploma or degree have protected their IP by registering a patent and/or trademark. The Chi-square test determined whether an association exists between these variables. A p-value of 0.394 was confirmed. There is no significant difference between respondents' level of education regarding protecting IP through patent and/or trademark registration.

Main finding 23: Close to half of the respondents (48.6%) have protected their IP by registering for a patent and/or trademark, regardless of their level of education.

The number of respondents that have protected their IP by registering a patent and/or trademark equal those that have not for respondents operating in businesses that focus mainly on marketing and media, finance and insurance as well as agriculture, forestry and fishing. Also from the information illustrated in Table 5.16, 33.3% of respondents from businesses focusing on retail and wholesale trade along with food products and beverages have protected their IP by registering a patent and/or trademark. The majority of respondents in manufacturing (62.5%), transport and travel (66.7%), pharmaceutical and biotech (57.1%), healthcare and medical technology (54.5%) and other services (76.2%) have protected their IP by registering a patent and/or trademark. 37% of the respondents operating in businesses the focus mainly on information technology have protected their IP by registering a patent and/or trademark. Lastly, 42.9% of respondents have the oil, gas, mining and quarrying business focus have protected their IP by registering a patent and/or trade mark. Respondents also do not differ with regards to protecting their IP by registering for a patent and/or trademark ($p=0.343$).

Main finding 24: A majority of respondents (51.6%) regardless of their business focus have protected their IP by registering for a patent and/or trademark.

Main finding 25: There is no significant difference between respondents' sector, level of education and business focus regarding the protection of IP through patent and/or trademark registration.

Table 5.17: Cross tabulation of variables of interest and whether respondents have applied for funding from government schemes

Variable of interest		I have applied for funding from government schemes e.g. TIA, DTI IDC.	
		Yes	No
Sector	Chi-square = 0.053	88 (48.4%)	94 (51.6%)
	Cramer's V = 0.180		
Academia		20 (69%)	9 (31%)
Government		28 (43.8%)	36 (46.2%)
Private sector		40 (44.9%)	49 (55.1%)
Level of Education	Chi-square = 0.615	88 (48.6%)	93 (51.4%)
	Cramer's V = 0.073		
Matric		10 (40%)	15(60%)
Diploma or degree		29 (48.3%)	31(51.7%)
Post-graduate degree		49 (51%)	47(49%)
Business focus	Chi-square = 0.080	79 (51.6%)	74 (48.4%)
	Cramer's V = 0.344		
Manufacturing		16 (66.7%)	8 (33.3%)
Retail and wholesale trade		1 (33.3%)	2 (66.7%)
Agriculture, forestry and fishing		5 (83.3%)	1 (16.4%)
Food products and beverages		1 (16.4%)	5 (83.3%)
Transport and travel		5 (83.3%)	1 (16.4%)
Oil and gas, mining and quarrying		3 (42.9%)	4 (57.1%)
Pharmaceutical and biotech		4 (57.1%)	3 (42.9%)
Healthcare and medical technology		5 (45.5%)	6 (54.5%)
Information technology		22 (47.8%)	24 (52.2%)
Finance and insurance		3 (75%)	1 (25%)
Marketing and media		2 (16.7%)	10 (83.3%)
Other services		12 (57.1%)	9 (42.9%)

Table 5.17 shows that just less than half (43.8%) of the respondents from government have applied for funding from government schemes which is relatively similar to respondents who are from the private sector (44.9%). On the other hand, a majority of respondents from academia (69%) have applied for funding from government schemes. The Chi-squared test

indicated that there was no significant difference (**p=0.053**) between respondents' sector and whether they had applied for funding from government schemes.

Main finding 26: Just below half (48.4%) of the respondents have applied for funding from government schemes, irrespective of their sector.

Furthermore, 40% of respondents who have completed matric have applied for funding from government schemes, while 48.3% of respondents with a diploma or degree have done the same. 51% of the respondents who have obtained a post-graduate degree have applied for funding from government. The Chi-squared test indicated that there was no significant difference (**p=0.615**) between respondents' level of education and whether they had applied for funding from government schemes.

Main finding 27: A slight majority of respondents (51.4%) regardless of their level of education have not applied for funding from government schemes.

In addition:

- 83.3% of respondents from agriculture, forestry and fishing as well as transport and travel have applied for funding from government schemes
- Close to half of the respondents operating in businesses that focus mainly on information technology (47.8%), healthcare and medical technology (45.5%) along with oil, gas, mining and quarrying (42.9%), have applied for funding from government schemes.
- A majority of respondents operating in businesses that focus mainly on manufacturing (66.7%) and other on finance and insurance (75%) have applied for funding from government schemes.
- 57.1% of respondents operating in businesses focusing mainly on pharmaceutical, biotech and other services have applied for funding from to government schemes.
- Only 33.3 % of the respondents from retail and wholesale trade have applied for funding from government schemes.
- 16.7 % of respondents whose business focus is mainly food products and beverages along with those that focus mainly on marketing and media have applied for funding from government schemes. Regarding the application of funding from government schemes, there is no significant difference between respondents' business focus (**p=0.08**).

Main finding 28: A majority of respondents (51.6%) have applied for funding from government schemes, irrespective of their business focus.

Main finding 29: With regards to whether respondents have applied for funding from government schemes, no significant differences exist amongst respondents' sector, level of education and business focus.

Table 5.18: Cross tabulation of variables of interest and whether respondents have approached commercial banks for funding.

Variable of interest		I have approach commercial banks for funding.	
		Yes	No
Sector	Chi-square = 0.251	40 (22%)	142 (88%)
	Cramer's V = 0.123		
Academia		3 (10.3%)	26 (89.7%)
Government		16 (25%)	48(75%)
Private sector		68 (76.4%)	40 (23.8%)
Level of Education	Chi-square = 0.507	40 (22.1%)	141 (87.9%)
	Cramer's V = 0.087		
Matric		4 (16%)	21 (84%)
Diploma or degree		16 (26.7%)	44 (73.3%)
Post-graduate degree		20 (20.8%)	76 (79.2%)
Business focus	Chi-square = 0.039	38 (24.8%)	115 (57.2%)
	Cramer's V = 0.366		
Manufacturing		12 (50%)	12 (50%)
Retail and wholesale trade		1 (33.3%)	2 (66.7%)
Agriculture, forestry and fishing		3 (50%)	3(50%)
Food products and beverages		1 (16.7%)	5 (83.3%)
Transport and travel		1 (16.7%)	5 (83.3%)
Oil and gas, mining and quarrying		3 (42.9%)	4 (57.1%)
Pharmaceutical and biotech		0	7 (100%)
Healthcare and medical technology		2 (18.2%)	9(81.8%)
Information technology		10 (21.7%)	36 (78.3%)
Finance and insurance		2 (50%)	2 (50%)
Marketing and media		1 (8.3%)	11 (91.7%)
Other services		2 (9.5%)	19 (90.5%)

From Table 5.18, it is determined that only 10.3 % of respondents from academia have approached commercial banks for funding compared to 25% of respondents from government. Similar to government, 23.6% of respondents in the private sector have approached commercial banks for funding. Further statistical analysis was conducted through a Chi-square test to determine whether an association exists between these variables. A p-value of **0.251** was recognised, indicating no statistical significant association between the respondents' sector regarding whether they have approached commercial banks for funding. This therefore implies that no practically significant difference exists between respondents' sector.

Main finding 30: The majority of respondents (88%) in each sector have not approached commercial banks for funding.

16% of respondents who had completed matric have approached commercial banks for funding. 26.7 % of respondents with a diploma or degree have approached commercial banks for funding, whereas 20.8 % of respondents with a post-graduate degree have done the same. Furthermore, a Chi-square test (**p=0.507**) revealed that no statistical significant difference between the respondents' level of education regarding whether they have approached commercial banks for funding. This therefore implies that no practically significant difference exists.

Main finding 31: The majority of respondents (87.9%), regardless of their level of education, have not approached commercial banks for funding.

Lastly, it can be seen that the number of respondents that have approached commercial banks for funding equal those that have not for respondents operating in businesses that focus mainly on finance and insurance as well as agriculture, forestry and fishing. None of the respondents from pharmaceutical and biotech have approached commercial banks for funding. 16.7% of businesses that focus on information technology as well as businesses focusing on transport and travel as well as food products and beverages have approached commercial banks for funding. Less than 50% of respondents from retail and wholesale trade (33.3%), Oil, gas, mining and quarrying (42.9%), healthcare and medical technology (18.2%), information technology (21.7%), marketing and media (8.3%) and other service (9.5%) have approached commercial banks for funding. The Chi-squared statistic also revealed that there is significant association (**p=0.039**) between respondents business focus regarding whether they have approached commercial banks for funding. The strength of association as indicated by the Cramer's V value was **0.37**. According to Field (2013:740) the value indicates medium strength of association between respondents' business focus and funding provided by commercial banks.

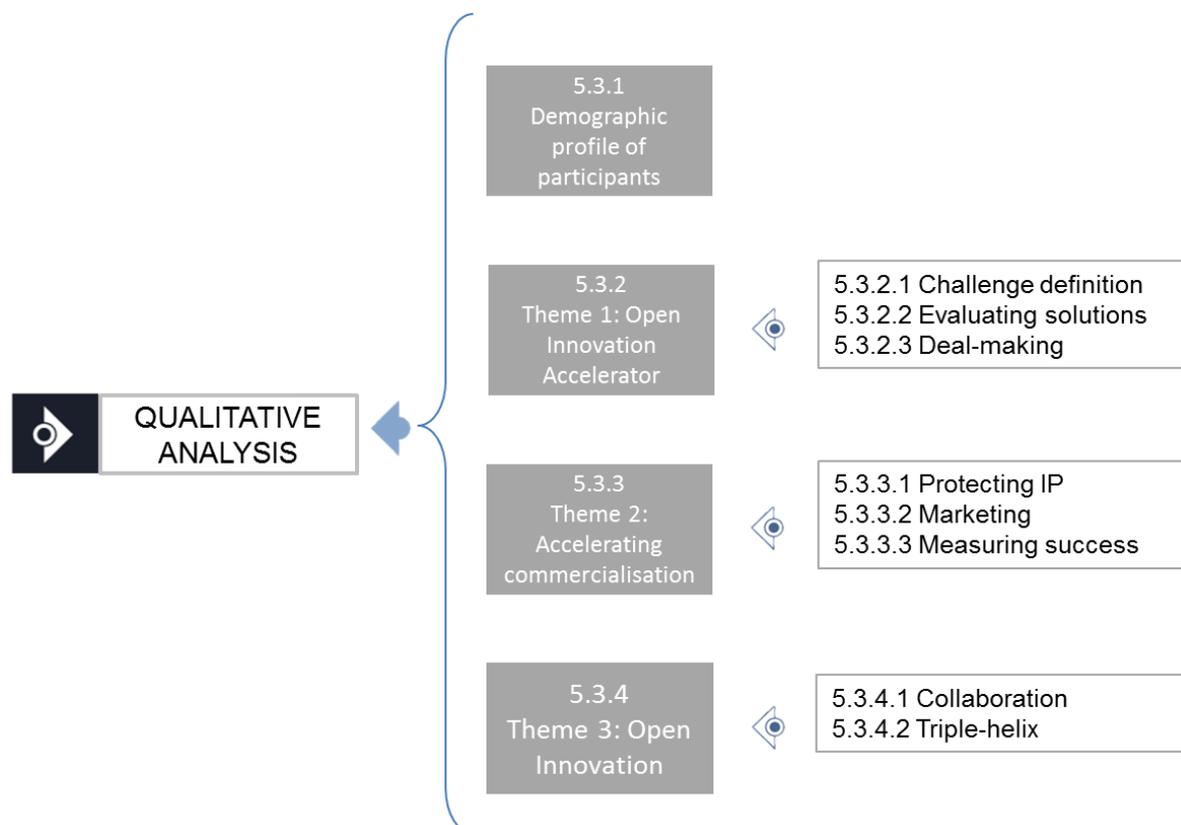
Main finding 32: The majority of respondents (57.2%) have not approached commercial banks for funding, irrespective of their business focus.

Main finding 33: No significant differences exist amongst respondents' sector and level of education regarding whether they have approached commercial banks for funding. Respondents from various business focuses do however differ regarding approaching commercial banks for funding. However a medium strength of association existed between respondents' business focus and the funding provided by commercial banks.

5.3 QUALITATIVE ANALYSIS

The qualitative data analysis was conducted based on semi-structured interviews. The purpose for conducting semi-structured interviews was to obtain supporting information providing a broader insight of the research from the perspective of the Open Innovation intermediary. The researcher assessed different levels of involvement in the Open Innovation platform. This means that the data collected through semi-structured interviews (qualitative method) resides alongside the data collected through questionnaires (Quantitative method) as two different perspectives providing an overall assessment of the problem. Figure 5.2 provides a synopsis of the qualitative analysis.

