



Financial scarcity and abundance of external connections in innovation

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Abstract

Resource scarcity and resource abundance along with a mindset of scarcity or abundance was researched within an innovative environment. The methodology involved the use of four different scenarios within an experimental context. This enabled the researcher to present different environments to the respondents.

The researched results analysed the effects that resources as well as mindset types had on innovation. It was found that decreasing amounts of financial resources and collaborations with suppliers and customers increased the confidence of innovation being successful.

The research results also indicate that abundant mindsets did not necessarily increase the rate of innovation. Although the abundant mindset definitely played a role in affecting the amount of resources being used in the different environments, set out by the scenarios.

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Name

Signature

Date

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I would like to acknowledge my family for the support they have provided. I would also like to acknowledge my research supervisor, Helena Barnard for her guidance and direction. Lastly I would like to acknowledge my best friends and colleagues who have providing their support.



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List of Abbreviations

Abbreviation	Description
ANOVA	Analysis of variance
AM	Abundance mindset
AR	Abundance resources
SM	Scarce mindset
SR	Scarce resources



Chapter 1 Research introduction

1.1 Introduction

This chapter defines the research problem and what the research objectives are. The need for the research is subsequently explored by indicating problems directly related to the research problem, which is noticeable in business. Lastly the link between the research objectives and the need for the research is explained to reveal the context of the research problem.

1.2 Definition of the research problem and the research objectives

The research problem is discussed below. The discussion is separated into sub topics including innovation, resources used in innovation and mindsets used in innovation.

1.2.1 Innovation as a critical tool

Innovation should be core to companies' strategies because innovation is something which drives the market and greatly assists companies to be successful. Morck and Yeung (2001) describe that companies use innovation as a critical tool to grow their market or market share, and to improve shareholder value.

1.2.2 How to control innovation

Van Zyl (2005) declared that many executives have not figured out how to create an environment that greatly enables innovation. Although Van Zyl (2005) also highlights that innovation is a creative process which is difficult to deal with because of its volatility.



For a company to innovate effectively it would want to know what enables innovation and what restricts it. Companies would also want to optimise their use of their innovation tool. They would want to understand if too much or too little of a resource is better or worse for innovation.

1.2.3 Resources used in innovation

Hoegl *et al.* (2008) indicates that financial resource slack supports innovation. Hoegl *et al.* (2008) also indicates that a resource constrained projects can lead to products which are successful in the marketplace. The products would not only be successful but also highly innovative in the marketplace.

This suggests that a shortage of resources supports innovation. So identifying more than just scarce financial resources supporting innovation can greatly increase a company's revenue.

1.2.3.1 Human capital

Human capital is ultimately needed in order to control and drive products in companies. Van Zyl (2005) states that creativity resulting in innovation is possible for most individuals at work.

This is also clarified by Morck and Yeung (2001) who regard human capital critical for innovation to take place. This suggests that the more human resources the better the economic pace of innovation.

1.2.3.2 Intellectual property created by human capital

Morck and Yeung (2001) describe that humans create their own intellectual property. Morck and Yeung (2001) indicate that the intellectual property is then used by companies by them extracting the knowledge and skills needed to be



successful. Morck and Yeung (2001) suggest that companies use human resources to grow their company and to develop their company's innovation.

1.2.4 A scarce or an abundant mindset

By not actually having small or large amounts of resources available but by having a mindset that sees many resources available or a small amount of resources available could be beneficial. A type of mindset could promote innovation more than the availability of resources themselves. Chapas (2006) argues that the source of innovation is the abundance mentality.

The abundance mentality is defined as perceiving that more of a resource is provided opposed to what actually is available. The abundance mentality is opposite to of a scarcity mentality.

English (2004) defines that the abundance mentality is when a person perceives that there are many resources available together and that sharing on their successes is normal. English (2004) also defines that a scarcity mindset is when a person protects finite resources but also keeps collecting finite resources, but only for their own benefit.

This suggests that an abundant mentality includes seeing more opportunities as compared to a scarce mentality which sees only limited amount of opportunities, which are difficult to achieve.

1.3 Need for the research

The need for the research is discussed below around the sub topics of resources and mindsets promoting innovation.



1.3.1 Resources promote innovation

Rooks *et al.* (2005) described that not much is known about the innovation behaviours of South African companies. Rooks *et al.* (2005) also described that during a comparison between South African companies and European Union companies, South African companies spend less on innovation. This led Rooks *et al.* (2005) to believe that more research is needed to provide an understandable explanation for this distinction.

1.3.2 Mindsets promote innovation

Hoegl *et al.* (2008) describes that in a laboratory environment subjects are most innovative when given fewer rather than more resources for solving innovative problems. Hoegl *et al.* (2008) indicates that a possible reason for this is that the human mind can be highly productive when restricted.

Ladika (2005, p. 28) identifies that having a scarcity mindset, is like “*coming down with a cold* and the ensuing fear that it will spread”. Ladika (2005) indicates that executives should preferably adopt an abundance mindset so that team members can share breakthrough ideas and advice more freely amongst one another.

Krishnan and Kumar (2003) indicate that opportunities are perceived as unsafe with a mindset conditioned by resource scarcity. This suggests that moving more towards a scarcity mindset is something which is to be avoided at all costs.

1.3.3 Scarcity and abundance

Srinvas & Sutz (2008) indicate that research is needed on the cognitive and institutional elements of the problem-solving process under conditions of

underdevelopment and scarcity. Srinivas & Sutz (2008) describe that under scarcity conditions idiosyncratic innovation directions appear which provide interesting solutions for problems that cannot be solved normally.

1.4 The link between the research objectives and the need for research

The link between the research objectives and the need for research is discussed below. Revenue growth is discussed, in addition to resource orientation and mindset orientation.

1.4.1 Revenue growth contributing to the economy

Rao & Drazin (2002) describe that several studies have demonstrated that product innovation is positively associated with revenue growth. Rooks *et al.* (2005) describe that innovation is also widely recognised as the driving force behind economic growth.

Innovation is therefore a tool that can assist a company to become successful. It would help satisfy not only the personnel or the stakeholders but also enable the company to be a positive contributor to the economy.

1.4.2 Resource orientation

Paladino (2007) describes resource orientation as entailing a “*unique resource base*”. Paladino (2007) describes that companies with a high degree of resource orientation will be able to achieve superiority in the market place together with making their internal operations and processes more efficient. Paladino (2007) goes on to indicate that companies will also be able to provide customers with offerings that satisfy their expectations.



1.5 Summary

The research problem deals with both resource environments and mindset environments. The resource environments include a scarce or an abundant supply of resources, which by themselves can affect innovation. A mindset environment of scarcity or abundance can also by itself affect innovation. The research also indicated that more of a type of resource or mindset is applicable to the outcome.

Table 1 illustrates that the resource and mindset environments can be divided into scarcity and abundant sections, along with having combinations of them both.

Table 1 - Resource and mindset innovation environments

Mindset	Abundant	Abundant Mindset Scarce Resources	Abundant Mindset Abundant Resources
	Scarce	Scarce Mindset Scarce Resources	Scarce Mindset Abundant Resources
		Scarce	Abundant
		Resources	

Innovation is a critical tool for companies to explore so that they can ensure success in their market. Ultimately companies would like to know how to control this innovation tool. By utilising scarce and abundant resources in combination with scarce and abundant mindsets, companies could optimise their innovation tool to outperform their competitors. By having different mindsets, companies

could overcome resource problems and still be innovative. By companies improving their revenue and aligning their innovation tool to their company's core strategy, success can be more easily achievable.

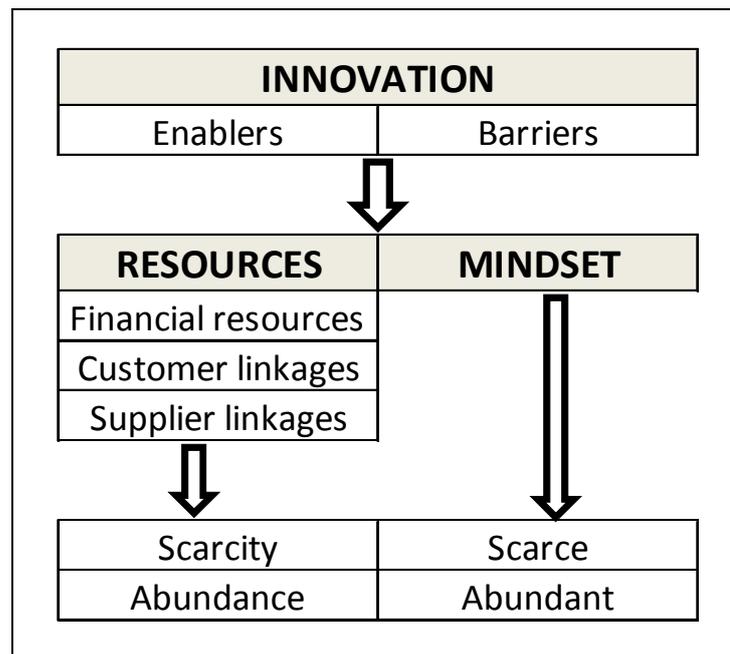
Chapter 2 Literature review

2.1 Introduction

This chapter describes the need for the research by presenting an argument with academic literature. The argument is built up and defended throughout this chapter to ensure that a solid foundation of the research topic is formed.

As shown in Figure 1, innovation generally is initially discussed, followed by innovation resources involving financial resources and customer and supplier linkages either being in a scarce or an abundant supply. The type of mindset is lastly discussed also being in a scarce or an abundant supply.

Figure 1 - The literature direction introduction



2.2 Innovation

Innovation is about “*pursuing radically new business opportunities, exploiting new or potentially disruptive technologies, and introducing change into the core concept of your business*” (Wolpert, 2002, p. 78).



Grobbelaar (2006) defines five types of innovation:

- new or improved products
- production techniques
- organisation structures
- discovery of new markets and
- use of new input factors

Grobbelaar (2006) describes that there are many ways to introduce and keep innovation in a company. Companies should always look at increasing their innovation by starting with one of their strong points and at the same time build up one of their weak points to ensure innovation is prioritised so that their business thrives on its success.

2.2.1 Make something new

Mentz (1999) indicates that to make something new one has to:

- generate or realise a new idea,
- develop this idea into a reality or product and
- implement and market this new idea

2.2.2 Innovation cycles

Mentz (1999) discusses the interaction between economic prosperity and technological innovation, concerning Kondratieff's cycles of world prosperity and depression. Mentz (1999) indicates that from Kondratieff's long wave graph technological innovations can be seen to happen in surges, which are clustered

together. This means that innovation seems to happen at critical areas and in a specific cycle.