Figure 5.2: Synopsis of qualitative analysis



5.3.1 Demographic profile of participants in the qualitative research

Participants for the qualitative component of this research were purposefully selected from the population. These participants have an in-depth understanding of Open Innovation in the South African context, the Open Innovation platform and the components needed in accelerating ideas (solutions posted onto the platform) into commercialised entities. The participants are involved in both the design and management of the Open Innovation platform or have extensive knowledge on supporting mechanisms for taking ideas to market through the use of Open Innovation. In this research, nine participants have been identified and approached for interviews, five participants of which agreed to be interviewed. These participants reflect the core project team of the Open Innovation platform (see section 4.3.6 and Figure 5.3).

Figure 5.3: Participants of the qualitative research

OPENIX CORE PROJECT TEAM	
 Project owner	→ Funds and enables the Open Innovation (OI) project
 Project Administrator	→ Facilitates and monitors activities in the OI project
 Open Innovation programme manager	→ Develops and implements OI strategies
 Campaign manager	→ Oversees the connect phase of the OI project
 Technical manager	→ Facilitates the running of the web-based platform for OI project

All the interviews were recorded and later transcribed for analysis at the consent of the participants. From the transcribed interviews three themes were identified and analysed, namely Open Innovation accelerator, accelerating commercialisation and Open Innovation.

5.3.2 Theme 1: Open Innovation accelerator

Open Innovation accelerators support businesses in executing Open Innovation projects, thereby running the project on behalf of businesses either through providing a solution to a given need or aiding businesses in building their own Open Innovation proficiencies. Chapter 3 (see section 3.6) provided a theoretical investigation into Open Innovation accelerators and the various techniques used in executing an Open Innovation project. In this section the participants' feedback regarding The Innovation Hub Solution Exchange, an Open Innovation Accelerator in the Gauteng Province, is presented. Three sub-themes emerged from the feedback namely challenge definition, evaluating solutions and deal-making. Tables 5.19 –

Table 5.21 reflect the direct words of the participants as evidence of their opinion regarding Open Innovation accelerators.

5.3.2.1 Challenge definition

Participants indicated that the first approach to defining a challenge is to identify needs within the business. These needs have not been solved internally because the business has no skills, knowledge or financial resources for the right solution. Business needs vary and may address operational problems or technical problems (1). Participants emphasised that the needs are then ranked and prioritised according to their urgency, their fit for Open Innovation and the perceived opportunity they present to the business. The need should be transferable across domains outside the business' core domain. They added that a kick-off meeting is set up to narrow down the need into a clear and transferable (cross-domain) challenge (2).

The need must be as specific as possible. Participants added the importance of ensuring that various stakeholders from both the Open Innovation accelerator and the business involved are present at the kick-off meeting. These stakeholders include the procurement team, Open Innovation experts, technical experts, and other parties involved in ensuring the transferability of the challenge. Their participation increases the possibility of absorbing the new solution into the business (3). Participants also added that it is vital that there is a budget to ensure the new solution's implementation in the business (4).

Table 5.19: Participants responses regarding defining a challenge

Theme 1	Number	Direct quotation
CHALLENGE DEFINITION	1	<ul style="list-style-type: none"> • A challenge is a business need, a real business need • ... a client with a high level need has been identified. • ... what their problems are or where do they lose money. • They have either not been able to solve internally or they don't have the skills or the information or resources. • They need solutions to address their operational problems, or technical problems.
	2	<ul style="list-style-type: none"> • ... tries to narrow down the issue [need]. • ... prioritising a challenge with a client. • ... one would be the most suitable for open innovation. • ... then presenting it in a way that is transferable across different domains outside of the core domain. • We will rank and prioritize them [the needs]...and see where the business wants a solution as a matter of urgency.
	3	<ul style="list-style-type: none"> • ... get a technical expert in the room, and we will ask them to get their technical expert in and also their procurement and everything else in the room. • The business development manager and our expert that we use, our OI expert sits with a team from the specific organization. • If we don't define also the human process then the chances of absorption of the technology to be found gets less.
	4	<ul style="list-style-type: none"> • ... look at whether there is budget to solve, to pay for the implementation of the proposals. • ... there is budget available for solving it. • His got a budget if the solution is found to implement it.

5.3.2.2 Evaluating solutions

Participants indicated that they first look at the economic and technical feasibility of a solution when setting evaluation criteria. This means setting evaluation criteria for technical, commercial and relationship elements (1). This means investigating the actual problem within that field, considering the costs and legalities around the solution and the relationship the challenge owner are looking for (2). Although that is the standard evaluation criteria, the majority of the participants indicated that it is not a very structured process as each challenge has its specific criteria that solution needs to meet. The criteria differed according to each challenge. Participants added that evaluating solutions therefore relies often on intuition and helping the challenge owners engage with potential solution providers (3).

Table 5.20: Participants responses regarding evaluation potential solutions

Theme 1	Number	Direct quotation
EVALUATING SOLUTIONS	1	<ul style="list-style-type: none"> • We are looking for solutions that are feasible both economically and technically. • ... what are the technical elements that of interest for them. • ... what are the commercial elements? • ... what kind of relationship is there?
	2	<ul style="list-style-type: none"> • Taking how look at the actual problem that must be solved. • ... the things around the cost or the proposed solution. • The solution will work at a certain cost point... and it must be legal • We have some standard evaluation criteria.
	3	<ul style="list-style-type: none"> • ... so each new challenge has its own evaluation criteria. • The challenge brief will outline the specifications for a solution. • ... there will be specific criteria, that every solution has to meet. • ... it relies a lot more on gut feel and helping the challenge owners engage with potential solution providers

5.3.2.3 Deal-making

Participants emphasised that The Open Innovation accelerator operates closely with businesses until there is an initial engagement with the potential solution provider (1). This is referred to as the commit phase (see section 3.6.2.1). Participants are also involved in trying to encourage the two parties to sign a Non-Disclosure Agreement (NDA). Participants mentioned that the Open Innovation accelerator facilitates the communication until a non-disclosure agreement is signed. This involves arranging meetings for the potential solution providers and the solution seeker, therefore shortlisting presentations and advising the SMMEs regarding IP. After mediating the first engagement, the Open Innovation accelerator withdraws from further engagement and deal-making becomes a negotiation between solution seeker and the solution provider (2). Since this is the case, participants emphasised the importance of guiding the potential solution providers in proposing a solution that fits the challenge and aligning the solution to the set criteria. They added that in doing this businesses (the solution seekers) are provided with solutions that are credible and have a fit for purpose (3).

Table 5.21: Participants responses regarding deal-making

Theme 1	Number	Direct quotation
DEAL-MAKING	1	<ul style="list-style-type: none"> • ... There's quite a specific boundary. • ... we go up to a point...and up to where the agreements are made between the solution provider and the solution seeker. • ...the initial engagement, we do one engagement between the challenge owner and the solution providers and then we hand over to the client normally.
	2	<ul style="list-style-type: none"> • ... we do facilitate it [the arrangement] a bit further. • ... we arrange the meetings, we arrange the shortlist presentations. • ... make sure that they sign the necessary agreements • It becomes a negotiation between the provider and the seeker.
	3	<ul style="list-style-type: none"> • We protect them [solution providers] and to make sure that they sign the necessary agreements. • ... we try to align the solutions to the criteria. • ...whatever we give the challenge owner is credible enough, it's got a fit for purpose and there's enough interest take it forward.

5.3.3 Theme 2: Accelerating commercialisation

In order to accelerate commercialisation using Open Innovation, three key activities are necessary, namely marketing techniques, funding the innovation, and protecting IP. Chapter 2 (see section 2.7) provided a theoretical investigation on the role that these activities play in supporting the overall innovation value chain. In this section the participants' feedback regarding accelerating commercialisation is presented. Three sub-themes emerged from the feedback namely protecting IP, marketing and measuring success. Table 5.22 - 5.24 reflect the direct words of the participants as evidence of their opinion regarding accelerating commercialisation.

5.3.3.1 Protecting IP

Participants highlighted the importance of confidentiality when participating in Open Innovation activities. They emphasised that before making a deal, the Open Innovation process is non-confidential (1). Participants stated that providers of the shortlisted solutions sign a non-disclosure agreement, adding that the Open Innovation accelerator facilitates this agreement between the solution providers and the solution seeker before they exchange any more detailed information. They indicated that solutions submitted are not made public or published

except between the solution seeker and provider (2). Most of the participants accentuated that IP leakage is prevented by advising the solution providers on what content they should and should not provide. Solution providers are advised to give information that is not proprietary unless it has been protected. Some participants mentioned that solution providers are advised to seek IP protection first before going any further (3).

Table 5.22: Participants responses regarding protecting intellectual property

Theme 2	Number	Direct quotation
PROTECTING IP	1	<ul style="list-style-type: none"> • ... everything is on a non-disclosed, which means it is open for the public. • We position it as a non-confidential process. • All solutions that we receive are considered to be confidential
	2	<ul style="list-style-type: none"> • We then advise the client and the potentially commercial partner to sign a NDA. • ... we can sign NDA's with the companies. • We would then facilitate the NDA between the solution provider and the challenge owner.
	3	<ul style="list-style-type: none"> • We try to advice the solution providers on what content they should be providing. • ... give us information that is not proprietary. • ... they might seek IP protection first before going a step further.

5.3.3.2 Marketing

The majority of participants indicated that using various academic networks and industry associations is vital when marketing business needs. They revealed that relationships that have been built are utilised to market challenges by requesting that partners send notifications to their databases (1). Participants also mentioned that where no partnerships are established, the prospective partners' websites are explored and a decision is made on whether or not to communicate the challenge with them. Participants emphasised that pro-actively searching for databases is done to identify emails and telephone numbers of people to invite to take part in the challenge. This requires the campaigning team to see where the opportunities lie in the different sectors (2).

Some participants indicated that google searches are conducted to find potential solution providers, while social networks such as LinkedIn are also used as a medium of marketing challenges. They added that most of the marketing is done through various communication channels such as bulk email, the use of personal emails, telephone calls, newsletters and

open innovation workshops. When potential solution providers attend workshops, the challenge is explained and they are given an opportunity to respond (3). Participants added that apart from this hand-driven process, challenges are posted onto the website and on newsletters in the hope that potential solution providers will log in and respond to the challenge (4).

Table 5.23: Participants responses regarding marketing

Theme 2	Number	Direct quotation
MARKETING	1	<ul style="list-style-type: none"> • We have various networks at universities, relationships that we build. • We send it to their databases.
	2	<ul style="list-style-type: none"> • ... campaigning team that phones these companies up and ask them to submit proposals. • ... we actually pro-actively search for databases. • We specifically, actively look for people who can potentially solve the challenge. • we read on the websites to then make a decision if we're going to email them the challenge or not. • ... it relies on the campaign people to see where opportunities lie.
	3	<ul style="list-style-type: none"> • We also do our own google searches and we make use of LinkedIn. • We use bulk email, we use personal emails, telephone calls, newsletters, OI workshops. • we invite people to attend the workshop... then we explain the challenge, they see an opportunity then they will respond.
	4	<ul style="list-style-type: none"> • It is quite a human driven process... • ... send it out in a newsletter...and send it out on the website. • ... and wait for responses. • The innovation network receives notification of the challenge but it is part of the innovation news. • They can visit the website to see the challenge.

5.3.3.3 Measuring success

Participants mostly emphasised the importance of deal-making as a measure of success. They mentioned that the success of an Open Innovation accelerator should be measured according to how many deals were made and the size of these deals over time (1). Although this is the case, participants shared that since the Open Innovation is relatively new in South Africa, other measures of success have been looked into. The accelerator investigates the number of

people that have used and registered onto the platform, the number of submissions made, visits to the website and workshops during the campaigning process. They have also noted the number of stakeholders running challenges as well as the number of shortlisted solutions for consideration (2). Participants also added that wider benefits through stakeholder engagement have contributed to the success of the platform, although this has been hard to quantify. Developed partnerships are starting to have impact as they support incubation and skills development programs run by the Innovation Hub (3).

The Innovation Hub Solution Exchange was launched to boost the Gauteng Employment Growth and Development Strategy (GEGDS) and the Gauteng Innovation and Knowledge Economy Strategy (GIKES) (The Innovation Hub, 2013:2). Since this is the case, participants added that another measure of success is the platform's alignment with the provincial strategies. One of the key objectives of GIKES is to stimulate SMME development. Participants stated that posting the challenges and business needs onto the platform created opportunities for SMMEs. They added that the platform provides SMMEs opportunities to showcase their technology and in turn build their businesses through partnerships and investment (4).

Apart from SMME development participants added that the platform tackled service delivery issues by identifying solutions that impact municipalities and are being implemented at community level. They also added that the platform encouraged technology transfer and partnerships between universities and industry on particular business needs (5).

Table 5.24: Participants responses regarding measuring success

Theme 2	Number	Direct quotation
MEASURING SUCCESS	1	<ul style="list-style-type: none"> • ... measure how many deals. • The deals that comes from it. • ... what's the size of the deals over a period? • We are looking for an actual deal.
	2	<ul style="list-style-type: none"> • How many people have used the process? • ... we identify the number of registrations, the number of submissions, the visits during the campaigning process. • ... measured in terms of identifying a short list. • We had workshops in those workshops, people attended. • ... measuring the number of solutions that are implemented
	3	<ul style="list-style-type: none"> • It's [OpenIX] got to support our incubation and our skills development programs. • There are wider benefits and we haven't figured out exactly how to capture it. • It's created those kind of entry points of our other programs can access. • ... indirect benefits are starting to come through slowly.
	4	<ul style="list-style-type: none"> • The project objectives which are driven, which are aligned to the Gauteng objectives. • ... the project managed to stimulate SME's development. • By putting challenges of a business needs on a platform and not making the best opportunities visible to the SME's.
	5	<ul style="list-style-type: none"> • Yes, we managed to identify solutions that are impacting municipalities. • They actually implemented the solution that is now actually impacting lives on community level. • We managed to get universities partner with the industries on particular business needs.