In addition, the economic cycles oppose the innovation graph. This is explained, that when economic recessions and depressions occur, technological innovations improve. Therefore, it would seem that innovation is its highest during a low cycle in the economy.

2.2.2.1 Innovation suppressed during business cycles

Eibel-Spanyi (2005) describes that innovation was suppressed in Hungary in the early 1990's due to significant economic, structural and political changes, as businesses struggled for survival. This could have been interpreted as a mistake as innovation could have been on the up-turn. It also suggests that resources matter – when firms are struggling for survival, they are not likely to be innovative.

2.2.3 Companies innovation differently

Innovation can be incremental, radical or a mixture of both (Davila *et al.* 2006). Small companies generally innovate radically and large companies innovate incrementally with handsome advantages (Morck and Yeung, 2001). This suggests that radical innovation is not necessarily seen as better than incremental innovation.

As an example, large companies incrementally innovate in a global economic downturn which results in them usually getting rid of their non-core items. This inadvertently enables smaller companies to utilise the opportunities, which the larger companies have exposed. The smaller companies usually have to innovate radically to ensure the outcome can be successful in the market. This relationship with different innovation types can enable smaller and larger

companies to stay buoyant even during economic downturns. This suggests that innovation can in principle happen whether resources are limited or not.

2.2.4 Companies grow with innovation

Van Zyl (2005) describes that companies are born utilising creative ideas and that they grow with innovation. Van Zyl (2005) highlights that for most of the twentieth century business focus was on efficiency, with innovation being placed second. Efficiency is important as van Zyl (2005) indicates although innovation is the key to long-term stability, shareholder satisfaction and industry leadership.

2.2.5 External information and innovation

Frishammar & Hörte (2005) indicate that additional research is needed to understand how companies' manage external information and how this affects innovation performance. If companies innovate they would usually assume that most of the innovation is grown within the company. Although from what Frishammar & Hörte (2005) describe perhaps external information can drastically affect innovation outcomes and grow companies at drastically different rates.

2.2.6 Links between innovation

Van Zyl (2005) indicates that by understanding the links between innovation and organisational practices, critical thinking can be stimulated, as opposed to just managing information or actual resources (Frishammar and Hörte, 2005).

As a result the links between information and resources could drastically be involved in determining a company's innovation potential. Van Zyl (2005)



describes that thinking or a mindset for innovation could be another key to optimising success with innovation.

2.3 Constraints and creativity

Prahalad (2006) excites interesting possibilities in innovation with his *innovation sandbox* approach. Prahalad (2006) explains that the innovation sandbox involves exploration and experimentation within specific constraints.

Prahalad (2006) indicates that the constraints must be accepted and used to innovate with, specifically for the bottom of the pyramid sector. Prahalad (2006) states “*people have become to believe that creativity must be unconstrained; in practice, however, breakthrough creativity requires an explicit knowledge of limits*”. This would suggest that resource constraints could actually encourage innovation.

2.4 Enablers and barriers in innovation

There are enablers in innovation, which assist in innovation and barriers in innovation, which restrict innovation.

2.4.1 Innovation enablers

Resource innovation enablers are discussed below.

2.4.1.1 Resource innovation enablers

Rao & Drazin (2002) describe that managers are the embodiments of organisational skills and knowledge and are needed for product innovation. Similarly Millward & Freeman (2002) indicate that the role of a manager facilitates innovation.



As managers are proposed to be enablers for innovation, Van Zyl (2005) also indicates that customers, organisational learning, technology and finance are also enablers for innovation. This would suggest that having access to resources does matter for innovation.

2.4.2 Innovation barriers

Innovation barriers are not what a company wants to improve on, but should be seen as a constraint that could promote innovation. Specific innovation barriers are discussed below.

2.4.2.1 Tight control barriers

Kanter (2006) indicates that tight controls in a company strangle innovation where as Amabile *et al.* (2002) discovers that as time pressures mount, creative thinking falls dramatically. This would suggest that tight controls and increasing time constraints could be seen as innovation barriers.

2.4.2.2 Human resource barriers

Van Zyl (2005) indicates that leadership with unclear goals and only short term profit goals are recognised as innovation barriers. As leadership or a manager drives innovation, Millward & Freeman (2002) describe that the role of a manager constrains innovation. This suggests that a manager with unclear goals could constrain innovation.

2.5 Scarcity and abundance in innovation

Srinivas and Sutz (2008) best describe scarcity consisting of quantitative and qualitative factors. Examples that Srinivas and Sutz (2008) describe are access to materials and access to equipment of the required quality or accuracy, and

enough people with the appropriate skills and money to rely on well-known solutions.

Pretorius (2008) indicates that under scarcity conditions, companies are underperforming or in a crisis, depending whether in an internal (operational) or external (strategic) situation. This would suggest that scarcity conditions act as a constraint in innovation, although other researchers indicate that it could be an enabler of innovation.

2.6 More detail on resources in innovation

To build up from the previous sections, more detail is discussed on specific resources in innovation.

2.6.1 Amount of resources available

Talke (2007) describes that a company's performance is affected due to it having different amounts of resources compared to another company within its industry. Papyrakis and Reyer (2004) describe that having natural resource abundance has a negative effect on growth. They describe that a country's economic growth is driven by resource scarce economies that often outperform resource abundance countries.

2.6.2 Financial resources

Hoegl *et al.* (2008) describe financial resources as liquid funding available to the project team. Hoegl *et al.* (2008) also describe technical equipment and prototype testing, parts of financial resources, specifically excluding human resources.

2.6.2.1 Financial resources as enablers of innovation

Hoegl *et al.* (2008) indicate that financial constraints on team performance can enable innovation, rather than inhibit innovation. This suggests that by having less financial resources available for a project the rate of innovation can be promoted. Contrastingly Heirman & Clarysee (2007) established that start-up companies have an abundance of finance in order to enable innovation.

2.6.2.2 Financial resources as barriers of innovation

Christensen (2007) conducted research in Denmark, North Jutland, which is in a less developed region. Christensen (2007) indicates that financing of innovation is important and that finance can be an obstacle to innovation.

Heirman & Clarysee (2007) agree with Christensen (2007) that financial constraints inhibit innovation. In other words, there is disagreement in the literature whether innovation is encouraged or constrained when there are limited financial resources.

2.6.3 Customer and supplier linkages

Linkages are also resources but are specifically defined here, as links with suppliers and links with customers. Oerlemans and Pretorius (2006) researched the effect of customer and supplier linkages had on innovation. Frishammar and Hörte (2005) suggest that innovative companies maintain contact with customers and suppliers in order to obtain ideas.

Freel (2000) suggests that subcontracting can enable companies to create new products requiring new production techniques without having to initially invest in production equipment. Freel (2000) describe that it can be beneficial to involve the customer in the initial design as well as in the development process.



Freel (2000) found that 10% of innovations involved collaboration with customers only, whereas 55% involved collaboration with customers and suppliers. This suggests that collaborations with customers as well as suppliers in different ratios could enable innovation differently.

2.6.3.1 Customer and supplier resources as enablers of innovation

Rao & Drazin (2002) conclude from their analyses that the greater an organisation's external linkages, the higher the probability of its product innovation. Similarly Freel (2000) find that based upon a sample of 228 manufacturers in the UK that making greater use of external linkages enable innovation. Oerlemans and Pretorius (2006) also conclude that the more external sources used the higher the level of innovation.

Rao and Drazin (2002) indicate that companies with external linkages exhibit higher rates of growth and innovation. Frishammar and Hörte (2005) describe that customer needs are central to innovation being successful. This suggests that external linkages involving customers are critical for innovation.

2.6.3.2 Customer and supplier resources as barriers to innovation

Frishammar & Hörte (2005) indicate that scanning the technological sector of the environment is an enabler to innovation, whereas scanning customers and suppliers are inhibitors to innovation. Contrastingly Heirman & Clarysee (2007) describe that collaboration agreements with third parties enable innovation, although their results indicate that alliances with other companies do not significantly enable innovation.

Van Zyl (2005) describes that creativity should be focused on meeting the needs of customers. Van Zyl (2005) indicates that incremental innovation is more aligned to customer needs. Van Zyl (2005) also describes that radical

innovation by definition ignores customers' needs because it is so new. Van Zyl (2005) indicates that this is why so many radical innovations fail.

2.6.4 Treat external linkages as a case-by-case basis

Freel (2000) describes that you cannot generalise about the existence and importance of small and medium enterprises external linkages. Freel (2000) indicates that while recognising the potential of external linkages, they should be best served by treating on a case-by-case basis.

2.7 Mindset in innovation

Van Zyl (2005) describes that an entrepreneurial culture is needed in order for innovation to take place. This signifies that the entrepreneurial mindset, which is like an abundance mindset, is extremely important for fostering innovation.

Srinvas & Sutz (2008) indicate that to innovate in scarcity conditions implies the capacity to find solutions to perceived problems. Srinvas & Sutz (2008) indicate that under scarcity conditions constraints exist which are technical, economical as well as cultural. This suggests that when there are physical constraints on innovation, solutions can still be discovered.

Krishnan and Kumar (2003) describe though that leadership and vision have played a role in overcoming barriers related to a resource scarcity mindset. This suggests that even if leaders have a resource scarcity mindset that goals can still be achieved.

2.7.1 Less resources and a more abundant mindset

Freel (2005) describe that studies of small innovative companies consistently stress that financial difficulties are barrier in innovation. This led Freel (2005) to

discover that innovation intensity is likely to be positively associated with perceptions of access to finance.

Hamel and Prahalad (1993) describes that a company which uses less resources but having a mindset of abundance can outperform a company which uses more resources but with a mindset of scarcity. Hamel and Prahalad (1993) indicate that the problem with having too many resources is that the ambition to perform decreases. This suggests that by utilising fewer resources but having a more abundant mindset innovation can be promoted.

2.7.2 More of an abundance mindset promotes innovation

Fredrickson (2004) describes that by increasing positive emotions innovation can be enhanced. This suggests that by having more of an abundant mindset the more confidence in innovation being successful will be created.

2.8 Summary

Innovation is important to develop and understand to enable a company to be successful in the market. There are enablers and barriers in innovation, which provide indications on how to manage and control innovation within a company.