5.3.4 Theme 3: Open Innovation

Open Innovation involves making deals through collaborating with various role players within the triple-helix, in hope of leveraging their innovation capabilities rather than confining a business' discovered knowledge to its internal market mediums alone. Chapter 3 (see section 3.3) provided a theoretical investigation into the birth of Open Innovation and its purpose as a collaborative innovation process. In this section the participants' feedback regarding Open Innovation is presented. Two sub-themes emerged from the feedback namely collaboration

and triple-helix. Table 5.25 and Table 5.26 reflect the direct words of the participants as evidence of their opinion regarding Open Innovation.

5.3.4.1 Collaboration

Participants indicated that various innovators, SMME's and universities with different interests, are given the opportunity to collaborate with desired partners through posing their technologies onto the platform in the form of technology offers. Posting technology offers on the platform creates a pipeline for venture capitalists, deal makers and various entrepreneurs seeking partnerships. Participants mentioned that the platform created a good entry point into organisations and therefore allowed for the establishing and broadening relationships (1). Although this is the case, most participants added that facilitating technology offers has been a passive process since it's relatively under-resourced. Initially, driving collaboration through deal-making was not the main objective; showcasing technologies was the primary objective (2). Participants further added that their role going forward as an Open Innovation accelerator is to facilitate collaboration and engagement between individuals offering their technology and their perspective partnerships. Some of the participants added that is relatively hard to monitor if any partnerships have occurred through technology offers, since they are unaware of what is occurring outside of the website (3).

Table 5.25: Participants responses regarding collaboration

Theme 3	Number	Direct quotation
COLLABORATION	1	<ul style="list-style-type: none"> • ... coming from this various partners - universities, SMEs and individual innovators. • ...venture capitalist and dealmakers to actually get easy access. • Owners have got different interests. • ... its more pipeline creation. • a good entry point for us into quite a few organisations. • looking to broaden their relationships.
	2	<ul style="list-style-type: none"> • It's essentially been passive because it's under resourced. • The aim is not necessarily to drive deal makings. • ...to follow a passive process. • ...it was a demonstration of our ability to bring in technologies.
	3	<ul style="list-style-type: none"> • ...our role is the intermediately is facilitate engagement. • ...you never now ultimately did it (collaboration/deal-making) happen. • And it's very possible that the partnerships that happen outside the website...it's difficult to monitor it

5.3.4.2 Triple-helix

The interaction of research, government and industry in order to promote business innovation is referred to as the triple-helix model (OECD, 2013:1) (see section iv). Most of the participants emphasised that the role of the triple-helix in Open Innovation is to accelerate the process of making deals (1). Participants mentioned that academia was approached to push challenges into the universities and have technologies posted on the platform, thereby opening up a research community. They added that the majority of the solutions provided and the challenges launched came from industry. Large businesses mainly launched challenges, thereby seeking solutions, while small businesses and entrepreneurs proposed solutions to those challenges. Government played the role of the intermediary and enabler of the Open Innovation platform (2). One participant added that the collaboration between triple-helix players also occurred in the stakeholder steering committee. The committee included government, state-owned companies, universities and private companies (3).

Table 5.26: Participants responses regarding triple-helix

Theme 3	Number	Direct quotation
TRIPLE-HELIX	1	<ul style="list-style-type: none"> • The involvement of the triple-helix is to get this underlined process [Open Innovation through deal-making] going. • to facilitate the collaboration between triple-helix players
	2	<ul style="list-style-type: none"> • ... just opens up a research community. • Private sector has become our clients... smaller ones [businesses] become our solution providers. • The enabler in this case was government. • ... government is acting as an intermediately. • the universities have given us some technology offers
	3	<ul style="list-style-type: none"> • The actual implementation of the project, a lot of role players were brought into as steering committee. • We included government, state-owned companies, we included the universities

5.4 SUMMARY

The results for the investigation of an Open Innovation platform to accelerate commercialisation have been provided in this chapter. The results were reported according to the statistical and qualitative analysis techniques detailed in the previous chapter. These results were obtained through frequency analyses, cross-tabulations, one-way ANOVAs and factor analyses.

For Quantitative analysis, an exploratory factor analysis was conducted to identify the variables structure that explained each of the specified underlying items of using Open Innovation to accelerate commercialisation. Seven factors were extracted. Cronbach's alpha was utilised under the EFA to confirm the reliability of these factors. A confirmatory factor analysis (CFA) was conducted to test the fit (validity) of the seven factors retained. One way ANOVA tests were then conducted to determine whether the identified factors were significantly different amongst variables of interest to this research. To conclude, quantitative analysis cross tabulations, based on the chi-square test, were carried out for questions 46-49. This was done in order to establish the association between the questions and the variables of interest.

It was found that respondents from academia, government and private sector do not differ, both statistically and practically, in views their regarding Innovation, Open Innovation, Open Innovation accelerators, entrepreneurship, the innovation value chain, collaboration and accelerating commercialisation in South Africa. Generating funds and ensuring that intellectual property is protected are two important aspects to look into when accelerating ideas to market through Open Innovation. A majority of respondents are not funded by angel investors (90.5%) or by commercial banks (76.8%). Although this is the case, close to half of the respondents (49%) have applied for funding from government agencies. Respondents who have protected their IP by registering for a patent or/and trademark equalled the number of respondents who have not done so.

For qualitative analysis, three themes were identified from the transcribed semi-structured interviews, namely Open Innovation accelerator, accelerating commercialisation and Open Innovation. These themes were discussed and direct quotations were provided in order to provide support to the findings.

From feedback regarding The Innovation Hub Solution Exchange, an Open Innovation accelerator in the Gauteng Province three sub-themes emerged, namely defining a challenge, evaluating the potential solutions and achieving some form of deal-making between the solution provider and the solution seeker. It was found that protecting Intellectual property and applying rigorous marketing techniques is a necessity when accelerating commercialisation using Open Innovation. Furthermore, it was found that through Open Innovation, encouraging collaboration amongst the triple-helix in turn accelerates the process of making deals, and thus accessing new markets.

The results reported in this chapter will be discussed in the form of conclusions and recommendations in Chapter 6.

Chapter 6

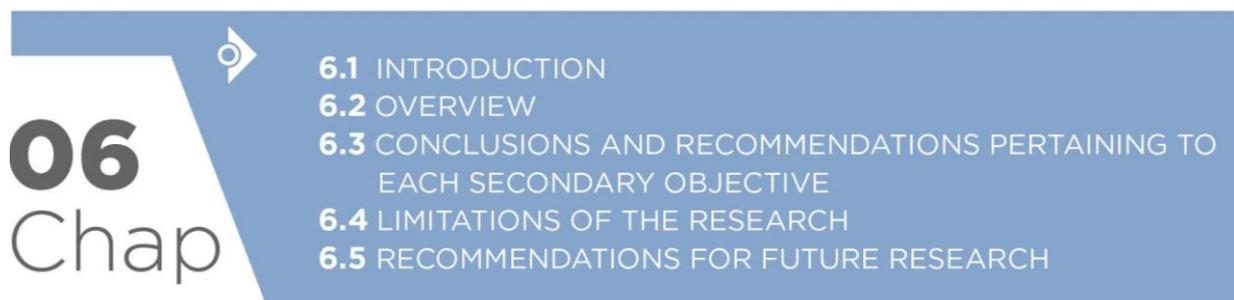
CONCLUSIONS AND RECOMMENDATIONS

6.1 INTRODUCTION

For this research, investigating the people, products, expectations and activities on the Open Innovation portal has contributed to an in-depth understanding of what is needed to bridge the gap from invention or idea to market or successful commercialisation. This chapter gives an overview of the research and subsequent conclusions and recommendations.

The goal for the research, outlined in Chapter 1, was to investigate an Open Innovation platform to accelerate commercialisation. Chapter 2 proceeded with a literature review on entrepreneurship and the innovation value chain, and in Chapter 3 a discussion was presented regarding the theory on innovation, with specific reference to the concept of Open Innovation. Chapter 4 provided the research methodology used for the research. Subsequently, results were reported in Chapter 5. This chapter commences with an overview of the research which is followed by sections that link the objectives of the research with the questions in the questionnaire, the main findings (where applicable), conclusions and the recommendations made. The limitations of the research are also discussed. This chapter concludes with recommendations for future research. Figure 6.1 provides an abbreviated synopsis of Chapter 6.

Figure 6.1: Synopsis of Chapter 6



6.2 OVERVIEW

For this research a literature search and an appropriate methodological framework was conducted. In doing so, various sources were utilised. In order to contribute to literature and outline the research methodology scholarly articles, journals, websites and books in this research's field were consulted.

In Chapter 2, an in-depth look at the theory of entrepreneurship and its relation with innovation commenced. The innovation process of taking an idea to market through commercialisation can be referred to as the innovation value chain. The innovation value chain is understood in three main phases, namely idea generation, idea conversion and idea diffusion. In order to increase commercialisation, collaboration at various parts of the innovation value chain ought to occur. This form of mass collaboration is referred to as Open Innovation.

Chapter 3 commenced with an in-depth investigation of Open Innovation and its benefits and challenges. Following this discussion, an exploration of Open Innovation accelerators, particularly the Open Innovation Solution Exchange in South Africa, was done. Open Innovation is being used as a method of connecting businesses seeking solutions with solution providers (see section 3.3). Solution providers are inventors, entrepreneurs or other businesses with inventions or solutions to organisational or market challenges and needs. Connecting the solution providers with businesses that seek such solutions relies on open innovation intermediaries and accelerators.

Although the benefits of open innovation in connecting solution seekers with solution providers is broadly spoken of and evident in theory (Chapter 2 and 3), little is understood on the successes of open innovation intermediaries in accelerating ideas to market or helping inventors or entrepreneurs in commercialising their ideas. Investigating the ability of an Open Innovation platform to accelerate commercialisation helps policy makers in making better decisions about what is needed to encourage success in taking ideas to market and in essence promoting a total early-stage entrepreneurial activity. The research also assists inventors by enabling them to better understand the intricacies and complexities of what it takes to successfully take an idea to market and thus making better decisions in regards to it.

6.2.1 Objectives of the research

The primary objective of this research was to investigate an Open Innovation platform to accelerate commercialisation. In order to achieve the primary objective of the research, a number of secondary objectives were set.

Secondary objectives derived from the research problem were to:

1. Investigate entrepreneurship in the innovation value chain.
2. Describe Open Innovation and the platform used in accelerating commercialisation.

3. Examine the challenges and opportunities presented by Open Innovation in accelerating ideas to market.
4. Determine respondents' perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation.

6.2.2 Research methodology

For this research, descriptive research methods were used to gather information as data was collected primarily through the use of Multi-methods research. Multi-methods research is the use of Quantitative and qualitative methods independently, in order to accomplish research objectives. Thus, data was collected primarily using Quantitative research while qualitative data were collected to compliment the Quantitative information. A multi-method approach was utilised to determine the ability of Open Innovation to accelerate commercialisation.

The population of this research was individuals who have used Open Innovation in South Africa. Convenience and purposive sampling was used for the selection of the sample from the population. The sample size for Quantitative data collection was determined by the number of respondents who attend prescribed Open Innovation workshops as well as members on the Open Innovation online platform. For qualitative data collection, the sample was individuals who were involved in both the design and management of the Open Innovation platform and have extensive knowledge on supporting mechanisms for taking ideas to market through the use of Open Innovation.

The research instrument used for Quantitative data was in the form of a self-administered questionnaire containing close-ended multiple choice, dichotomous and Likert-scale questions. The questionnaire was handed out at workshops and uploaded onto *SurveyMonkey*. For the qualitative research open-ended, semi-structured, one-on-one interviews served as the research instrument.

Data entry, tabulation and statistical analysis were done with the assistance of the Statistical Consultation Services of the North-West University (Potchefstroom Campus). Exploratory factor analysis (EFA) was used to identify the variables structure that explained each of the specified underlying items of using Open Innovation to accelerate commercialisation. Subsequently, the Cronbach alpha coefficients were used to determine the reliability of the research. The results of quantitative analysis were reported from seven factors extracted from the EFA, namely innovation, Open Innovation accelerators, Open Innovation, accelerating commercialisation, the innovation value chain, collaboration and entrepreneurship. The validity of the research was tested using a confirmatory factor analysis (CFA). Analysis of

Variance (ANOVA) and Chi-Square tests were conducted to determine whether the extracted factors and selected questions were significantly different amongst sector, level of education and business focus (See Chapter 5).