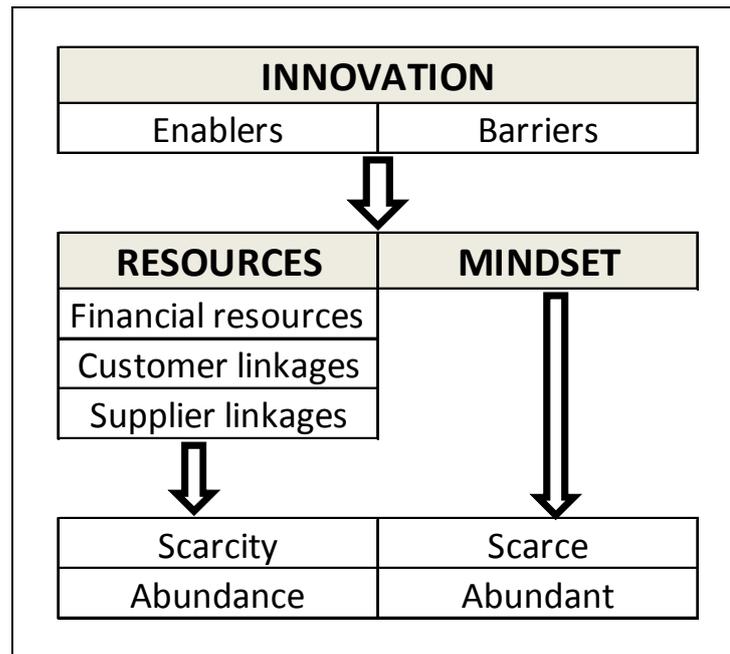
Fewer amounts of financial resources are suggested to promote innovation although so are an abundance of financial resources. Increased amounts of customer as well as supplier linkages are also shown to enable innovation. Although a small amount of customer and supplier linkages can also inhibit innovation.

The literature does indicate that external linkages should be treated as a case-by-case basis. This could present that within different environments different decisions should be made on the use of the different amount of resources.

An abundant mindset is identified as being important for innovation. Together, resources and mindsets are both important for innovation to take place and need to be accurately selected to ensure innovation can be successful.

Figure 2 graphically shows the literature summary.

Figure 2 - The literature summary





Chapter 3 Research hypotheses

3.1 Introduction

The chapter describes the research hypotheses which are split into three main hypotheses sections and are developed from Chapter 1 and Chapter 2.

3.2 Actual amount of resources and the amount a mindset type has on promoting innovation

Financial resources are not the only resources driving innovation, so are external connections (linkages) with suppliers and customers. The mindset of abundance is something which is seen as applicable to innovation and it should seem that the greater the mindset of abundance, the better it is for innovation.

Table 2 identifies four actual resource and mindset hypotheses.

Table 2 - Actual amount of resources and the amount a mindset type has on promoting innovation hypotheses

No.	Hypothesis
H1.a	The greater the supply of financial resources, the greater the confidence that innovation will be successful
H1.b	The greater the amount of connections with suppliers, the greater the confidence that innovation will be successful
H1.c	The greater the amount of connections with customers, the greater the confidence that innovation will be successful
H2	The greater the mindset of abundance, the greater the confidence that innovation will be successful

3.3 Amount of resources and the type of mindset needed to estimate resource amounts

The more resources that are available the more resources are selected to complete a project. The abundance mentality perceives more of a resource available compared to what is actually available. The abundance mentality



therefore sees more opportunities available. Table 3 identifies three estimated resource and mindset hypotheses.

Table 3 - Amount of resources and the type of mindset needed to estimate resource amounts hypotheses

No.	Hypothesis
H3	The greater the availability of resources, the greater the internal people, contractors and salaries are estimated as needed to complete a project
H4.a	The greater the mindset of abundance, the more the amount of contractors are estimated as needed to complete a project
H4.b	The greater the mindset of abundance, the more the amount of connections with customers are estimated as needed to complete a project

3.4 Resource and mindset type interaction

Building on sections 3.2 and 3.3 before, the interaction of resource and mindset environments are detailed below. Table 4 identifies the interaction hypotheses.

Table 4 - Resource and mindset type interaction hypotheses

No.	Hypothesis
H5.a	A mindset of abundance will interact with resource abundance so that more contractors are estimated as needed to complete a project
H5.b	A mindset of abundance will interact with resource scarcity so that less internal people are estimated as needed to complete a project



Chapter 4

Research methodology

4.1 Introduction

This chapter describes details of the methodology used. It goes into detail describing the unit of analysis, the sample size and the sampling method. The detail on data collected and data analysis is also described. The literature review in Chapter 2 provides an input for the methodology described in this chapter.

4.2 Research design

An experimental design was proposed, which is defined by Zikmund (2003) as “*a design that uses statistical methods to isolate the effects of extraneous variables or to allow for manipulation of multiple independent variables*”. Ströh (2004) states that to determine true cause and effect relationships, experimentation is recommended.

By introducing the experimental design, four scenarios were proposed. The scenarios all had a constant component, which was the innovative project that had to be completed over a fixed period of 10 months. The project consisted of developing two qualified crash recorders for the military or industrial sector. The challenge for the project was to involve innovative solutions as the crash recorders would have had to be developed and qualified against strict requirements.

4.3 Unit of analysis

As the research design was to discover what estimated resources were required as well as what type of mindset promotes or hinders innovation,



individuals were polled. The individuals were people working on electronic engineering projects within the military or the industrial sectors or a combination of the two sectors.

The individuals being the respondents ranged from assistants in projects, to engineers and directors. In a typical electronic engineering environment all the respondents would be involved in the project. A typical project would entail the directors and managers driving the direction of the project with the engineers and technicians executing the work. The researcher involving most people working on typical electronic engineering projects, ensuring varying levels of experience and contributions as well as ensuring well rounded responses were obtained.

Each respondent completed one questionnaire and the questionnaire's goal was to receive feedback on what the respondent would need to qualify two innovative crash recorders. The questionnaire included most of the typical project questions, such as the financial budget required, the amount of human resources required and the time estimate to complete the project. Therefore the unit of analysis was the respondent's feedback to the questionnaire.

4.4 Population and sampling

A similar population and sampling method used by Mentz (1999) was proposed, by selecting organisations where innovation is a core process. The military and industrial electronic engineering environment was used as the population, with companies developing and producing products within that environment being sampled.



4.5 Data gathering process

Trade Publishing Resources represents Kompass International in South Africa and maintains databases of South African Business' (TPR, 2009). This database available online was used as a starting point from which to sample companies. After this list was exhausted the researcher selected additional companies in Gauteng, which were provided on advice from previous surveyed companies. The researcher did take into effect that the industry was still the same and that they were conducting electronic engineering projects.

To collect the data the researcher randomly handed out questionnaires to company personnel. These questionnaires discovered the main and interaction effects that the independent variables caused.

A total of 131 surveys were collected which were obtained from individuals from eighteen different companies. This enabled a broader analysis to be conducted, which reduced bias by ensuring more than just a single company's perspective was obtained.

The primary sample, which is the total sample of valid respondents, was taken from all the applicable companies. The secondary sample, which is the average of the amount of valid respondent over the amount of companies selected, entailed 7.2 individuals. The company names were replaced with dummy names to ensure that company-effects were accounted for.

4.6 Scenarios

The scenarios described the way the internal operations of the companies were conducted with the external market, setting the scene for the new innovative project.



4.6.1 Dependent variables

As the research design was an experimental design, the dependent (response) variables are the values that are expected to be dependent on the experiments manipulation of the independent variable (Zikmund, 2003). These variables were:

1. the amount of financial resources needed to fund the project,
2. the number of collaborations with suppliers and
3. the number of collaborations with customers

4.6.2 Independent variables

The independent variables have an influence on the response variables and had deliberately been changed by varying them in the different scenarios. The independent variables start with the resource type being scarce or abundant. The mindset independent variable was also changed in the text to attempt to manipulate the respondent's state of mind to either a scarce or an abundance state.

4.6.3 Treatment variables

The treatment variables indicate which group the response variables belonged to and were linked to each scenario. Therefore four treatment variables were used:

1. Scarce resource - Scarce mindset (SR-SM).
2. Scarce resource - Abundant mindset (SR-AM).
3. Abundant resource - Scarce mindset (AR-SM).
4. Abundant resource - Abundant mindset (AR-AM).

The detail scenarios are available in Appendix-A.

4.6.4 How a mindset of scarcity or abundance was created

Each scenario attempted to manipulate the respondent to think with a scarcity or an abundant mindset.

4.6.4.1 Scarcity mindset

The sense of scarcity was created by manipulating the scenario to present a world that was hopeless. This was accomplished by presenting an environment where it was difficult to succeed and an environment where there is no one to help a person, never mind a company along a positive growth path.

An extract from the scenario to create a scarcity mindset was created as follows: “... *you are no doubt aware, the current downturn is fundamentally challenging companies around the world. Giants in business like GE are floundering, and small businesses like ours find ourselves in a very difficult situation.*”

4.6.4.2 Abundant mindset

The sense of abundance was created by manipulating the scenario to include a kind and welcoming perspective of the world. The sense of abundance was also created by presenting an environment that was enabling success and enabling people and companies to communicate amongst one another.

An extract from the scenario to create a sense of an abundant mindset was created as follows: “... *we have, to a greater extent than ever before, access to cutting-edge resources of the leading companies in the world. In addition, government is welcoming international trade which is creating new opportunities for our company to succeed.*”



4.6.5 How a sense of few or many resources was created

Each scenario attempted to manipulate the respondent to view the market as having too few or too many resources.

4.6.5.1 Sense of resource scarcity

The sense of few resources was created by manipulating the scenario to present a low amount of financial resources being available and indicated that additional finance was very rare. By manipulating the scenario to indicate that the workforce count was low and that not many of them were available to conduct new work. A view of the customers was also created to show that they were disinterested in new products and that suppliers were not willing to help provide inputs to solutions for projects.

An extract from the scenario to create a sense of a resource scarcity was created as follows: *"...we have R3.2 million in cash available for the project. Given the tight financial situation right now, I am not sure how easy we will find it to access additional debt from our banks and loan departments."*

4.6.5.2 Sense of resource abundance

The sense of many resources was created by manipulating the scenario to present a higher amount of resource being available and indicating additional finance options were readily available. This scenario also manipulated that there was a good workforce and that many were willing to work. In addition, customers and suppliers were presented to show interest in projects and were willing to help make them succeed.

An extract from the scenario to create a sense of abundant resources was created as follows: *"...we have R4.8 million in cash available for development*



projects. More financial resources are available as we have received positive feedback from our banks and loan departments regarding additional finance.”

4.7 Questionnaire

The questionnaire details are discussed below.

4.7.1 Questionnaire design

Each questionnaire contained an introductory page that was similar for all scenarios. The introductory page briefly explained the purpose of the questionnaire, along with indications that the data will be confidential and that the questionnaire was voluntary. The introductory page also indicated who the researcher and the supervisor were.