The semi-structured interviews conducted through qualitative research were transcribed for analysis. A content analysis method was utilised to examine the transcribed interviews. This was done by systematically categorising the participants' responses with the aim of identifying overall themes and patterns. Three main themes were identified and analysed, namely Open Innovation accelerator, accelerating commercialisation and Open Innovation.

Although both Quantitative and qualitative research methods were used to collect data, no triangulation was reached in this research since neither the integration of data nor the connection across phases was utilised. The researcher's primary aim was to collect Quantitative data while the use a qualitative component was to provide supportive information, thus giving a broader perspective of Open Innovation platforms' ability to accelerate commercialisation.

The conclusions made from the literature review and the results obtained for the research, compared with the objectives of the research, are discussed in the following section. The key recommendations pertaining to each secondary objective are discussed.

6.3 CONCLUSIONS AND RECOMMENDATIONS PERTAINING TO EACH SECONDARY OBJECTIVE

Chapter 3 addressed secondary objectives 1 and 2 while the third secondary objective was addressed in Chapter 2. Chapter 4 explained how secondary objectives 4 and 5 would be investigated while Chapter 5 served to address those secondary objectives. In Chapters 2 and 3, the theoretical framework against which the empirical part of the research is set, was provided. As a result, no detailed main findings have been formulated for the first three secondary objectives. However, the information obtained from the framework was utilised for constructing the questionnaire. The theoretical framework strengthens the conclusions and recommendations in relation to the subsequent secondary objectives formulated for this research. In the following sections (6.3.1 to 6.3.7), all secondary objectives are discussed. In each section, the relevant secondary objective is stated. Where applicable, the main findings related to the particular secondary objective are referred to, conclusions are formulated and subsequently, recommendations are made. The conclusions and recommendations are subsequently presented.

6.3.1 Secondary objective 1: Investigate entrepreneurship in the innovation value chain

A country's economic development has a direct effect on its level of entrepreneurship. The progress and development of entrepreneurship is therefore vital for the economic growth of developing countries. Economic growth is also strongly associated with innovation since new and competitive businesses are created through new ideas. As ideas increase, innovation capabilities increase and subsequently the level of entrepreneurship increases. The nature of innovation is therefore linked to entrepreneurship. The definition of entrepreneurship was concluded as the ability of an entrepreneur, who comes across a worthwhile idea, to introduce his idea to a market or industry (see section 2.2). Entrepreneurship therefore results in new innovations from existing inputs and through the emergence of new industries. This in essence means that innovation is a key function of entrepreneurship (see section 2.5). It addresses market needs and involves entrepreneurship in order to successfully commercialise new ideas.

Innovation through entrepreneurship does not occur instantaneously but instead takes place through a wide-ranging process. This process of taking an idea and turning it into a successful commercial product or service is referred to as the innovation value chain and takes place in three phases.

The innovation value chain starts with the idea generation phase. In this phase new ideas and new knowledge are generated in a large number of ways and later screened through ranking, profiling and scenario building. As sources of new knowledge and ideas are generated, entrepreneurship becomes evident during the idea generation phase. One of the key characteristics of entrepreneurs is their ability to recognise, discover and utilise opportunities. This characteristic is prevalent during the idea generation phase since entrepreneurship is also described as the creation of something that did not previously exist (see section 2.2.2).

The second phase in the innovation value chain is idea conversion. This phase is comprised of all the activities involved in converting the selected ideas into products or services which are ready for commercialisation. During this phase the various functions of the business collaborate in defining the concept by ensuring that the proposed idea has features that add value to the end-user. They develop the prototype to ensure that the prototype operates as projected and analyses its business model to determine the feasibility of the prototype and its overall fit with the business. In the conversion phases entrepreneurs first determine if the venture seems viable before investing all their resources and time. Taking calculated to higher risks is another key characteristic of entrepreneurs; both personal and financial risks are

incurred when undertaking entrepreneurship (see section 2.2.1). During the idea conversion, risks are calculated as the feasibility of the prototype is looked into. Idea diffusion is the last phase in the innovation value chain and involves exploiting the new innovation in order to escalate the business's growth and the value provided to the consumers.

During the idea diffusion phase concepts are tested and implemented in the market for further development opportunities. All activities regarding the testing and commercialisation of the new product occurs during idea diffusion as new products and services are rolled out across various distribution channels and markets. Launching the new product or service into the market is a crucial step of commercialisation during this phase. Entrepreneurship is vital in this last phase since it is closely associated with starting a new venture. The role of entrepreneurs from an economic perspective is seen as one that informs the market of new elements. Entrepreneurs not only seek opportunities in market gaps but also provide the market with innovations that fill these gaps. Entrepreneurship is key for economic growth and progression. In its most primitive sense, entrepreneurship is the ability to capture an idea, convert it into an innovative product or service and then construct a venture for taking it into the market (see section 2.2). These are all key functions performed throughout the innovation value chain.

6.3.1.1 Recommendations pertaining to the conclusions made regarding objective 1: Investigate entrepreneurship in the innovation value chain

Businesses should utilise the innovation value chain in accordance with their specific business functions and preferences. The innovation value chain serves as a generic adaptation of various innovation processes that take place. Innovation value chains may differ according to the industry, the business, as well as the product being commercialised. However demonstrating entrepreneurial behaviour throughout the innovation value chain is crucial regardless of any variations found in different businesses or industries. Businesses should therefore encourage entrepreneurship amongst managers and innovation departments – this is known as intrapreneurship (see section 2.3.2).

Businesses should consider three key supporting functions necessary for successfully accelerating commercialisation through the innovation value chain. The first is marketing: In order for the new product or service to succeed, the business should target a specific market develop a positioning strategy, build the brand by developing a marketing mix and lastly launching the new product or service into the market through rigorous campaigning, public relations and communication strategies that fit the identified target market.

Funding is the second supporting function businesses should consider for successfully accelerating commercialisation through the innovation value chain. Businesses should consider bootstrapping as a mechanism to minimise the cost of resources throughout the early stages of the innovation value chain. Businesses should also consider government-funded schemes that have been designed to finance innovation. These schemes aim to develop new marketable technologies that have commercial feasibility. Businesses should not overlook the value of networking and referrals as they potentially provide access to angel investors. Angel investors are invaluable in the innovation value chain because of their willingness to make small investments into completely new products that don't necessarily require a great deal of money.

Intellectual property protection is the third supporting function needed to successfully commercialise new products or services through the innovation value chain. Businesses should conduct due diligence on new partners throughout all the phases in the innovation value chain. Further, businesses should understand the different phases of IP, the stakeholders that need to be involved to secure it and the value that the protection could bring.

6.3.2 Secondary objective 2: Describe Open Innovation and the platform used in accelerating commercialisation

In previous years businesses focused mainly on the notion that innovation must primarily reside from within the borders of the business. Research and development meant investing in generating a business' own ideas, which would then be developed, manufactured, marketed, distributed and serviced internally too. However, in recent times, government, universities, research institutions and even individuals, have become attracted to forming industry partnerships in hope of monetising their R&D efforts. Businesses have become less confidential with their innovation practices, leaning towards the idea of leveraging each other's innovations assets, such as their products, people and even intellectual property. This led to the revolution of "Open Innovation" (see section 3.2).

Open Innovation is the merging of a business's internal assets and resources, with those outside the business, in an overall effort to acquire the best value from existing and available information. It suggests that businesses should not confine their discovered knowledge to their internal market mediums alone, nor should internal pathways necessarily be limited to bringing only the businesses' internal knowledge to market. Open Innovation is a form of mass collaboration, connecting various role players within the triple-helix, in the hope of leveraging their innovation capabilities. Open Innovation is the use of purposive inflows and outflows of knowledge, in order to accelerate internal innovation, and expand the markets for external use

of innovation, respectively (see section 3.3). Open Innovation can therefore be outbound or inbound. Outbound Open Innovation depicts the outward transfer of technology in open utilisation processes while inbound Open Innovation supports the sourcing and acquisition of external ideas and knowledge into internal innovative processes. Open Innovation thus requires the translation of information, coordination, and the alignment of different perspectives (see sections 3.2 to 3.4).

In order to accelerate commercialisation, businesses often depend on the support of intermediary services. Intermediaries play a major role in Open Innovation procedures, and are involved in an estimated 20% of all technology transactions (see section 3.5.2). These intermediaries are known as Open Innovation Accelerators (OIA) and support businesses in executing Open Innovation projects. Open Innovation accelerators either run the Open Innovation project on behalf of their clients, therefore providing a solution to a given task, or aid their clients in building their own Open Innovation proficiencies.

In South Africa, The Innovation Hub is using Open Innovation as one of the methods to implement the Gauteng Employment, Growth and Development Strategy and the Gauteng Innovation and Knowledge Economy Strategy. One of the aims of this strategy is to stimulate innovation and successful commercialisation. They have therefore piloted one of Africa's first Open Innovation accelerators: The Innovation Hub Open Innovation Solution Exchange (now referred to as OpenIX). The Open Innovation Solution Exchange is a web-based innovation network, which connects experts from various businesses, research scientists, SMME's and government to relevant R&D problems across the Gauteng province. Businesses or governmental entities with a particular business need which could not be solved internally post these needs, referred to as challenges, on the platform. Researchers, innovators, entrepreneurs, SMME's and larger businesses are invited to respond to these challenges posted on the platform, by submitting potential solutions. These experts are referred to as solution providers or solvers while businesses posting the challenge are referred to as solution seekers.

The C4 methodology (see section 3.6.2) is used to implement the Open Innovation platform. The methodology takes place in four phases namely challenge definition, connect, consider and commit. Challenge definition involves identifying a list of needs within the business, and structuring the needs in such a way that it creates a position for specific challenges. The connect phase involves marketing the challenge by stimulating the local innovation ecosystem. During the consider phase the proposed solutions are evaluated, shortlisted and feedback is given to the selected solution providers. The last phase of the C4 methodology, the commit

phase, is a confidential process between the solution seeker and the solution provider. The objective of this phase is to reach some form of agreement where a deal is made.

6.3.2.1 Recommendations pertaining to the conclusions made regarding objective 2: Describe Open Innovation and the platform used in accelerating commercialisation

Open Innovation, although it is a relatively new concept in South Africa, should not be overlooked. The successes of Open Innovation accelerators in helping entrepreneurs commercialise their ideas through deal-making and partnerships is critical for SMME development, entrepreneurship and job creation in South Africa. Thus an Open Innovation accelerator should provide multiple value-added services that hold enough legitimacy to influence the development of technology. Open Innovation accelerators such as The Innovation Hub Open Innovation Solution Exchange should therefore ensure that they have cross-industry associations and wide-spread knowledge regarding industry specific issues.

Apart from their own business networks and databases, Open Innovation accelerators need to build an overall innovation ecosystem. This means having a diverse array of members (triple-helix stakeholders) and resources that contribute to and are necessary for ongoing innovation. This include entrepreneurs, investors, researchers, university faculties, venture capitalists, policy makers. In addition, stakeholders could also include business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development. Having these different styles of thinking and incongruent understandings will allow Open Innovation accelerators to operate effectively across multiple clusters of specialisation, therefore establishing a common language of reference and transforming interpretations through innovation.

6.3.3 Secondary objective 3: Examine the challenges and opportunities presented by Open Innovation in accelerating ideas to market

Open Innovation has a realistic influence on a business's innovation strategy and performance. This influence of Open Innovation either poses as challenges or benefits that a business incurs when adopting an Open Innovation process.

The most prevalent challenge expressed regarding Open Innovation is the prospect of revealing a business's IP. A business revealing its intellectual property by disclosing ideas or inviting other businesses into its innovation process is often seen as a weakness (see section 3.5.2). A business's competitive advantage may possibly decrease, resulting in future planned products or services being blemished. For Open Innovation accelerators, drafting a legal

framework around IP management may emanate as an additional and time-consuming expense. Although setting legal agreements involve complex administrative procedures, managing and regulating IP rights effectively can yield optimal outcomes both for innovators and society at large. As IP rights are prioritised, an increased protection of new innovations in South Africa will result.

Collaborative relationships are at the core of Open Innovation. However, encouraging parties within the business to commit is an unstated challenge. Businesses often assume that the source of the external innovation, in some cases the Open Innovation accelerator, will continue with the production and implementation of the innovation within the business. This free-riding behaviour and lack of internal commitment hinders the success of Open Innovation. Similarly, the cognitive, cultural, institutional and organisational differences between the collaborating businesses could present as stumbling blocks. This is in addition the lack of resources and skills needed to understand and combine the new innovation with the business's internal innovation.

Although merging businesses and the practice of collaboration may pose as challenges, the opportunity to gain access to various triple-helix role players cannot be forgone. With Open Innovation, new knowledge can come from government, private sector and academia. No source is off-limits. Through engaging in various stages in the innovation value chain, a business's suppliers, consumers, development and trade partners, and even competitors, form part of the Open Innovation process. This opportunity to collaborate with the triple-helix is an ideal way to tackle challenges in South Africa. Working in partnerships increases the innovation ecosystem, thereby creating access to new competencies and skills, to markets within other industries and essentially leading to the creation of new markets.