The research questionnaire is illustrated in parts split up from section 4.7.2 up until section 4.7.7 below and shown in totality in Appendix-B. The questionnaire makes use of categorical scales and Likert scales. For the category scale, the respondents are provided with alternative ratings. (Zikmund, 2003)

4.7.2 Financial resources

The first open-ended response was initiated by a budgetary question, which was generated and modified from the research done by Papyrakis and Reyer (2004), Heirman and Clarysee (2007), Hoegl *et al.* (2008) and van Zyl (2005). Table 5 illustrates the question with an open-ended response expected.



Table 5 - The research questionnaire: Budget question

Question
Project related questions
Estimate the budget to produce the crash recorders to spec and on time?
EXCLUDE the cost of human resources. The budget should consist of materials, technical equipment, qualified testing etc.

4.7.3 Human resources

Table 6 asked the respondent questions which were derived from Paladino (2007), Freel (2005) and Van Zyl (2005) with the response being open-ended.

Table 6 - The research questionnaire: Human resources questions

Question
How many internal people do you estimate are needed to develop the crash recorders?
How many contractors do you estimate are needed to help <i>InnoTron</i> develop the crash recorders?

Table 7 asks the respondent to indicate the Human Resources salaries which would assist along with the financial resource question to help identify the total financial resources needed to develop the project. These questions were derived from the research of done by Heirman and Clarysee (2007), Hoegl *et al.* (2008) and Van Zyl (2005).

Table 7 - The research questionnaire: Human resources salaries question

Question
Estimate the budget (cost to company) for the salaries of the human resources involved in developing the crash recorders, including contractors over the 10 months?

4.7.4 Customer and supplier resources

To capture the customer and supplier resources, the amount of hours that customers would contribute and the amount of hours that suppliers would

contribute to the project were requested. These questions were derived from the research done by Freel (2000), Freel (2005), Frishammar and Hörte (2005), Heirman and Clarysee (2007), Mentz (1999), Oerlemans and Pretorius (2006), Paladino (2007) and Rao and Drazin (2002). The questions are illustrated in Table 8.

Table 8 - The research questionnaire: External resource questions

Question
Estimate how many hours customers will contribute to help <i>InnoTron</i> develop the crash recorders?
Estimate how many hours suppliers will contribute to help <i>InnoTron</i> develop the crash recorders?

4.7.5 Resource manipulation check

The questionnaire had manipulation checks built-in to test whether the respondent was actually manipulated as the scenario was destined to do. This was inspired from what Latham, Erez and Locke (1988) did.

To check that the manipulation had worked with the respondent a simple dichotomy validation question was asked as in Table 9. A manipulation check was verified to ensure that the survey did in fact work and that the respondent had the correct view on either a lot or a little amount of resources available.

These questions were derived from the research of Freel (2000), Krishnan and Kumar (2003), Ladika (2005) and Mentz (1999).

Table 9 - The research questionnaire: Resource verification question

Question
Do you feel that to develop the crash recorders that there will be adequate resources available?

4.7.6 Mindset manipulation check

To check that the mindset manipulation has worked a 5-point Likert scale response was requested from the respondent as in Table 10. The response tests the optimism and pessimism of the respondent, which was related to an abundant or scarcity mindset. The question was adapted from Prentice Hall's self-assessment library (2007) and from Queendom (2008), which is a web site that describe "a full range of professional-quality, scientifically-validated psychological assessments..."

Table 10 - The research questionnaire: Mindset manipulation question

Question
Do you generally find something positive in even the most difficult situations?

4.7.7 Demographics

Standard demographic questions were requested as shown in Table 11. Gantsho (2006) questionnaire's style for demographics were expanded by the researcher and modified to fit the typical engineering environment.

As this was a questionnaire that had to be filled in by electronic engineering people, the common positions normally associated with engineers were chosen for these selection criteria.



Table 11 - The research questionnaire: Demographic questions

Question
Demographics
What is your current age?
What is your race?
What is your gender?
How many years have you been at your current company?
What is the closest match to your current job position?
Approximately how many people work for the company you work for?

4.8 Questionnaire retrieval

The questionnaires were first checked before they were processed further. The checking process consisted of ensuring that the questionnaire was 100% complete. This was accomplished electronically by checking each question had a valid answer.

4.8.1 Missing values

Missing values on respondent questionnaires had an effect rendering the questionnaire to be incomplete. In those cases the incomplete questionnaires were discarded as no neutral values could be provided or substituted in the beginning of the sampling stage.

4.8.2 Data analysis

There were 250 surveys that were sent out with 131 being returned. This provided a response rate of 52 percent.

The questionnaire consisted of either a paper or an electronic version. The researcher manually entered the paper responses into an electronic format whereas the electronic responses were electronically copied over to a suitable format and not retyped. This was done because Ströh (2004) indicates that raw

data has to be converted into a suitable format. This ensured that the data can be manipulated correctly.

After the data was in an electronic format the amount of responses were automatically calculated. This enabled the researcher to determine how many responses were still needed in order to achieve a minimum amount for statistical purposes.

4.9 Indication of the research limitations

4.9.1 Sample selection error

A sample selection error, as defined by Zikmund (2003) is “an administrative error caused by improper selection of a sample, thus introducing bias”. By not sampling randomly, as convenience sampling is proposed, a limitation of the research is introduced by creating a possibility of skewing the results. Therefore only conclusions about the companies being surveyed can be discussed. However, the allocation to conditions was accomplished randomly.

4.9.2 Respondent qualifications

The researcher wanted to ensure random allocation and therefore did not want to exclude any respondents from being sampled. The researcher therefore sampled individuals from assistants to directors. The researcher did oversample but later removed assistants and technicians from the sample, as they seemed not to understand enough about the project requirements as well as forming the minority of the sample.



4.9.3 The innovative project and the respondents capabilities

Some respondents indicated that they were not sure of the costing involved for such a project. This could show that the respondents were not in the correct positions to answer the questions. A project manager will definitely know the details of the costing involved in a project. A technician on the other hand would only know about minor costs being involved in a project.

4.10 Summary

An experimental research design was conducted. This included four different type of scenario's, which were made up of scarcity and abundance resources and scarcity and abundance mindsets.

The unit of analysis concerned respondents answering a single questionnaire. There were 131 respondents. The questionnaire incorporated two innovative crash recorders. The questionnaire included financial resource questions, customer and supplier linkages questions, along with resource and mindset manipulation checks. The demographics were also requested which were requested at the end of the questionnaire.

Chapter 5 Results

5.1 Introduction

The results of the data collected are presented in this chapter. The data is presented around the research questions with sparse discussions provided. The resource manipulation checks are initially discussed with a brief discussion on the demographics, followed by discussions on the rules. The three sections of hypotheses results are discussed last.

5.2 Resource manipulation check

The count of the resource manipulation variable *Adequate Resources* over the resource environments is shown in Table 12.

Table 12 - Resource manipulation variable split over resource environments

		Adequate Resources		
		Yes	No	Total
Scenario	AR	49	6	55
	SR	43	14	57
	Total	92	20	112

Table 12 indicates that in abundant resource situations (AR) most respondents indicated that they were happy that there were adequate resources available. In scarcity resource (SR) situations respondents also indicated that there were adequate resources available, although more indicated that not enough resources were available.

Table 13 indicates the means for the resource manipulation variable *Adequate Resources*. As can be seen the means are different for the different resource environments.



Table 13 - Descriptive statistics for the *Adequate Resources* manipulation variable

Term	Count	Mean	Standard Error
Means and Standard Errors of Adequate Resources			
All	112	1.18	
AR	55	1.11	0.090561
SR	57	1.25	0.088958

Far more respondents indicated in a scarce resource (SR) environment that there were not enough resources available compared to as in an abundant resource (AR) environment. Therefore the resource manipulation worked.

5.3 Mindset manipulation check

A respondent who was put in an abundant mindset environment would have felt that there were many opportunities available and that they were positive about situations. Table 14 indicates that the means for the mindset manipulation variable *Positive Situation* are different for the different mindset environments. A lower mean indicates that the respondent felt to be in an abundant mindset environment.

Table 14 - Descriptive statistics for the *Positive Situation* mindset manipulation variable

Term	Count	Mean	Standard Error
Means and Standard Errors of Positive Situation			
All	112	1.73	
AM	53	1.55	0.092283
SM	59	1.92	0.087465

Table 15 indicates with applying the F-ratio approach, that the p-value is equal to 0.013297 at an alpha level of 0.05. As can be seen there is a significant difference between the means for the *Positive Situation* variable in a scarcity mindset (SM) environment compared to an abundant mindset (AM) environment. Therefore the mindset manipulation worked.

Table 15 - Positive Situation ANOVA results split over mindset environments

Analysis of Variance Table for Positive Situation					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: MINDSET	1	3.78E+00	3.78E+00	6.33	0.013297*
S	110	6.57E+01	5.97E-01		
Total (Adjusted)	111	6.95E+01			
Total	112				

5.4 Demographics

The amount of time which respondents stayed with their companies was predominantly more than 8 years for all scenarios. Responses were predominantly engineers over all scenarios as well as for specific scenarios. Assistants and technicians were also surveyed although the statistics indicated that the data was more accurate for higher qualified personnel, therefore they were removed from the main analysis.

The responses concerning company sizes were predominantly towards companies having more than 66 personnel. There is a good spread between the samples of companies with some company sizes employing less than 20 people.

5.5 Decision rules for the analyses

The decision rule which was made on ANOVA tests was accomplished by analysing the amount of variation in the dependent variable. The outcome would indicate if the overall test is significant, which indicates that there is statistical variation in the dependent variable.

For the 2-way ANOVA, the possible null hypotheses are:

- There is no difference in the means of factor A
- There is no difference in means of factor B
- There is no interaction between factors A and B

5.6 Analyses separated by hypotheses sections

The results of the hypotheses statistical analyses are presented in three main sections below, as presented in the separate tables as in Chapter 3.

5.6.1 Actual amount of resources and the amount a mindset type has on promoting innovation

This section of hypotheses is split into three resource hypothesis sections and one mindset hypothesis section.

5.6.1.1 H1.a - The greater the supply of financial resources, the greater the confidence that innovation will be successful

The researcher assumed the mean value for the supply of financial resources to be the mean value from the responses. This value as from Table 16 is R 6 029 677.

Table 16 - Descriptive statistics for Financial Resources response variable split over resource and mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Financial Resources			
All	112	6 029 677.00	
AM-AR	26	6 390 769.00	0.132680
AM-SR	27	5 701 537.00	0.130200
SM-AR	29	6 812 069.00	0.125630
SM-SR	30	5 214 334.00	0.123519

The researcher conducted a one sample t-test at an alpha level of 0.05 on the data and used the mean value of R 6 029 677 to substitute for the H_0 value. The assumption results indicated a rejection of the normality tests. A Wilcoxon Signed-Rank test was therefore conducted.

The result of the Wilcoxon Signed-Rank test indicated that with a p-value of 0.000015 the alternative hypothesis of the median being less than R 6 029 677 was failed to be rejected.

Therefore the $H_{1.a}$ hypothesis is rejected. This suggest that the less the supply of financial resources, the greater the confidence that innovation will be successful is true.

5.6.1.2 H1.b - The greater the amount of connections with suppliers, the greater the confidence that innovation will be successful

The researcher assumed the average value for the supplier hours to be the mean value from the responses. This value as from Table 17 is 895.48 hours.

**Table 17 - Descriptive statistics for Supplier Hours response variable split over resource and mindset environments**

Term	Count	Mean	Standard Error
Means and Standard Errors of Supplier Hours			
All	112	895.48	
AM-AR	26	1 284.77	0.132680
AM-SR	27	708.59	0.130200
SM-AR	29	566.39	0.125630
SM-SR	30	1 022.17	0.123519

The researcher conducted a one sample t-test at an alpha level of 0.05 on the data and used the mean value of 895.48 hours as a substitute for the H_0 value. The assumption results indicated a rejection of the normality tests. A Wilcoxon Signed-Rank test was therefore run.

The result of the Wilcoxon Signed-Rank test indicated that with a p-value of 0.000000 the alternative hypothesis of the median being less than 895.48 hours was failed to be rejected.

Therefore the H1.b hypothesis is rejected. This suggests that the less time spent with suppliers, the greater the confidence that innovation will be successful is true.

5.6.1.3 H1.c - The greater the amount of connections with customers, the greater the confidence that innovation will be successful

The researcher assumed the average value for the customer hours to be the mean value from the responses. This value as from Table 18 is 389.07 hours.



Table 18 - Descriptive statistics for Customer Hours response variable split over resource and mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Customer Hours			
All	112	389.07	
AM-AR	26	431.77	0.132680
AM-SR	27	627.78	0.130200
SM-AR	29	256.22	0.125630
SM-SR	30	240.50	0.123519

The researcher conducted a one sample t-test at an alpha level of 0.05 on the data and used the mean value as a substitute for the H_0 value. The assumption results indicated a rejection of normality tests. A Wilcoxon Signed-Rank test was therefore run.

The result of the Wilcoxon Signed-Rank test indicated that with a p-value of 0.000004 the alternative hypothesis of the median being less than 389.07 was failed to be rejected.

Therefore the $H_{1.c}$ hypothesis is rejected. This suggests that the less time spent with customers, the greater the confidence that innovation will be successful is true.

5.6.1.4 H2 - The greater the mindset of abundance, the greater the confidence that innovation will be successful

The researcher assumed the average value for the *Positive Situation* to be the mean value from the responses. This value as from Table 18 is 1.73.



Table 19 - Descriptive statistics for Positive Situation response variable split over resource and mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Positive Situation			
All	112	1.73	
AM-AR	26	1.42	0.132680
AM-SR	27	1.67	0.130200
SM-AR	29	1.93	0.125630
SM-SR	30	1.90	0.123519

The researcher conducted a one sample t-test at an alpha level of 0.05 on the data and used the mean value as a substitute for the H_0 value. The assumption results indicated a rejection of normality tests. A Wilcoxon Signed-Rank test was therefore run.

The result of the Wilcoxon Signed-Rank test indicated that with a p-value of 0.772841 the alternative hypothesis of the median being less than 1.73 was rejected. The test also indicated that alternative hypothesis of the median being greater and equal to 1.73 was rejected.

Therefore there can be no conclusion drawn on the H_2 hypothesis.

5.6.2 Amount of resources and the type of mindset needed to estimate resource amounts

This section is split into three hypothesis sections.

5.6.2.1 H3 - The greater the availability of resources, the greater the internal people, contractors and salaries are estimated as needed to complete a project

There are response variables within different environments therefore the researcher has conducted ANOVA tests to analyse the hypotheses. This is



similarly as to how Ströh (2004) conducted ANOVA tests in order to verify whether a significant difference between the environments existed.

5.6.2.1.a Response variables with the ‘Resource’ environment used as the factor variable

The researcher has conducted statistical tests on the response variables with the resource environment used as the factor variable.

Table 20 indicates the response variables which results have been classified as marginally significant, significant or highly significant regarding their p-values conducted by ANOVA tests. This indicates that these response variable ANOVA results are likely to be true, probably true and very probably true.

Table 20 - Resource environment ANOVA results

Marginally significant <10%	Significant <5%	Highly significant <1%
Salaries	Internal People	-
-	Contractors	-

The statistical results of the response variables identified in Table 20 are discussed in more detail below.

5.6.2.1.a.i. Response variable - Internal People

Table 21 indicates with applying the F-ratio approach, that the p-value is equal to 0.018898 at an alpha level of 0.05. As can be seen there is a significant difference between the means for the amount of internal people in a scarcity resource environment compared to an abundant resource environment.



Table 21 - Internal People ANOVA results split over resource environments

Analysis of Variance Table for Internal People					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: RESOURCES	1	548.2901	548.2901	5.68	0.018898*
S	110	10622.7	96.57001		
Total (Adjusted)	111	11170.99			
Total	112				

As in Table 22 the mean value for the amount of internal people in a scarce resource environment is 11.71. This compares to 16.14 in an abundant resource environment.

Therefore the researcher fails to reject the hypothesis for the case of the amount of Internal People.

Table 22 - Descriptive statistics for Internal People response variable split over resource environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Internal People			
All	112	13.92	
AR	55	16.14	0.090561
SR	57	11.71	0.088958

5.6.2.1.a.ii. Response variable - Contractors

Table 23 indicates with applying the F-ratio approach, that the p-value is equal to 0.045745 at an alpha level of 0.05. As can be seen there is a significant difference between the means for the amount of contractors in a scarcity resource environment compared to an abundant resource environment.



Table 23 - Contractors ANOVA results split over resource environments

Analysis of Variance Table for Contractors					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: RESOURCES	1	87.26862	87.26862	4.08	0.045745*
S	110	2351.086	21.37351		
Total (Adjusted)	111	2438.355			
Total	112				

As in Table 24 the mean value for the amount of contractors in a scarce resource environment is 3.31. This compares to 5.07 in an abundant resource environment.

Therefore the researcher fails to reject the hypothesis for the case of the amount of contractors.

Table 24 - Descriptive statistics for Contractors response variable split over resource environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Contractors			
All	112	4.19	
AR	55	5.07	0.090561
SR	57	3.31	0.088958

5.6.2.1.a.iii. Response variable - Salaries

Table 25 indicates with applying the F-ratio approach, that the p-value is equal to 0.092142 at an alpha level of 0.05. As can be seen there is a marginal significant difference between the means for the amount of salaries for the personnel in a scarcity resource environment compared to an abundant resource environment.



Table 25 - Salaries ANOVA results split over resource environments

Analysis of Variance Table for Salaries					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: RESOURCES	1	2.21E+14	2.21E+14	2.89	0.092142
S	110	8.43E+15	7.66E+13		
Total (Adjusted)	111	8.65E+15			
Total	112				

As in Table 26 the mean value for salaries in a scarce resource environment is R5.9 million. This compares to R8.7 million for an abundant resource environment.

Therefore the researcher fails to reject the hypothesis for the case salaries.

Table 26 - Descriptive statistics for Salaries resource variable split over resource environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Salaries			
All	112	7 284 517.00	
AR	55	8 690 262.00	0.090561
SR	57	5 878 772.00	0.088958

5.6.2.2 H4.a - The greater the mindset of abundance, the more the amount of contractors are estimated as needed to complete a project

There are response variables within different environments therefore the researcher has conducted ANOVA tests to analyse the hypotheses.

5.6.2.2.a Response variables with the 'Mindset' environments used as the factor variable

The researcher has conducted statistical tests on the response variables with the mindset environment used as the factor variable.



Table 27 indicates the response variables which results have been classified as marginally significant, significant or highly significant regarding their p-values conducted by ANOVA tests. This indicates that these response variable ANOVA results are likely to be true, probably true and very probably true.

Table 27 - Mindset environment ANOVA results

Marginal <10%	Significant <5%	Highly significant <1%
-	Contractors	-

The statistical results of the response variable identified in Table 27 are discussed in more detail below.

5.6.2.2.a.i. Response variable - Contractors

Table 28 indicates with applying the F-ratio approach, that the p-value is equal to 0.032466 at an alpha level of 0.05. As can be seen there is a significant difference between the means for the amount of contractors in a scarcity mindset environment compared to an abundant mindset environment.

Table 28 - Contractors ANOVA results split over mindset environments

Analysis of Variance Table for Contractors					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: MINDSET	1	99.74762	99.74762	4.69	0.032466*
S	110	2338.607	21.26007		
Total (Adjusted)	111	2438.355			
Total	112				

As in Table 29 the mean value for the amount of contractors in a scarce mindset environment is 3.28. This compares to 5.17 in an abundant mindset environment.

Therefore the researcher fails to reject the hypothesis for the case of the amount of contractors.

Table 29 - Descriptive statistics for Contractors response variable split over mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Contractors			
All	112	4.22	
AM	53	5.17	0.092283
SM	59	3.28	0.087465

5.6.2.3 H4.b - The greater the mindset of abundance, the more the amount of connections with customers are estimated as needed to complete a project

The researcher has conducted statistical tests on the response variables with the mindset environment used as the factor variable.

5.6.2.3.a Response variables with the 'Mindset' environments used as the factor variable

Table 30 indicates the response variables which results have been classified as marginally significant, significant or highly significant regarding their p-values conducted by ANOVA tests. This indicates that these response variable ANOVA results are likely to be true, probably true and very probably true.

Table 30 - Mindset environment ANOVA results

Marginal <10%	Significant <5%	Highly significant <1%
Customer Hours	-	-

The statistical results of the response variable identified in Table 30 are discussed in more detail below.



5.6.2.3.a.i. Response variable - Customer Hours

Table 31 indicates with applying the F-ratio approach, that the p-value is equal to 0.090026 at an alpha level of 0.05. As can be seen there is a marginal significant difference for the amount of customer hours spent in a scarcity mindset environment compared to an abundant mindset environment.

Table 31 - Customer Hours ANOVA results split over mindset environments

Analysis of Variance Table for Customer Hours					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: MINDSET	1	2.24E+06	2.24E+06	2.93	0.090026
S	110	8.43E+07	7.67E+05		
Total (Adjusted)	111	8.66E+07			
Total	112				

As in Table 32 the mean value for the amount of hours spent with customers in a scarce mindset environment is 248.23 hours. This compares to 531.62 hours in an abundant resource environment.

Therefore the researcher fails to reject the hypothesis for the case of the amount of hours spent with customers.