6.3.3.1 Recommendations pertaining to the conclusions made regarding objective 3: Examine the challenges and opportunities presented by Open Innovation in accelerating ideas to market

Due to the increased level of competition internationally, innovation has become the key measure of a business's sustainability. Although Open Innovation poses a few challenges, businesses need to embrace Open Innovation as it presents unmerited opportunities in this fast-paced knowledge economy therefore increasing a business's competitive advantage. No one structure for Open Innovation is likely to be sufficient going forward. It is recommended that policymakers, research institutions and businesses explore various technologies across industries relevant to their Open Innovation proficiencies. Flexibility is vital when implementing Open Innovation. Triple-helix role players embracing Open Innovation should seek to find

approaches of collaboration that are the most appropriate for them and for the Open Innovation project at hand keeping in mind that these approaches are likely to change.

6.3.4 Secondary objective 4: Determine perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation

Section B of the research questionnaire sought to determine the respondents' perceptions regarding concepts on entrepreneurship the innovation value chain, Open Innovation and accelerating commercialisation (see appendix A). For each of the statements containing the scales measuring these concepts, descriptive statistical techniques were utilised. The mean as a measure of central tendency was determined, while standard deviation as a measure of dispersion for interval data were determined. Measuring central tendency and dispersion helped the researcher describe and summarise the data in simple and understandable methods. Furthermore, inferential statistical techniques, namely independent samples t-tests, were used to draw comparisons between two groups and one-way ANOVAs to compare more than two groups. Comparisons were made within the demographic groups based upon their perceptions in terms of entrepreneurship, the innovation value chain, Open Innovation and accelerating commercialisation.

Conclusions pertaining to the respondents' perceptions of the factors were extracted and comparisons made regarding entrepreneurship, the innovation value chain, Open Innovation and accelerating commercialisation were formulated based on main findings 3 to 9, in section 5.2.3 and main findings 13 to 33 in section 5.2.6 and 5.2.7.

6.3.4.1 Perceptions on Innovation

Respondents' perceptions on Innovation were formulated in main finding 3 (section. 5.2.3). From the Quantitative research instrument, section B contained five questions (Question 3; 4; 5; 9; 10; 18) that measured the respondents perception on Innovation (see appendix A). Also main findings 13 to 15 regarding comparisons made within the demographics of this research regarding innovation, are concluded. As previously concluded in regards to secondary objective 1, entrepreneurship is viewed as an innovation since it has the ability to invent something new. Through innovation, combined with entrepreneurship, respondents are able to address market needs and successfully commercialise innovations. It is therefore vital that respondents recognize the various aspects of innovation.

In conclusion, respondents have particularly similar views regarding innovation. They create and pursue opportunities with the aim to fill a gap in the market. Respondents do so by aiming to accomplish more with minimum expenditure and continually improving and grow their

product and services range. This proves the theory of innovation as any form of development that brings about change. Since respondents do not differ in views regarding innovation regardless of their sector, level of education or business focus, it is also concluded that innovation truly can be applied throughout all functions of the businesses and industries. It is a specific instrument of entrepreneurship occurring in existing businesses, government agencies as well as research institutions across South Africa.

6.3.4.2 Perceptions on the Open Innovation accelerator

Section B from the Qualitative research instrument comprised of nine questions (see section 4.4.1) that measured respondents' perceptions of the Open Innovation platform. Main finding 4 was formulated based on the respondents' perception on the Open Innovation accelerator. In order to understand respondents' perceptions of this platform it was also imperative to obtain broader knowledge regarding the platform. Therefore, qualitative questions regarding the Open Innovation accelerator were posed to participants and are concluded on in this section. As mentioned previously the Open Innovation Solution Exchange is an Open Innovation accelerator in South Africa, connecting experts from various businesses, research scientists, SMME's and government to relevant R&D problems across the Gauteng province.

It's concluded that respondents have a similar opinion on the Open Innovation platform run by The Innovation Hub. Irrespective of sector, business focus or level of education, respondents also do not differ in views regarding the platform. They believe that the Open Innovation platform provides opportunities to compete on a global scale and across different industries and markets. The platform provides respondents with the opportunity to understand other businesses' problems and leveraging on external resources whilst sharing ideas in a protected environment. Respondents' believed that the platform provides personalised support to identify suitable innovation partners. These perceptions indicate the necessity of an organisation or body, acting as an agent or broker in providing support services businesses through executing Open Innovation projects.

Participants involved in the running of this Open Innovation platform provided detailed insight regarding the success of this platform thus far. The Open Innovation accelerator ensures that a business clearly defines its needs in a manner that ensures the transferability of these needs across domains outside the business' own. The procurement team, Open Innovation experts, technical experts and other parties play a role in the transferability of the challenge plan accordingly during the kick-off meeting, in order to increase the possibility of absorbing the new solution into the business. The economic and technical feasibility of a solution is always evaluated whilst considering the costs and legalities around the solution and the relationship

the challenge owner is looking for. When it comes to making the deal, the Open Innovation accelerator facilitates the communication through arranging meetings between the potential solution providers and the solution seeker, shortlisting presentations and advising the SMMEs regarding IP. This is done until a non-disclosure agreement is signed; hereafter deal-making becomes a negotiation between the solution seeker and the solution provider.

6.3.4.3 Perceptions on Open Innovation

Section B of the Quantitative research instrument (appendix A) measures respondents' perceptions concerning Open Innovation. Main finding 4 was formulated based on the respondents' perception on the Open Innovation. Also main findings 13 to 15 regarding comparisons made within the demographics of this research regarding Open Innovation, are concluded upon. From chapter 3 (see section 3.3) a theoretical investigation into the birth of Open Innovation and its purpose as a collaborative innovation process was conducted. From the qualitative interviews Open Innovation emerged as one of the main themes discussed by the platform managers. Conclusions are made based upon the findings of both the Quantitative and qualitative data.

It is concluded that respondents agree on statements regarding Open Innovation and do not differ in views regardless of sector, business focus and level of education. To a certain degree, respondents incorporate internal assets and resources with businesses outside their own. They are committed to collaborating with various external stakeholders. Sharing the business' knowledge and technology allows them to leverage on one another's IP. Participants in the qualitative interviews emphasised the importance of the involvement of the triple-helix when promoting Open Innovation. The triple-helix accelerates the process of making deals through Open Innovation. Large businesses mainly launched challenges while academia and smaller businesses posted their technologies onto the platform and submitted solutions to the challenges. Government plays the role of the intermediary, enabling Open Innovation in the province. It is quite difficult to bring industry and government into the same room, however, through the Open Innovation platform, a good entry point to start building those relationships is created. The innovation chasm between the universities and the industry is also bridged.

6.3.4.4 Perceptions on the innovation value chain

Section B from the qualitative research instrument comprised of statements (section 4.6.1 and appendix A) measured respondents' perceptions of the innovation value chain. Main findings 5 and 13 to 15 were formulated based on the respondents' perception on the innovation value chain and the differences amongst the demographic variables. As earlier concluded on

secondary objective 1, three phases take place within the innovation value chain, namely idea generation, idea conversion and idea diffusion. It is therefore vital to understand respondents' application of the innovation value chain.

It is concluded that respondents do not differ in their perceptions regarding the innovation value chain. They analyse the processes by which a new invention will be manufactured and investigate the technical competencies of that invention. Key steps in the innovation value chain are prototype development, business model analysis and testing. It was found that respondents investigate whether prototypes demonstrate the functionality of the future product. Respondents further explore the fit of their prototypes with the overall business model and test whether the performance of a new product is what the end-user requires. The phases that occur throughout the innovation value chain are crucial in successfully taking an idea into the market. The result of a successfully commercialised product or service relies greatly on respondents' ability to conduct the three phases of the innovation value chain effectively through the use of supporting functions such as marketing, funding and IP protection.

6.3.4.5 Perceptions on entrepreneurship

The first objective outlined the importance of entrepreneurship since it is a prerequisite for innovation and commercialising new ideas. The role that entrepreneurship plays in Open Innovation is crucial due to its attribution to economic development. Section B from the questionnaire contained statements that measure the perception of respondents on entrepreneurship. Main findings 6 and 13 to 15 (see section 5.2.3 and 5.2.6) were formulated based on perceptions of respondents and the comparisons made within the demographics of this research regarding entrepreneurship.

The conclusion is that regardless of sector, business focus or level of education respondents have similar views regarding entrepreneurship, in fact, they view themselves as individuals who exert entrepreneurial behaviour. They have the ability to scan business environments and take calculated risks. When taking part in Open Innovation, entrepreneurs determine whether their IP is directly linked to the new product's competitive advantage and if protecting their IP will increase the new solutions value in the market.

6.3.4.6 Perceptions on collaboration

Collaboration through deal-making is at the essence of Open Innovation (see section 3.3). From the qualitative interviews, collaboration emerged as one of the sub-themes for Open Innovation discussed by the platform stakeholders. Conclusions made are based on both the Quantitative and qualitative findings. Respondents' perceptions on collaboration were

measured in Section B of the research instrument. Main findings 7 and 13 to 15 were formulated based on these perceptions.

Respondents mostly agreed with statements concerning collaboration. It is concluded that defining specific business problems that could not be solved internally is imperative, as this allows for potential partnerships with other business partners, customers and industry communities. Respondents consider ideas, knowledge and technology from government, private sector and academia. From the findings gathered from participants in the qualitative data collection, it is concluded that collaboration is at the core of the Open Innovation platform. Innovators, SMME's and universities with different interests are given the opportunity to collaborate with desired partners through posing their technologies onto the platform as technology offers. Technology offers are a good entry point into various organisations, therefore broadening partnerships. Although posting technology offers onto the platform present the opportunity to broaden partnerships through collaboration, facilitating these technologies has been a passive process since it is relatively under resourced. Participants in the qualitative interviews added that it is difficult to monitor collaboration through technology offers as it could not possibly know what occurs outside the borders of the platform. Using the website and sending out occasional newsletters regarding technology offers is not an effective way of promoting technology offers. More can be done to improve collaboration through technology offers.

6.3.4.7 Perceptions on accelerating commercialisation

Respondents' perceptions on accelerating commercialisation were formulated in main finding 9 (section 5.2.3). From the Quantitative research instrument, section B contained five multiple-choice statements (19, 20, 21, 23, and 24) and four dichotomous statements (46 to 49) that measured the respondents' perception on accelerating commercialisation (see appendix A). Also main findings 13 to 15 and 16 to 33 are concluded based on the differences amongst the demographic variables regarding accelerating commercialisation. Accelerating commercialisation emerged as one of the main themes from the qualitative interviews with the platform stakeholders. Conclusions are made based upon the findings of both the Quantitative and qualitative data.

Although ideas are screened and become prototypes, many of these inventions are commercial failures and do not make it into the marketplace (see section 2.7). This shows that in order to accelerate commercialisation a number of supporting activities are required. Through marketing, funding and IP protection the process of successfully commercialising a product can be accelerated. It was found that respondents have similar views regarding

accelerating commercialisation. Pertaining to marketing, respondents understand the market into which new products or services will be launched and thus the need to create marketing campaigns that differentiate products or services from competition.

To accelerate commercialisation, respondents apply their new technology across multiple industries. With regards to funding, a majority of the respondents have not funded their inventions through angel investment or commercial banks. However almost half of the respondents have applied for funding from government agencies such as TIA, DTI and IDC. No significant differences exist amongst respondents' sector, level of education and business focus with regard to receiving financial assistance from an angel investor or government agencies. However a medium strength of association existed between respondents' business focus and funding provided from commercial banks. Concerning protecting IP, respondents authenticate new partners' credibility. However, the number of respondents who have registered for a patent and/or trademark equals to the number of respondents who have not done so. No significant differences between respondents' sector, level of education and business focus regarding the protection of IP through patent and/or trademark registration exist.

Accelerating commercialisation was a prominent theme established during the qualitative data collection. Marketing and IP protection within the Open innovation platform were key sub-themes that emerged from accelerating commercialisation. The Open Innovation process is non-confidential before a deal is made. The OIA plays an advisory role when dealing with the protection of IP. The OIA prevents the leakage of IP by advising the solution providers on what content they should and should not provide. It also ensures that solutions submitted are not made public or published except between the solution seeker and provider. To accelerate taking ideas to market, the Open Innovation accelerator uses various networks and industry associations to market the challenges to potential solution providers. Marketing the challenges requires the campaigning team to identify opportunities in the different sectors. This is accomplished by pro-actively identifying emails and telephone numbers of people to invite to take part in the challenge, as well as running challenge workshops. The platforms databases is used and grown as each challenge is marketed. Apart from this hand-driven process, challenges are posted onto the website and on newsletters in hope that potential solution providers will log in and respond to the challenge. There is tendency to always target the general market through a generic email.

Since Open Innovation is relatively new in South Africa, apart from deal-making, other measures of the platform's success have also been looked into thus far. The increased number

of registrations of the platform, submissions to solutions and visits to the website indicate a better awareness of Open Innovation over time. The platform's alignment with the provinces key strategies serves a measure of success. One of the key objectives of the Gauteng province is to stimulate SMME development; the platform opportunities for SMMEs as they showcase their technology and in turn build their businesses through partnerships and investment. Apart from SMME development the platform has tackled service delivery issues by identifying solutions that impact municipalities and are being implemented at community level. Lastly, the platform encourages technology transfer and partnerships between universities and industry on particular business needs.