Table 32 - Descriptive statistics for Customer Hours response variable split over mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Customer Hours			
All	112	389.92	
AM	53	531.62	0.092283
SM	59	248.23	0.087465

5.6.3 Resource and mindset type interaction

This section of hypotheses is split into two hypothesis sections.

5.6.3.1 H5.a - A mindset of abundance will interact with resource abundance so that more contractors are estimated as needed to complete a project

The researcher has conducted statistical tests on the response variables with the mindset environment used as the factor variable.

5.6.3.1.a Response variables with the 'Resource' and 'Mindset' environments combined as the factor variables

Table 33 indicates the response variables which results have been classified as marginally significant, significant or highly significant regarding their p-values conducted by ANOVA tests. This indicates that these response variable ANOVA results are likely to be true, probably true and very probably true.

Table 33 - Resource and mindset environments ANOVA results

Marginal <10%	Significant <5%	Highly significant <1%
-	-	Contractors

The statistical results of the response variable identified in Table 33 are discussed in more detail below.

5.6.3.1.a.i. *Response variable - Contractors*

Table 34 indicates with applying the F-ratio approach, that the p-value is equal to 0.005566 at an alpha level of 0.05. As can be seen there is a highly significant difference between the means for the amounts of contractors within the entire environments being scarcity and abundant resource as well as mindset environments.



Table 34 - Contractors ANOVA results split over resource and mindset environments

Analysis of Variance Table for Contractors					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: Scenario Type	3	267.5144	89.17146	4.44	0.005566*
S	108	2170.841	20.10037		
Total (Adjusted)	111	2438.355			
Total	112				

As in Table 35 the mean values for the amount of contractors in the four different environments are shown.

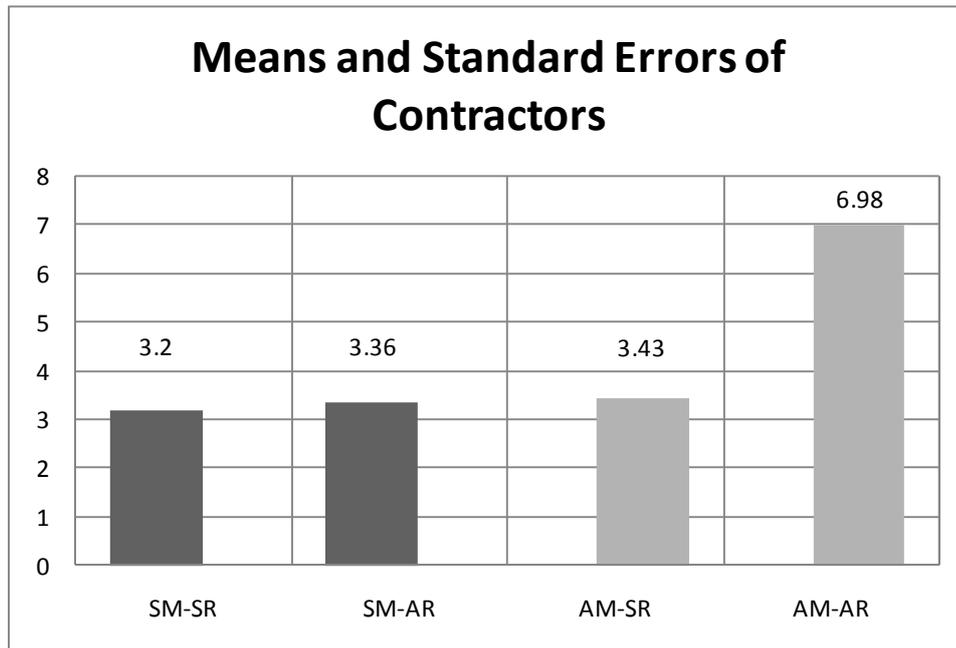
Table 35 - Descriptive statistics for Contractors response variable split over resource and mindset environments

Term	Count	Mean	Standard Error
Means and Standard Errors of Contractors			
All	112	4.24	
AM-AR	26	6.98	0.132680
AM-SR	27	3.43	0.130200
SM-AR	29	3.36	0.125630
SM-SR	30	3.20	0.123519

Figure 3 shows graphically the results. As can be seen the more abundant the resource environment the more contractors are needed. In addition the more abundant the mindset environment the more contractors are also needed.

Therefore the researcher fails to reject the hypothesis for the case of the mindset of abundance interacting with resource abundance.

Figure 3 - graphical representation of the amount of contractors split over resource and mindset environments



5.6.3.2 H5.b - A mindset of abundance will interact with resource scarcity so that less internal people are estimated as needed to complete a project

The researcher has conducted statistical tests on the response variables with the mindset environment used as the factor variable.

5.6.3.2.a Response variables with the 'Resource' and 'Mindset' environments combined as the factor variables

Table 33 indicates the response variables which results have been classified as marginally significant, significant or highly significant regarding their p-values conducted by ANOVA tests. This indicates that these response variable ANOVA results are likely to be true, probably true and very probably true.

Table 36 - Resource and mindset environments ANOVA results

Marginal <10%	Significant <5%	Highly significant <1%
-	-	Internal People

The statistical results of the response variable identified in Table 33 are discussed in more detail below.

5.6.3.2.a.i. Response variable - Internal People

Table 37 indicates with applying the F-ratio approach, that the p-value is equal to 0.006369 at an alpha level of 0.05. As can be seen there is a highly significant difference between the means for the amounts of internal people within the entire environments being scarcity and abundant resource as well as mindset environments.

Table 37 - Internal People ANOVA results split over resource and mindset environments

Analysis of Variance Table for Internal People					
Source Term	DF	Sum of Squares	Mean Square	F-Ratio	Prob Level Power (Alpha=0.05)
A: Scenario Type	3	1.20E+03	3.99E+02	4.33	0.006396*
S	108	9.97E+03	9.23E+01		
Total (Adjusted)	111	1.12E+04			
Total	112				

As in Table 35 the mean values for the amount of internal people in the four different environments are shown.

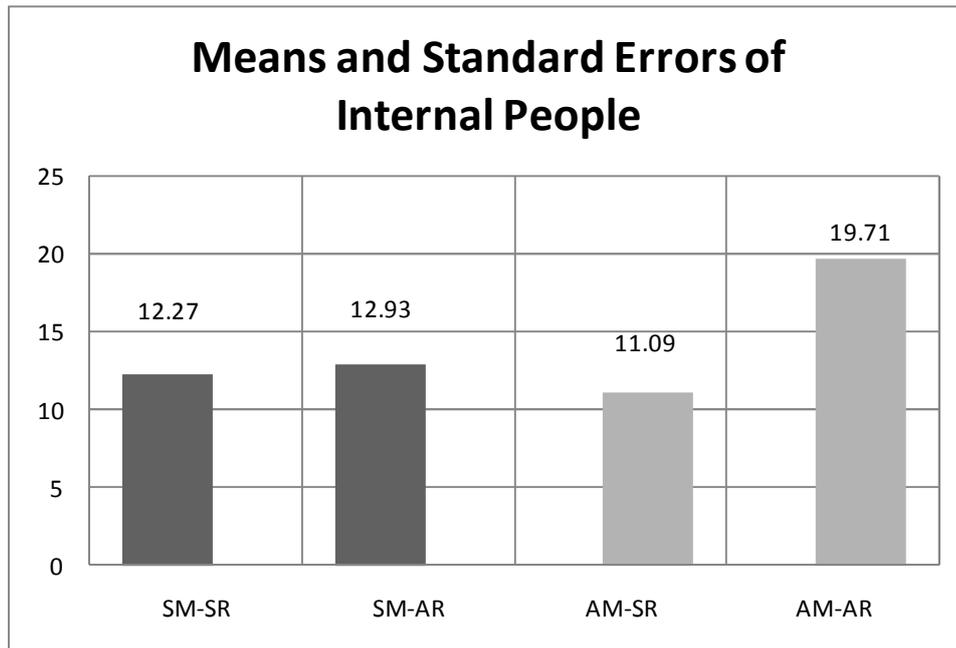
**Table 38 - Descriptive statistics for Internal People response variable split over resource and mindset environments**

Term	Count	Mean	Standard Error
Means and Standard Errors of Internal People			
All	112	14.00	
AM-AR	26	19.71	0.132680
AM-SR	27	11.09	0.130200
SM-AR	29	12.93	0.125630
SM-SR	30	12.27	0.123519

Figure 4 shows graphically the results. As can be seen the more abundant the resource environment more internal people are needed. In addition the more abundant the mindset environment more internal people are also needed. Only specifically in the case of an abundance mindset and scarce resource (AM-SR) environment are the amount of internal people at their minimum.

Therefore the researcher fails to reject the hypothesis for the case of the mindset of abundance interacting with resource scarcity.

Figure 4 - graphical representation of the amount of internal people split over resource and mindset environments



5.7 Summary

Firstly the manipulation checks were described indicating that the checks did work. This verified that the responses were manipulated into the scenarios they received.

The demographics were briefly discussed indicating that they were many engineer respondents. Table 39 indicates which hypotheses are shown to be supported, which are not supported and if no conclusion can be made.

Table 39 - The hypotheses that are supported and not supported

No.	Hypothesis	Decision
H1.a	The greater the supply of financial resources, the greater the confidence that innovation will be successful	Not supported
H1.b	The greater the amount of connections with suppliers, the greater the confidence that innovation will be successful	Not supported
H1.c	The greater the amount of connections with customers, the greater the confidence that innovation will be successful	Not supported
H2	The greater the mindset of abundance, the greater the confidence that innovation will be successful	No conclusion
H3	The greater the availability of resources, the greater the internal	Supported



No.	Hypothesis	Decision
	people, contractors and salaries are estimated as needed to complete a project	
H4.a	The greater the mindset of abundance, the more the amount of contractors are estimated as needed to complete a project	Supported
H4.b	The greater the mindset of abundance, the more the amount of connections with customers are estimated as needed to complete a project	Supported
H5.a	A mindset of abundance will interact with resource abundance so that more contractors are estimated as needed to complete a project	Supported
H5.b	A mindset of abundance will interact with resource scarcity so that less internal people are estimated as needed to complete a project	Supported

Table 39 indicates that:

- You do not necessarily need many financial resources, connections with suppliers or customers to be innovative.
- There is no indication if the mindset makes a direct difference to innovation.
- The greater the availability of resources, the greater internal people, contractors and their salaries are estimated for a project.
- The greater the mindset of abundance, the more contractors is estimated for a project.
- The greater the mindset of abundance, the more the amount of connections with customers is estimated for a project.
- The mindset of abundance interacts with resource abundance in the case that more contractors are estimated for a project.
- The mindset of abundance interacts with resource scarcity in the case that less internal people are estimated for a project.

Chapter 6 Discussion of Results

6.1 Introduction

This chapter discusses the results in terms of the research hypotheses and in terms of the literature. This chapter indicates if the research objectives have been met or not and the implications thereof. Any concerns as a result of the research sample are also discussed.

6.2 Discussion of results in terms of the hypotheses

6.2.1 Actual amount of resources and the amount a mindset type has on promoting innovation

This section is split into three resource hypothesis sections and one mindset hypothesis section.

6.2.1.1 H1.a - The greater the supply of financial resources, the greater the confidence that innovation will be successful

Chapter 5 concluded that the less the supply of financial resources, the greater the confidence that innovation will be successful.

6.2.1.1.a The less financial resources, the greater the confidence that innovation will be successful

Hoegl *et al.* (2008) described financial resources as liquid funding liquid funding available to the project team. Hoegl *et al.* (2008) also describe technical equipment and prototype testing, parts of financial resources, specifically excluding human resources. The researcher agrees with Hoegl *et al.* (2008) who indicate that financial constraints increase confidence that innovation can be successful.

The analysis that scarce financial resources promoting innovation also supports Hoegl *et al.* (2008) who indicate that people are more innovative when given



few rather than more resources. As the less the financial resources are available the results indicate that innovation will be successful.

6.2.1.1.b Restricting financial resources enable personnel to increase innovation

Hoegl *et al.* (2008) suggest that the human mind could be more productive when restricted. The researcher agrees with this statement because by decreasing the supply of financial resources innovation can be increased. This suggests that by restricted resources for personnel to work with they are more creative to increase innovation. The researcher therefore agrees with Hoegl *et al.* (2008) that financial resource slack supports innovation.

6.2.1.1.c Start-ups do not necessarily have more money

The researcher disagrees with Heirman & Clarysee (2007), who establish that start-up companies have an abundance of finance in order to enable innovation. It is not clear from the research analyses whether the business is new or well established.

Although the researcher definitely disagrees with Christensen (2007) who indicates that financing for innovation is relatively important to promote innovation. It is important but an abundant of finance is not necessarily needed.

6.2.1.1.d Financing innovation is not an obstacle for innovation

Christensen (2007) and Heirman & Clarysee (2007) found that financing innovation as an obstacle to innovation. The analysis in the researcher's experimental results indicates the opposite. It is important in the sense of using finance for innovation, although it is definably not an obstacle.

6.2.1.1.e Financial resources used in an environment for innovation

The research indicates that an environment where scarce financial resources are available would enable innovation. This would provide a starting point for



van Zyl (2005) who wants to know what to establish to enable an environment prone to innovation.

6.2.1.1.f More of the profits can be used to expand

Finance is shown to be important for innovation but not an abundant amount of it is needed. Rooks *et al.* (2005) indicates that innovation is recognised as the driving force behind economic growth. By having a scarce amount of finance available, the profits from the business can rather be used more for other ventures such as growth.

6.2.1.2 H1.b - The greater the amount of connections with suppliers, the greater the confidence that innovation will be successful

Chapter 5 concluded that the less the collaboration with suppliers, the greater the confidence that innovation will be successful.

6.2.1.2.a Spend less time with suppliers

The researcher does agree with Heirman & Clarysee (2007) and Frishammar & Hörte (2005) as their results indicate that alliances with other companies do not significantly enable innovation. Suppliers form part of the supply chain which is critical for companies to manage. So it is interesting that less time spent with suppliers increases the confidence that innovation will be successful. Although if less time is spent with suppliers innovative ways can be deduced on how to improve items such as just-in-time deliveries.

Other innovative ideas can possibly be increased by having more time available to ensure the parts or suppliers needed are more innovative from design and development meetings before ordering the parts.

6.2.1.2.b An increase in external connection do not necessarily increase the confidence that innovation will be successful

Rao & Drazin (2002) and Oerlemans and Pretorius (2006) conclude that the greater companies external connections, the higher their product innovation.



The research results indicate the less the collaborations with suppliers the higher the innovation. This suggests that that in an electronic engineering environment spending excessive time with suppliers is not best practice.

6.2.1.2.c Treated as a case-by-case basis

The researcher does agree with Freel (2000) describing that external linkages are best treated on a case-by-case basis. This can be that not all engineering companies work in the same manner and perhaps they are unique between their management of supplier collaborations.

6.2.1.3 H1.c - The greater the amount of connections with customers, the greater the confidence that innovation will be successful

Chapter 5 concluded that the less the collaboration with customers, the greater the confidence that innovation will be successful.

6.2.1.3.a The customer is important

The researcher does agree with Frishammar and Hörte (2005) who indicate that innovative companies maintain contact with customers. The researcher also agrees with Freel (2000) who indicates that involving the end user can promote success in business. This assists in ensuring the product is more innovative and that the end product and life span of the product is superior.

The researcher also agrees with Frishammar and Hörte (2005) who describe that customer needs are very important for innovation to be successful. This suggests that having more collaboration with the customers innovation could be increased, although the research results indicate the opposite.

6.2.1.3.b Decrease interaction with the customer

The researcher does not agree with Rao & Drazin (2002) who conclude that the greater the company's external connections that higher the products innovativeness is. The customer is important in business and the end results



are for their needs. Although to be innovative this research shows that less interaction with the customer is then needed.

6.2.1.3.c Scan customers but do not overdo it

The researcher does not agree with Frishammar & Hörte (2005) who indicate that scanning customers inhibits innovation. Customers are important to enable innovation, although it must not be overdone in an electronic engineering environment. This will ensure that the confidence in increasing innovation will be successful.

6.2.1.3.d Limited amount of resources to satisfy the customer's needs

Paladino (2007) describes resource orientation as entailing a “*unique resource base*”. Paladino (2007) describes that companies with a high degree of resource orientation will be able to achieve superiority in the market place together with making their internal operations and processes more efficient. Paladino (2007) goes on to indicate that companies will also be able to provide customers with offerings that satisfy their expectations.

The research results indicate that fewer resources are used to increase the confidence that innovation will be successful. In addition by having less customer collaborations with each part of the resource base the use of the limited amount of resources will satisfy the customer's needs.

6.2.1.4 Resources are important

The three hypotheses mentioned above include financial resources, supplier collaborations and customer collaborations. All the resources are important for innovation although in electronic engineering environments the research shows that by rather having a scarce supply of them the increase in the confidence of innovation can be increased.



The researcher therefore disagrees with Paladino (2007) who states that a high degree of resources orientation will enable achievement of superiority in the marketplace and promote efficiency in the company.

6.2.1.5 A different amount of resources affects a company's success rate

Talke (2007) describes that a company's performance is affected due to it having different amount of resources compared to another company within its industry. The research results indicate that the fewer financial resources, collaborations with suppliers and customers, increase the confidence that innovation will be successful. This indicates that by a company having fewer resources than another one in the same industry competitive advantage can be gained.

6.2.1.6 H2 - The greater the mindset of abundance, the greater the confidence that innovation will be successful

Chapter 5 concluded that no conclusion can be drawn from having a greater mindset of abundance and innovation.

6.2.1.6.a The source of innovation is not necessarily the abundance mentality

Chapas (2006) argues that the source of innovation is the abundance mentality. The research results indicate that the abundance mentality is not necessarily the source of innovation.

6.2.1.6.b More research is needed

Scarcity conditions as defined by the three resource hypotheses mentioned before. As there is no conclusion on the greater the mindset of abundance and innovation, the researcher confirms with Srinvas & Sutz (2008) that more research is needed in conditions of underdevelopment and scarcity. This is

especially in the case of the type of mindset needed to increase the confidence of innovation being successful.



6.2.2 Amount of resources and the type of mindset needed to estimate resource amounts

This section is split into three hypothesis sections.

6.2.2.1 H3 - The greater the availability of resources, the greater the internal people, contractors and salaries are estimated as needed to complete a project

Chapter 5 concluded that the greater the availability of resources, the greater the internal people, contractors and salaries are estimated as needed to complete a project.

6.2.2.1.a Take advantage of more human capital

Morck and Yeung (2001) describe that humans create their own intellectual property. Morck and Yeung (2001) indicate that the intellectual property is then used by companies by them extracting the knowledge and skills needed to be successful. Electronic engineering companies should consider in a resource abundant environment of using more personnel, as this will create the intellectual property necessary for companies to be successful.

6.2.2.1.b More human capital does not increase the pace of innovation

Paladino (2007) and Yeung (2001) indicate that the more human capital available within a company does not necessarily mean that the pace of innovation is faster. It is definitely more costly as salaries also increase although the pace of innovation could be the same if human capital is used in a scarce amount.

6.2.2.2 H4.a - The greater the mindset of abundance, the more the amount of contractors are estimated as needed to complete a project

Chapter 5 concluded that the greater the mindset of abundance, the more the amount of contractors are estimated as needed to complete a project.



6.2.2.2.a Employment opportunities with an abundance mindset

Krishnan and Kumar (2003) indicate that opportunities are perceived as unsafe with a mindset conditioned by resource scarcity. This suggests that moving more towards a scarcity mindset is something which is to be avoided at all costs.

This is confirmed here because by having a greater mindset of abundance the more contractors are employed. This in turn promotes business and lessens unemployment rates. Therefore by having a greater mindset of abundance more opportunities are foreseen and unemployment rates decrease with risk being reduced.

6.2.2.3 H4.b - The greater the mindset of abundance, the more the amount of connections with customers are estimated as needed to complete a project

Chapter 5 concluded that the greater the mindset of abundance, the more the amount of connections with customers are estimated as needed to complete a project.

6.2.2.3.a The greater the abundance mindset the more customer collaborations are needed

Hypothesis H1.c is supported with Paladino (2007) that fewer customers are collaborated with to increase the confidence that innovation will be successful. English (2004) defines that the abundance mentality is taken on when a person perceives that there are many resources available together with success to share with others. This suggests that in this case where the greater the abundance mindset the greater the amount of customer collaborations are needed.



6.2.3 Resource and mindset type interaction

This section of hypotheses is split into two hypothesis sections.

6.2.3.1 H5.a - A mindset of abundance will interact with resource abundance so that more contractors are estimated as needed to complete a project

Chapter 5 concluded that a mindset of abundance will interact with resource abundance so that more resources are estimated as needed to complete a project.

Companies should notice that they would use fewer contractors if they have a scarcity mindset. As the environment goes more towards an abundant mindset as well as an abundant resource environment the mean value from the amount of contractor's increases.

In an abundance mindset scenario people are more positive compared to a scarcity mindset scenario where people are not as positive. English (2004) defines that the abundance mentality is taken on when a person perceives that there are many resources available together with success to share with others. The researcher agrees with Ladika (2005) who identifies the abundance mindset being the mindset for team executive to adapt to. In this case the greater the adaptation to an abundance mindset the more contractors are estimated to complete a project.