6.3.4.8 Recommendations pertaining to the conclusions made regarding objective 4: Determine perceptions regarding Open Innovation and the Open Innovation platform associated with accelerating commercialisation

The researcher has defined the following key recommendations to address respondents' perceptions of the factors extracted and comparisons made regarding entrepreneurship, the innovation value chain, Open Innovation and accelerating commercialisation.

- Open Innovation accelerators should ensure that key stakeholders from the client's side are involved in the process during the challenge definition phase of the Open Innovation project. When stakeholders are involved at this initial phase of the Open Innovation process this increases the chances that when a solution is found it is likely to be incorporated and fitted into the organisation's business strategy and day to day operations.
- A more rigorous approach to fostering collaboration through technology offers should be employed. A mainstream approach to technology showcasing is vital. This reiterates the need for using the support functions of the innovation value chain (see section 2.7). A strong marketing strategy or collaboration with a media partner is recommended in order to build a culture for and interest in research technologies in South Africa over a longer period of time.
- Measuring collaboration is quite a big task. It is recommended that stakeholders look across a range of tools to tell a holistic story. There cannot be one approach that can measure collaboration on its own. Exploring a few different approaches and tools to measuring various collaboration efforts is recommended.
- In order to improve marketing campaigns, it is recommended that more sustainable partnerships be built beyond simply requesting the distribution of the challenge brief to

industry associations and research institutions. This will grow the platforms database, and contribute to building an Open Innovation ecosystem. A database gap analysis in terms of what is available on the database and what data needs to be recruited is recommended.

- In order to overcome the time consumption factor that is associated with campaigning, it is recommended that stakeholder consider automated campaigning processes such as semantic tools, online campaigning tools, calling tools and report generating tools. It is also important that campaigners exert entrepreneurial behaviour. They should continuously recognise opportunities for solving solutions in unexpected domains and as a result, effectively marketing the challenges across domains.
- The OIA should consider technical measures for actively preventing IP leakage, rather than simply advising the solution providers regarding IP. Various IP protection programmes and methods exist.
- Open Innovation in South Africa is a concept that is still emerging; patience and persistence is recommended if more impact is to be realized.

6.4 LIMITATIONS OF THE RESEARCH

There were a few challenges experienced in this research. The limitations relevant to the research include the following:

- This research only focussed on using an Open Innovation platform as a method of accelerating commercialisation. Other approaches to accelerating commercialisation were not investigated.
- Due to time and financial constraints, the research was only conducted on one Open Innovation Platform in South Africa. Since Open Innovation is distinctive, the results cannot be generalised to other platforms across Southern Africa.
- Demographic variables such as ethnicity and socio-economic status were not tested scientifically. Assumptions cannot be made on the validity of the results for the most the major ethnic and socio-economic groups.
- The innovation value chain framework developed in Chapter 2 (see Figure 2.2 to 2.5) is based on the experience and knowledge of the researcher as well as the results found in literature.

6.5 RECOMMENDATIONS FOR FUTURE RESEARCH

From the limitations found in this research, recommendations for further research have been made. Future research can include:

- Investigating other approaches to accelerating commercialisation in South Africa such as innovative funding, global marketing techniques and intellectual property procedures.
- Studies that can compare different Open Innovation platforms in South Africa or across Southern Africa with respect to accelerating commercialisation.
- Investigating the role of the triple-helix in accelerating commercialisation through Open Innovation.
- Investigating the readiness of South African businesses (regardless of their size, industry and business focus) to embrace Open Innovation as a core business strategy.

LIST OF REFERENCES

- Aaker, D. A., Kumar, V., Leone, R. P. & Day, G. S. 2013. Marketing research. 11th Ed. United States of America: Wiley.
- Anon. 2009. Creating an environment for Open Innovation. *IFM Briefing* 1(4):1-2.
- Anon. 2010. Evaluation briefs: increasing questionnaire response rates.
<http://www.cdc.gov/healthyyouth/evaluation/pdf/brief21.pdf> Date of Access: 7 Jan 2014.
- Anon. 2013. OpenIX: Open Innovation Exchange by The Innovation Hub. Date of
www.openix.theinnovationhub.co.za Date of access: 12 March 2013.
- Anon. 2013b. Open Innovation and Competitive Advantage: a risk you should be willing to take. <http://blog.mindjet.com/2013/09/open-innovation-competitive-advantage/> Date of access: 5 March 2014.
- Anon. 2013c. Weighing the costs and benefits of Open Innovation.
www.crowdsourcing.org/editorial/weighing-the-costs-and-benefits-of-open-innovation/27261 Date of access: 2 March 2014.
- Anon. 2014. The marketing Mix: The 4Ps of marketing.
www.smartdraw.com/examples/view/4ps+marketing+mix/ Date of access: 6 March 2014.
- Anon. 2014b. The technology Innovation Agency. www.tia.org.za/about-us Date of access: 6 March 2014.
- Anon. 2014c. What is outsourcing? www.wisegeek.org/what-is-outsourcing.htm Date of access: 17 February 2014.
- Anon. 2014d. Idea Bounty: international ideas exchange for clients and creatives.
www.ideabounty.com Date of access: 12 March 2014.
- Anon. 2014e. Pioneering Consumer Immersion. www.consumereyes.com Date of access: 12 March 2014.
- Anon. 2014f. Ninesigma Overview. www.ninesigma.com Date of access: 12 March 2014.
- Barringer, B. R. & Ireland, D. R. 2008. Entrepreneurship: Successfully launching new ventures. 2nd Ed. New Jersey: Pearson educational international.

- Berndt, A. B. and Petzer, D. 2011. Marketing Research. Cape Town: Heineman.
- Bessant, J. & Tidd, J. 2011. Innovation and Entrepreneurship. 2nd Ed. United Kingdom: John Wiley and Sons Ltd.
- Bird, A. 2010. Four problems facing Open Innovation.
<http://www.executiveboard.com/marketing-blog/against-open-innovation/> Date of access: 2 March 2014.
- Bloor, M. & Wood, F. 2006. Keywords in Qualitative Methods: A Vocabulary of Research Concepts. California: Sage.
- Bodhanya, S. 2008. Systemic competitiveness and local economic development. Duisburg: Jörg Meyer-Stamer.
- Bradley, N. 2010. Marketing research: Tools and techniques. 2nd Ed. New York: Oxford.
- Braunerhjelm, P. 2010. Entrepreneurship, Innovation and Economic Growth -past experience, current knowledge and policy implications. (CESIS Electronic Working Paper Series, 224).
- Bry, N. 2011. When Open Innovation meets rapid innovation.
<http://nbry.wordpress.com/2011/01/22/when-rapid-innovation-meets-open-innovation/> Date of access: 5 March 2014.
- Bryman, A. & Bell, E. 2007. Business Research Methods. 2nd Ed. New York: Oxford University Press.
- Burns, P. 2013. Corporate Entrepreneurship: Innovation and strategy in large organisations. 3rd Ed. United Kingdom: Palgrave Macmillan.
- Burns, R. B. & Burns, R. A. 2008. Business research methods and statistics using SPSS. London: Sage.
- Burns, A. C. & Bush, R. F. 2014. Marketing research. 7th Ed. England: Pearson.
- Cant, M. 2003. Marketing research. Claremont: New Africa Books Ltd.
- Cant, M. 2008. Marketing research. 2nd Ed. Pretoria: New Africa Books.
- Chaminade, C. & Edquist, C. 2010. Rationales for public policy intervention in the innovation process: A systems of innovation approach. (In Kuhlman, S., Shapira, P. &

- Smits, R., Eds. Innovation policy – theory and practice. London, UK: Edward Elgar Publishers).
- Chesbrough, H.W. 2003. Open Innovation: The New Imperative for Creating and Profiting from Technology. Boston: Harvard Business School Press.
- Chesbrough, H. 2006. Open Business Models: How to Thrive in the New Innovation Landscape. Harvard Business School Press, Boston.
- Chesbrough, H. & Crowther, A. K. 2006. Beyond high tech: early adopters of Open Innovation in other industries. *R&D Management*, 36 (3): 229-236.
- Christensen, L. B., Johnson, R. B. and Turner, L.A. 2001. Research methods, design and analysis. 11th Ed. Boston: Pearson.
- Churchill, G. A. & Iacobucci, D. 2005. Marketing research: methodological foundations. 9th Ed. Canada: South-Western Cengage Learning.
- Churchill, G. A. & Iacobucci, D. 2010. Marketing research: methodological foundations. 10th Ed. Canada: South-Western Cengage Learning.
- Churchill, G.A., Brown, T.J & Suter, T.A. 2010. Basic Marketing research. 7th Ed. Asia South-Western College Publishing.
- Cohen, J. 1988. Statistical power analysis for the behavioural sciences. 2nd Ed. New Jersey: Lawrence Erlbaum.
- Coldwell, D. & Herbst, F. 2004. Business Research. Cape Town: Juta and Co Ltd.
- Cooper, D. R. & Schindler, P. S. 2014. Business research methods. 12th Ed. New York: McGraw Hill.
- Creswell, J.W. 2009. Research design: Qualitative, quantitative and mixed methods approaches. 3rd Ed. USA: Sage.
- Creswell, J. W. 2013. Educational Research: Planning, conducting and evaluating qualitative and quantitative research. 5th Ed. New Jersey: Pearson.
- Creswell, J.W. 2014. Research design: qualitative, quantitative and mixed methods approaches. 4th Ed. USA: Sage.

- Creswell, J.W., Clark, V. L. & Garret, A. L. 2008. Methodological issues in conducting mixed methods research designs. (In Bergman, M. M., ed. *Advances in mixed methods research*. London; Sage. p66-83).
- Creswell, J.W. & Clark, V. L. 2011. *Designing and conducting mixed methods research*. 2nd Ed. California: Sage.
- Cunningham, S. 2012. *The fundamentals of Innovation System Promotion for Development Practitioners*. Mesopartner Monograph 5. Pretoria: South Africa.
- Dane, F. C. 2011. *Evaluating research: Methodology for people who need to read research*. USA: Sage.
- De Vos, A.S., Strydom, H., Fouche, C.B. & Delpont, C.S.L. 2012. *Research at grassroots: for the social sciences and human service professions*. 4th Ed. Pretoria: Van Schaik Publishers.
- Drucker, P. F. 1985. *Innovation and Entrepreneurship*. New York: Harper and Row.
- Drucker, P.F. 2011. *The discipline of innovation*. Harvard Business Review. The best of Harvard. Harvard Business School Publishing Corporation.
- Du Plooy, G. M. 2009. *Communication research: Techniques, methods and applications*. 2nd Ed. Cape Town: Juta and Co, Ltd.
- Dutta, S. & Lanvin B. 2013. *The Global Innovation Index: The local dynamics of innovation*. Geneva, Switzerland: Cornell University, INSEAD, and WIPO.
- Elliott, A. C. & Woodward, W. A. 2007. *Statistical analysis: Quick reference guidebook with SPSS examples*. California: Sage.
- Ellis, S.M. & Steyn, H.S. 2003. Practical significance (effect sizes) versus or in combination with statistical significance (p-values). *Management Dynamics*, 12(4):51-53.
- Elo, S., & Kyngäs, H. 2008. The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), 107-115.
- Fal, M., Sefolo, T., Williams, A., Herrington, M., Goldberg J. & Klaasen, M. 2010. *State of entrepreneurship in South Africa*.
<http://www.gibs.co.za/SiteResources/documents/The%20Entrepreneurial%20Dialogues%20->

[%20State%20of%20Entrepreneurship%20in%20South%20Africa.pdf](#) Date of access: 13 March 2013.

Feinberg, F. M., Kinnear, T. C. & Taylor, J. R. 2013. Modern marketing research: concepts, methods and cases. 2nd Ed. Canada: South-Western Cengage learning.

Field, A. 2012. Discovering statistics using IBM SPSS Statistics. 4th Ed. London: Sage.

Fikkert, M., Dhaver-Young, K., & Muringani, J. 2011. Eskom initiated open innovation pilot case study. South Africa: Sustainability Group.

Fritsch, M. & Lukas, R. 2001. Who cooperates on R&D? *Research Policy*, 30 (2): 297-312.

Ganotakis, P. & Love, J. H. 2012. The innovation value chain in new technology-based firms: Evidence from the UK. *Journal of product innovation management*, 29 (5): 839:860.

Gans, J. S. & Stern, S. 2003. The product market and the market for ideas: commercialisation strategies for technology entrepreneurs. *Research policy*, 32:333-350.

Gaskell, A. 2013. The commercial benefits of Open Innovation.

www.dzone.com/articles/commercial-benefitsopenwww.dzone.com/articles/commercial-benefits-open

Date of access: 1 March 2014.

Gassmann, O. & Enkel, E. 2004. Towards a theory of Open Innovation: three core process archetypes. <https://www.alexandria.unisg.ch/Publikationen/274> Date of access: 8 Jan 2014.

Gbadamosi, A., Bathgate, I. K. & Nwankwo, S. 2013. Principles of Marketing: A value-based approach. United Kingdom: Palgrave Macmillan.

Gravetter, F.J. & Wallnau, L.B. 2009. Statistics for the behavioural sciences. 8th Ed. Belmont: Wadsworth Cengage.

Greene, J. C. 2007. Mixed methods in social inquiry. San Francisco: Jossey-Bass.

Grinnel, R.M. & Unrau, Y. A. 2011. Social work research and evaluation: Foundations of evidence-based practice. 9th Ed. New York: Oxford University Press.

Guion, R. M. 2004. Validity and reliability. (In Rogelberg, S. G. Handbook of research methods in industrial and organisational psychology. Australia: Blackwell Publishing p. 57-76).

- Gundogdu, M.C. 2012. Re-thinking entrepreneurship, intrapreneurship and innovation: A multi-concept perspective. *Procedia – Social and behavioural sciences*, 41:296-303.
- Hague, C., Hague, E. & Breitbach, C. 2011. Regional and local economic development. United Kingdom: Palgrave Macmillan.
- Hansen, M. T. & Birkinshaw, J. 2007. The innovation value chain. Harvard Business review. Harvard Business School Publishing Corporation.
- Hattori, R. A. & Wycoff, J. 2002. Innovation DNA: A good idea isn't enough. It has to create value. *Technology & Development*, 56(1):25-30.
- Hemert, P., Nijkamp, P. & Masurel, E. 2013. From innovation to commercialisation through networks and agglomerations: Analysis of sources of innovation, innovation capabilities and performance of Dutch SME's. *Annual regular science*, 50: 425-452.
- Hofstrand, D. 2006. Peter Drucker and Innovation. www.extension.iastate.edu/agdm Date of Access: 15 February 2014.
- Howe, J. 2009. Crowd sourcing: why the power of the crowd is driving the future of business. Random House.
- Howells, J. 2006. Intermediation and the role of intermediaries in innovation. *Research Policy*, 35 (5): 609-766.
- Hu, L. & Bentler, P. M. 1999. Cut-off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling: A Multidisciplinary Journal*, 6 (1): 1-55,
- Huston, L. & Sakkab, N. 2006. Connect and develop: Inside Procter and Gambles new model for innovation. *Harvard Business Review* 84 (3): 58–66.
- Janssen, W., Bouwman, H., van Buuren, R. & Haaker, T. 2014. An organisational competence model for innovation intermediaries. *European journal of innovation management*, 17 (1): 2-24.
- Johnson, D. 2001. What is innovation and entrepreneurship? Lessons from large organisations. *Industrial and commercial training*, 33 (4):135-140.
- Johnson, R. B & Onwuegbuzie, A. J. 2004. Mixed-methods research: a research paradigm whose time has come. *Educational researcher*, 33(7) 14-26, October.

- Kaluwa, T. M. 2012. Innovation: more benefits from Open Innovation.
<http://www.eci.es/blogs/tabithahmkandawire/2012/02/13/innpvation-more-benefits-from-open-innovation/> Date of access: 1 March 2014.
- Kolb, B. 2008. Marketing research: a practical approach. London: Sage Publications.
- Kruger, R.L. & Gericke, G. 2004. A qualitative approach for exploration of feeding practices. knowledge and attitude on child nutrition framework. *Journal of Family Ecology and Consumer Sciences*, 32:36-45.
- Kuratko, D. F. & Hodgetts, R. M. 1995. Entrepreneurship: A contemporary approach. 3rd Ed. Florida: Dryden press.
- Kuratko, D. F. 2014. Introduction to entrepreneurship. 9th Ed. South-Western: Cengage Learning.
- Lamb, C. W., Hair, J. F. & McDaniel. 2013. MKTG6. South-Western: Cengage Learning.
- Lambing, P. & Kuehl, C.R. 2000. Entrepreneurship. 2nd Ed. New Jersey: Prentice Hall.
- Leydesdorff, L. 2006. The Knowledge-Based Economy: Modelled, Measured, Simulated. Boca Raton, FL: Universal Publishers.
- Lichtenthaler, U. 2009. Outbound Open Innovation and its effects on firm performance: examining environmental influences. *R&D Management*, 39 (4): 317-330.
- Lichtenthaler, U. & Ernst, H. 2008a. Innovation intermediaries: Why internet marketplaces for technology have not yet met the expectations. *Creativity and Innovation Management*, 17 (1): 14–25.
- Lichtenthaler, U. & Ernst, H. 2008b. Intermediary services in the markets for technology: organizational antecedents and performance consequences. *Organization Studies*. 29 (7): 1003–1035.
- Malhotra, N.K. 2010. Marketing research: An applied orientation 6th Ed. England: Pearson Education.
- Malhotra, N.K. & Birks, D.F. 2006. Marketing research: An applied approach. 2nd Ed. England: Pearson Education.

Manceau, D. Moatti, V., Fabbri, J. Kaltenbach, P. & Bagger-Hansen, L. 2011. Open Innovation: what's behind the buzzword? http://institut-innovation-competitivite.eu/sites/default/files/what_behind_the_buzzword_i7_institute_accenture_2011_0.pdf

Date of access: 13 October 2014.

Marais, S. J. & Schutte, C. S. L. 2010. The development of Open Innovation models to assist the innovation process. Stellenbosch: University of Stellenbosch (Dissertation - MscEng).

Matthews, B. & Ross, L. 2010. Research methods: a practical guide for the social sciences. England: Pearson.

Mbhele, T.P. 2012. The study of venture capital finance and investment behaviour in small and medium-sized enterprises. *Journal of economics and management science*, 15 (1):94-111.

McDaniel, C. & Gates, R. 2001. Marketing research essentials. 3rd Ed. United States: South-Western College Publishing.

McDaniel, C. & Gates, R. 2013. Marketing research essentials. 8th Ed. United States: John Wiley & Sons Inc.

McQuarrie, E. F. 2006. The marketing research toolbox: A concise guide for beginners. 2nd Ed. California: Sage Publications.

Michael S. C., Pearce J. A. 2009. The need for innovation as a rationale for government involvement in entrepreneurship. *Entrepreneurship and Regional Development* 21:285–302.

Miles, M. B., Huberman, A. M. & Saldana, J. 2014. Qualitative data analysis: a methods sourcebook. 3rd Ed. California: Sage.

Morse, J. M., Barret, M., Mayan, M., Olson, K. & Spiers, J. 2002. Verification strategies for establishing reliability and validity in qualitative research. *International journal of qualitative methods*, 1(2):1-19.

Mortara, L. Napp, J. J. Slacik, I. & Minshall, T. 2009. How to implement Open Innovation: lessons from studying large multinational companies. Great Britain: University of Cambridge.

Mourkogiannis, N. 2006. Purpose and innovation: How to optimise cooperate R&D efforts. www.strategy-business.com Date of access: 6 March 2014.

- Nambisan, S. & Sawhney, M. 2007. A buyer's guide to the innovation bazaar. *Harvard Business Review*. 85 (6):109-118.
- Niewenhuizen, C. & Nieman, G. 2009. Entrepreneurship: A South African perspective. Pretoria: Van Schaik Publishers.
- Onwuegbuzie, A. J., Johnson, R. B. & Collins, K. M. T. 2009. Towards a philosophy of mixed data analysis. Paper presented at the American Educational Research Association. San Diego, CA. 13-17 April 2009.
- OECD (Organisation for Economic Co-operation and Development). 2013. Knowledge-based entrepreneurship, the triple helix and local economic development. Workshop organised at the Triple Helix Conference, London, 10 July.
http://www.oecd.org/cfe/leed/Concept%20note%20London%20Triple%20Helix%20Workshop_revJP.pdf Date of access: 8 January 2014.
- Pallant, J. 2010. SPSS survival manual: a step by step guide to data analysis using SPSS. 4th Ed. England: McGraw-Hill , Open University.
- Parasuraman, A., Grewal, D. & Krishnan, R. 2007. Marketing Research. 2nd Ed. Boston: Houghton Mifflin Company.
- Patton, M.Q. 2002. Qualitative research and evaluation methods. 3rd Ed. California: Sage.
- Piercy, K. W. 2004. Analysis of semi-structured interview data.
http://konference.fdvinfo.net/rc33/2004/Data/PDF/stream_03-15.pdf Data of Access: 15 June 2015.
- Piller, F. T. 2011. Open Innovation Readiness: Creating a culture and organization to profit from Open Innovation and customer co-creation. RWTH Aachen University: Technology Innovation Management Group.
- Piller, F. T. & Diener, K. 2013. The market for Open Innovation: the 2013 RWTH Open Innovation accelerator survey. United States of America: Lulu Publishing.
- Riemers, M. A. F. 2006. Outsourcing information technology services. Potchefstroom: NWU (Dissertation- MBA).
- Saunders, M., Lewis, P. & Thornhill, A. 2012. Research Methods for Business Students. 6th Ed. England: Pearson.

Schreiber, Stage, King, Nora, & Barlow, 2006. Reporting structural equation modelling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, 99 (6):323-338.

Schumpeter, J. A. 1934. *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. New Brunswick: Transaction Publishers.

Shao, A.T. 2002. *Marketing research: An aid to decision making*. 2nd Ed. Ohio: South-Western College Publishing.

Shane, S. & Venkataraman, S. 2000. Entrepreneurship as a field of research: the promise of entrepreneurship as a field of research. *Academy of management review*, 25 (1):217-226.

Shenton, A. K. 2004. Strategies for ensuring trustworthiness in qualitative research projects. *Journal for Education for Information*, 22: 63-75.

Shim, J. K. & Siegel, J. G. 2000. *Entrepreneurship 101*. Hong Kong: Barron's Educational Series.

Shiu, E., Hair, J., Bush, R. & Ortinau, D. 2009. *Marketing research*. United Kingdom: McGraw-Hill Education.

Shurrab H. & El Bouassami, M. 2013. The luxury of Open Innovation: A case study of Whirlpool. http://www.academia.edu/3165935/The_Luxury_of_Open_Innovation_A_Case_Study_of_Whirlpool Date of access: 14 October 2014.

Silverman, D. 2013. *Doing qualitative research*. 4th Ed. London: Sage.

Singh, K. 2007. *Quantitative social research methods*. Los Angeles, CA: Sage.

Slowinski, G. & Sagal, M. W. 2010. Good practices in Open Innovation. *Research Technology Management*. 53(5):38-45.

Smith, D. 2006. *Exploring innovation*. United Kingdom: McGraw-Hill.

Soriano, D. R. & Huarng, K. 2013. Innovation and entrepreneurship in knowledge industries. *Journal of Business Research*, 66:1964–1969.

Spithoven, A. Clarysse, B. & Knockaert, M. 2009. Building absorptive capacity to organise inbound Open Innovation in low tech industries. http://feb1.ugent.be/nl/Ondz/wp/Papers/wp_09_606.pdf. Date of access: 8 Jan. 2014.

Stangor, C. 2011. Research methods for the behavioural sciences. 4th Ed. Wadsworth, ILL: Cengage Learning.

Stibel, J. 2009. Are You an Inventor or an Entrepreneur? Harvard Business Review Blog Network <http://blogs.hbr.org/2009/06/are-you-an-inventor-or-an-entrepreneur/> Date of Access: 13 October 2013.

Timmons, J.A. & Spinelli, S. 2010. New venture creation: Entrepreneurship for the 21st century. 8th Ed. New York: McGraw-Hill.

The Innovation Hub, 2013. Open Innovation solution exchange pilot project case study. The Innovation Hub Management Company. Pretoria, South Africa.
<http://solexinnovation.com/templates/images/TIH%20Solution%20Exchange%20CaseStudy.pdf> Date of access: 14 March 2014.

Theyel, N. 2013. Extending Open Innovation throughout the value chain by small and medium-sized manufacturers. *International small business journal*, 31(3):256-274.

Tolmie, A., Muijs, D. & McAteer, E. 2011. Quantitative methods in educational and social research: using SPSS. England: McGraw Hill.

Turton, N. & Herrington, M. 2012. Global entrepreneurship monitor report. South African report 2012. Cape Town: UCT.

Tustin, D.H., Ligthelm, A. A., Martins, J. H., & van Wyk, H.J. 2005. Marketing research texts and cases. 2nd Ed. Binghamton, New York: Best Business Books.

Vaismoradi, M., Turunen, H., & Bondas, T. 2013. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Sciences*, (15) 398-405.

van de Vrande, V., de Jong J.P.J., Vanhaverbeke, W. & de Rochemont, M. 2009. Open Innovation in SMEs: Trends, motives and management challenges. *Technovation*, 29:423-437.

van der Merwe, 2013. Getting innovative about funding. *Finweek*, 10 Sept.
<http://finweek.com/2013/09/10/getting-innovative-about-funding/> Date of access: 6 March 2014.

Viale, R. & Etzkowitz, H. 2010. The capitalization of knowledge: A triple helix of university-industry-government. United Kingdom: Edward Elgar.

von Nell, P.S. & Lichtenthaler, U. 2011. The role of innovation intermediaries in the markets for technology. *International Journal of Technology Intelligence and Planning*, 7 (2): 128-139.

Welman, J. C., Kruger, S. J. & Mitchell. B. 2005. *Research Methodology*. 3rd Ed. Cape Town: Oxford University press.

West, J. & Gallagher, S. 2006. *Challenges of Open Innovation: the paradox of firm investment in open-source software*. San Jose State University: Scholar Works.

Williams, B., Brown, T. & Onsman, A. 2010. Exploratory factor analysis: A five-step guide for novices. *Australasian Journal of Paramedicine*, 8 (3) 1-13.

WIPO. 2012. *What is Intellectual property?* Switerland: World Intellectual Property Organisation. http://www.wipo.int/edocs/pubdocs/en/intproperty/450/wipo_pub_450.pdf Date of access: 6 January 2015.

Zhao, F. 2005. Exploring the synergy between entrepreneurship and innovation. *International Journal of Entrepreneurial Behaviour and Research*, 11(1):25-41.

Zikmund, W. G. & Babin, B. J. 2013. *Essentials of marketing research*. 5th Ed. OH: South-Western Cengage learning.

Zikmund, W. G., Babin, B. J., Carr, J. C. & Griffin, M. 2013. *Business research methods*. 9th Ed. Canada: South-Western Cengage learning.

ANNEXURE A

RESEARCH QUESTIONNAIRE



QUESTIONNAIRE

INVESTIGATING AN OPEN INNOVATION PLATFORM TO ACCELERATE COMMERCIALISATION

This questionnaire forms part of a research project submitted in partial fulfilment to the requirements for the degree Master of Commerce in Entrepreneurship at the **School of Business Management, North-West University, Potchefstroom Campus**. The student is Lerato E. Mohalajeng (079 977 9329/email: lerato.mohalz@gmail.com) with the study leader, Prof Japie Kroon (Tel: 018 299 1423/1, email: Japie.Kroon@nwu.ac.za).

Successful entrepreneurship is crucial for South Africa's economy and economic growth is strongly associated with innovation. Businesses across all industries are embracing Open Innovation in order to maintain their competitive advantage. Open Innovation plays a significant role in the economy as it stimulates entrepreneurship through commercialisation of emerging technologies. The **central theme** of this research is **to investigate the capability of Open Innovation to accelerate commercialisation** and provide an in-depth understanding of what is needed to bridge from invention or idea to market or successful commercialisation.

This questionnaire is divided into two sections. **Section A** contains demographic questions, while **Section B** measures entrepreneurship, the innovation value chain and Open Innovation as perceived by innovators. It will take approximately 10 minutes to complete this questionnaire.

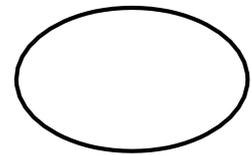
All information is confidential. Only overall results from all responses will be compiled and used. The aggregate data will only be used in research and articles to report on commercialisation through Open Innovation.

I would like to thank you in advance for taking the time to share this information with me.

**Please circle the applicable answer or mark with an X.
Mark only one alternative.**

For statistical purposes, it is important to complete ALL the questions.

SECTION A: MY DEMOGRAPHIC VARIABLES



1. Sector	Academia	1	
	Government	2	
	Private Sector	3	
2. Your highest qualification?	Grade 12	1	
	Diploma or Degree	2	
	Post-graduate Degree	3	
3. Business focus	Manufacturing	1	
	Retail and wholesale trade	2	
	Agriculture, forestry and fishing	3	
	Food products and beverages	4	
	Transport and Travel	5	
	Oil and gas, mining and quarrying	6	
	Pharmaceutical and Biotech	7	
	Healthcare and Medical technology	8	
	Information Technology	9	
	Finance and insurance	10	
	Marketing and media	11	
	Other services	12	

SECTION B: ENTREPRENEURSHIP AND INNOVATION

Indicate the extent to which you agree with the following statements:

SCALE: 1 = Strongly disagree to 5 = Strongly agree

	STATEMENT	Strongly disagree -- Strongly agree				
		1	2	3	4	5
1	I create original products or services.	1	2	3	4	5
2	I do consider how I can increase the country's	1	2	3	4	5
3	I create opportunities with the aim to achieve them.	1	2	3	4	5
4	I change the way my product or service is created and delivered to meet the needs of new clients	1	2	3	4	5
5	I use existing products or services for a new or different application.	1	2	3	4	5
6	Innovation is part of the core business process.	1	2	3	4	5
7	I have the ability to scan business environments.	1	2	3	4	5
8	I take calculated to higher risks.	1	2	3	4	5
9	I am determined to fill a gap in the market.	1	2	3	4	5

10	I renew, improve or grow my product or service range.	1	2	3	4	5
11	I engage in the market through meeting with business partners, consumers and industry communities.	1	2	3	4	5
12	I analyse the processes by which a new invention will be manufactured.	1	2	3	4	5
13	I investigate whether prototypes fit with the overall business model.	1	2	3	4	5
14	My prototypes demonstrate the functionality of the future service or product.	1	2	3	4	5
15	I test if the performance of the new product is what the end-user requires.	1	2	3	4	5
16	I rank the ideas in order of its value and worth for the business.	1	2	3	4	5
17	I investigate the technical competencies of the new product	1	2	3	4	5
18	I attempt to accomplish more with minimum expenditure.	1	2	3	4	5
19	The marketing campaigns differentiate the product from potential competition.	1	2	3	4	5
20	I have a good understanding of the market in which the product will be/is launched into.	1	2	3	4	5
21	I always authenticate new partners' credibility.	1	2	3	4	5
22	My intellectual property is directly linked to the new products competitive advantage.	1	2	3	4	5
23	I have marketing campaigns that appeal to the targeted market.	1	2	3	4	5
24	The business seeks to apply new technologies across multiple industries.	1	2	3	4	5
25	Open innovation platforms such as OpenIX provide an efficient way of understanding other organisations' problems and proposing solutions	1	2	3	4	5
26	I share and incorporate internal assets and resources with partner organisations and businesses outside my own.	1	2	3	4	5
27	Revealing the business's intellectual property to external parties decreases our competitive advantage	1	2	3	4	5
28	Commitment to using my technology to solve a problem on OpenIX or other Open Innovation platforms has been made.	1	2	3	4	5
29	Sharing the business knowledge and technology has allowed us to leverage other people's IP.	1	2	3	4	5
30	Open innovation platforms such as OpenIX expose me to opportunities on a global scale.	1	2	3	4	5

31	There is internal commitment to collaborate from stakeholders within the other business.	1	2	3	4	5
32	Through Open Innovation platforms such as OpenIX I am able to leverage external resources or share ideas in a protected environment.	1	2	3	4	5
33	Collaborating with external parties increases the business's productivity.	1	2	3	4	5
34	The business invests extensive time into participating with external partners.	1	2	3	4	5
35	Open Innovation platforms such as OpenIX help me/the business identify new business opportunities.	1	2	3	4	5
36	External technology identified is not incorporated in the business overall strategy.	1	2	3	4	5
37	The business has an outward transfer or external engagement around its technology before commercialisation.	1	2	3	4	5
38	Open Innovation platforms such as OpenIX broaden my business focus into different sectors/industries.	1	2	3	4	5
39	Ideas, knowledge and technology from government, private sector, academia and the community are considered.	1	2	3	4	5
40	The business clearly defines problems needing specific solutions.	1	2	3	4	5
41	Open Innovation platforms such as OpenIX create opportunities for joint access into new markets.	1	2	3	4	5
42	I confine the business's discovered knowledge to its internal market mediums alone.	1	2	3	4	5
43	Open Innovation platforms such as OpenIX enable me/my business to solve problems in other companies	1	2	3	4	5
44	Working in partnerships helps gain access to new markets.	1	2	3	4	5
45	OpenIX provides personalised support to find suitable innovation partners.	1	2	3	4	5

Indicate Yes (1) or No (2) regarding the following statements:

46	Angel investors have financed my innovation.	Yes	1	No	2
47	I have protected my intellectual property by registering a patent and/or trademark.	Yes	1	No	2
48	I have applied for funding from government schemes e.g. TIA, DTI, IDC.	Yes	1	No	2
49	I have approached commercial banks for funding.	Yes	1	No	2

All information is confidential.

We appreciate your time and participation very much.

ANNEXURE B

COVER LETTER EMAIL FOR ONLINE QUESTIONNAIRES

4f86637b7a651ed

igating open innovat... x Masters - Google Drive x PDF to Word Converter - 1... x SurveyMonkey - Collector ... x

in:sent

Lerato E. Mohalajeng 1 of 1,843

Siyabulela Mdaka

Add to circles

5:00 PM (0 minutes ago)

Lerato E. Mohalajeng <lerato.mohalz@gmail.com>
to Siyabulela

Good Day Siya,

I hope this email finds you well.

I am conducting research in partial fulfillment of the requirements of an M.Com Entrepreneurship degree at the North West University. The central theme of this research is to investigate the capability of Open Innovation platforms such as OpenIX by The Innovation Hub to accelerate commercialization. The research study will help policy makers in making better decisions about what is needed to encourage success in taking ideas to market and in essence promoting early-stage entrepreneurial activity. The study can also help inventors better understand the intricacies and complexities of what it takes to successfully take an idea to market.

In connection with this, I would like to invite you to participate in the research by completing my research questionnaire. It will take approximately 5-10 minutes to complete this questionnaire. This questionnaire contains demographic questions and measures entrepreneurship, the innovation value chain and Open Innovation as perceived by innovators.

Kindly complete the questionnaire on the following link: [Open Innovation questionnaire](#)

Thank you in advance for taking the time to share this information with me.

If you have any questions about this questionnaire or would like further information, please contact Lerato E. Mohalajeng at North West University on +27 79 977 9329 or 22016740@nwu.ac.za. This questionnaire is confidential.

Kind regards
Lerato E. Mohalajeng
M.Com student
0799779329

05:01 PM 2015/09/23

ANNEXURE C

CONFIRMATION OF STATISTICAL CONSULTATION



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Faculty of Economic and Management Sciences
Tel: 018 299-1218
Fax: 018 299-1339
Email: energy.sonono@nwu.ac.za

28 October 2015

To whom it may concern

RE: DISSERTATION OF MS L.E. MOHALAJENG (STUDENT NUMBER: 22016740)

I hereby confirm that I have analysed the data and assisted with the interpretation of the results of the dissertation of Ms L.E. Mohalajeng (Student Number: 22016740).

However, any opinions, findings or recommendations expressed in this document are entirely of the author. The Subject Specialist in Statistics does not accept responsibility for the correctness of the reporting of the results.

Yours sincerely

A handwritten signature in black ink, appearing to be 'M.E. Sonono'.

Mr M.E. Sonono (MSc)

Subject Specialist: Statistics – Faculty of Economic and Management Sciences

ANNEXURE D

LETTER OF CONFIRMATION OF LANGUAGE EDITING

28 October 2015

Re: Language edit on thesis by Lerato E. Mohalajeng

To whom it may concern:

I hereby confirm that I, Lisa-Anne Julien, professional writer and editor, during the month of October 2015, conducted a language edit on the thesis ***Investigating an Open Innovation platform to accelerate commercialisation***, owned by Lerato E. Mohalajeng (student number, 22016740), studying towards a MCom in Entrepreneurship.

Please do not hesitate to contact me for further clarification.

Sincerely



Lisa-Anne Julien

072 936 4765

lisaannejulien@gmail.com

ANNEXURE E

TITLE CONFIRMATION



NORTH-WEST UNIVERSITY
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Private Bag X6001, Potchefstroom
South Africa 2520

Tel: 018 299-1111/2222
Web: <http://www.nwu.ac.za>

Higher Degree Administration
Tel: 018 299 2640
Email: margaret.kruger@nwu.ac.za

28 September 2015

Dear Ms Mohalajeng

TITLE REGISTRATION/NOTICE OF SUBMISSION

Note has been taken that you wish to submit your mini-dissertation/dissertation/thesis. The registered title as it must appear on the examining copies and on the title page of the final copies is indicated below.

Investigating an open innovation platform to accelerate commercialisation

Your attention is drawn to the following matters regarding the above:

- 1 May 2015 to 13 November 2015 to qualify for the May 2016 graduation ceremony;
- 16 November 2015 to 29 April 2016 to qualify for the October 2016 graduation ceremony.

Should you neglect to submit by 13 November 2015, the possibility exists that you will not qualify to graduate in May 2016. You will then be required to register for 2016 to qualify for the October 2016 graduation ceremony.

You are required to submit your examination copy in the format mentioned below.

One electronic copy in PDF format should be submitted on the eFundi website, under your faculty tab, in a Drop Box created for you for this purpose. Should an examiner prefer a ring bounded printed copy, you will be informed about it, so that the necessary preparation for the submission of a soft bound copy can be made by you. Enquiries about this matter can be directed to the faculty advisor who sent out this correspondence to you.

The following forms should be included when you submit for examination:

- The signed Solemn Declaration form
- A copy of your identity document/passport
- Personal particulars form (only applicable for PhD students)

Yours sincerely

Ms Margaret Kruger

FOR CAMPUS REGISTRAR

Original details: Marietjie Ackermann(10512128) C:\Users\10512187\Desktop\Notice of submission.docm
14 March 2014

File reference: 7.1.11.2.1