6.2.3.2 H5.b - A mindset of abundance will interact with resource scarcity so that less internal people are estimated as needed to complete a project

Chapter 5 concluded that a mindset of abundance will interact with resource scarcity so that fewer resources are estimated as needed to complete a project.



6.2.3.2.a An entrepreneur and innovation

The researcher agrees with Van Zyl (2005) indicating that an entrepreneurial mindset (abundant mindset) is important for promoting innovation. As an entrepreneur starts his company there are usually not a lot of people so the research results fit directly into an entrepreneurial culture. This suggests that by having an abundant mindset within an environment of resource scarcity fewer people will be employed.

Although for an abundance mindset and scarce resource environment less internal people are needed. This can be quite effective as by having people with abundant mindsets and having an environment where resources are scarce innovation can be promoted. This could also mean that the size of the company could be less with having less human resources being needed.

6.2.3.2.b Constraints must be used

Prahalad (2006) indicates constraints in an innovation sandbox must be accepted and used to innovate with. In resource scarcity environments it seems that South African engineering companies would promote innovation. Having a mindset of abundance and resource constraints the amount of internal people are fewer. This suggests that by using the resource constraints the abundance mindset to estimate less resources needed.

6.2.3.2.c Idiosyncratic innovation directions are encouraged

Srinivas & Sutz (2008) describe that under scarcity conditions idiosyncratic innovation directions appear which provide interesting solutions for problems that cannot be solved normally. As this hypothesis indicates the fewer internal people create a resource scarcity environment, although with a mindset of abundance it is true that solutions can be found to encourage innovation.



6.2.3.2.d Less resources and a mindset of abundance increasing the success of innovation

Hamel and Prahalad (1993) describes that a company which uses less resources but having a mindset of abundance can outperform a company which uses more resources but with a mindset of scarcity. Hamel and Prahalad (1993) indicates that the problem with having too many resources is that the ambition to perform decreases. This suggests that by utilising fewer resources but having a more abundant mindset innovation can be promoted.

The research results confirm that fewer resources and a mindset of abundance do results in electronic engineering companies to employ less people. As in hypothesis H1.a, fewer financial resources are encourages to increase the success of innovation.



6.3 South Africa spends less on innovation

Rooks *et al.* (2005) described that not much is known about the innovation behaviours of South African companies. Rooks *et al.* (2005) also described that during a comparison between South African companies and European Union companies that South African companies spend less on innovation. This is true as research indicates that less financial resources are spent on innovation.

6.4 The results indicate how to take innovation further

The researcher's results do definitely indicate that there are a lot of worthwhile learning's and important enablers for innovation, which are discussed in more detail below.

6.4.1 An entrepreneurial culture fosters innovation

Van Zyl (2005) describes that an entrepreneurial culture is needed to foster innovation. This is confirmed here that an abundant mindset and scarce financial resources do foster innovation.

6.4.2 An abundance mindset increases the use of contractors and customers

For external connections with customers the researcher has indicated that an abundant mindset environment promotes an abundant amount of hours to be spent with customers in order to promote innovation. Similarly with an abundant mindset more contractors are foreseen.

An abundant mindset is therefore ideal in order to interface more with customers and employ more external personnel to promote innovation.



Although to use a scarce amount of resources, the research data only indicates that less internal people can be used within a scarce resource environment.

6.4.3 Environments do matter

The researcher has indicated that environments can make a difference to what the company would like to achieve. This suggests that under different conditions managers can utilise resources and human capital mindsets differently to increase the effectiveness of innovation.

6.5 What does the researcher want to accomplish next

To explore the results further the researcher discusses more ways to move forward below.

6.5.1 Test scenarios out in practice

It would be ideal if the scenarios could be tested out in practice so that the results can be confirmed. If for instance people with abundant mindsets could all operate in different companies to produce the same innovative product in industry, then the experimental design could be realised.

Ultimately experiments are only worthwhile when they are confirmed in practice. The outcome of the success in using less financial resources with training people to have an abundant mindset many positive outcomes for the economy can be realised. This in itself can not only help companies be more successful with innovation but also promote provinces, countries and ultimately the whole world to be more understanding about promoting innovation and living contentedly.



6.5.2 Real live situation being surveyed

It would be ideal if companies could be surveyed which are actually competing on similar products as this would take this current research into a real live situation.

It is very difficult to control data in real life, although if a business has many subsidiaries competing internally against one another but with different strategies, the results from this experimental data could be tested in practice and surveyed to spread the word of how companies can be successful.

6.5.3 Opportunity for companies to succeed

Companies should understand that innovation is important for their development and their success in the market. Hichert and Roux (2009) describe that scenario planning can be used to test methods for companies to find potential solutions to ensure they are still around in the future.

This suggests that companies should utilise experimental scenarios as useful tools, which they can learn from and adapt to fit their company's strategies. By using these scenarios companies will be able to always be one step above the rest as they will more accurately know which directions they can follow to gain from there foreseen opportunities.

By companies running internal scenarios they can experimentally find solutions that do not require actual resources, funding or groups of personnel. The benefits from internal scenarios can be enormously beneficial to companies to be more successful.

6.6 Concerns as a result of the research sample

Concerns that are a result of the research sample as discussed below.



6.6.1 More information on target prices

The researcher could have indicated that the CEO envisioned a target price or a type of quality for the innovative crash recorders. This would have given the respondents more target prices of the environment that the company works in.

To have a better idea on the background of the actual product or project is critical for the analysis to be conducted correctly.

6.6.2 Prioritise timescale achievement

In lieu of the recent airplane accidents that have taken place worldwide in 2009, perhaps there should have been more emphasis on the timescale to achieve a new crash recorder. If different models could be launched with different specifications then timescales could potentially be minimised.

If this was made more of a priority in the scenarios then the research sample could have been more aware of the importance of the innovative product being finalised.

6.7 Summary

The discussion of the results indicates that fewer financial resources and the less supplier collaborations and customer collaboration has an effect on increasing the confidence that innovation will be successful. As fewer resources are important for innovation the researcher indicates that start-up companies do not necessarily have an abundance of financial resources.

The discussion of the results indicate that the greater the mindset of abundance is not necessarily the source of innovation and that more research is needed, especially in scarcity conditions.

The researcher indicates that in abundant resource environments companies should take advantage of hiring more internal people and contractors although they will need to increase the salary budget. This can be beneficial to decrease unemployment but will cost more and not necessarily increase innovation.

The greater the mindset of abundance the more customer collaborations are needed along with hiring more contractors. By having a mindset of abundance with a resource abundant environment the researcher indicates that more contractors are needed to complete projects. Whereas still having a mindset of abundance but being in a resource scarce environment less internal people are needed.

These results suggest that constraints must be used in a company and can benefit the company. The results indicate that an entrepreneurial cultures foster innovation and most importantly, different environments do make a difference to performance outcomes within a company.

The researcher has indicated two concerns about the research sample. The first being that more information could have been provided on target prices to get better responses from the research sample. By also prioritising timescale achievement for the product to be launched, more awareness of the importance of the innovative product being finalised could have been achieved.



Chapter 7 Conclusion

7.1 Introduction

This chapter indicates what the main findings are with recommendations to stakeholders provided. Limitations of the research are discussed with future research areas discussed last.

7.2 Main findings from this research

The main findings from this research are discussed below.

7.2.1 Fewer connections with suppliers and customers along with less financial resources are needed to increase the confidence in innovation

The research has indicated that for electronic engineering companies spending less time with customers and suppliers along with having smaller budgets for projects, confidence in innovation can be increased. This is fascinating as usually one would expect to spend more time with suppliers and customers in order to promote your project further. A very positive outcome is that by having a smaller budget for a project, innovation is actually improved. This suggests that more of profit does not need to be spent on funding projects further, but can be spent on other strategic ventures.

7.2.2 The greater the mindset of abundance does not necessarily increase the confidence that innovation will be successful

The research results indicate that the greater the mindset of abundance does not directly affect the confidence in innovation. The researcher does indicate that further research is needed on the mindset of abundance as well as the mindset of scarcity. By having more research with conclusive results on the

impact that the greater the mindset has on innovation, more structure can be added to the current literature.

7.2.3 More abundant mindsets increase the amount of contractors and customer collaborations

The research has shown that by having more abundant mindsets the amount of contractors and customer collaborations are increased. This is not necessarily a bad thing although innovation is not guaranteed to be increased within this environment. These results though do add to the literature regarding the results more abundant mindsets have on resources in electronic engineering companies.

7.2.4 Scarce resources and abundant mindset environments do matter

The research has shown that in innovative electronic engineering companies, fewer internal people are recruited in scarce resource environments. Although to enable this a mindset of abundance is required.

Many start-up companies are in situations where too many human resources are sourced, which result in the companies being unsuccessful. This is usually because companies perceive that the more personnel available, the better the company can succeed.

Human resources who boast mindsets of abundance within companies can assist their companies to employ less human resource and ensure a result in being successful in resource scarce environments. This suggests that environments are always changing in a company's life cycle and adaptations to hiring techniques and management of resources are extremely important to continue being innovative.



7.3 Recommendations to stakeholders

From the results obtained and the main findings from this research the recommendations to stakeholder are discussed below.

7.3.1 The more resources which are available the more companies will employ people

The research results have indicated that when more resources are available, that companies will employ more internal people and more contractors. This will result in increased amounts of funding required in the form of salaries, to finance the growth of the company.

Stakeholders should therefore notice that when resources are in an abundance supply, they are more likely to employ more personnel as well as increasing their human resource financial budget. The research does indicate though that this does not necessarily affect the rate of innovation.

The benefit for the company employing more personnel is that the company will grow and decrease the unemployment rate for the country. This can also help to increase the economic output of the country and enable a small sized company to become a medium sized company.

7.3.2 A company working in an abundant resource environment employing abundant mindset personnel will employ more contractors

The research has shown that a company working in an abundant resource environment employing abundant mindset personnel will employ more contractors. This again is not necessarily a bad thing as growth is foreseen and by providing more business to contractors companies can grow by outsourcing non core elements to external people.



7.3.3 Every company is unique and needs to be analysed individually

The research results have shown that electronic engineering companies, which utilise scarce resources, can increase the confidence of innovation being successful. Although in different environments such as abundant resource environments, resources can decrease the confidence of innovation being successful. The researcher does agree with the literature to treat companies promoting these tactics as a case-by-case basis. This suggests that these results are specific to the companies which were surveyed and should be taken lightly to other companies.

All companies are unique and therefore need to analyse their cause and effect plans separately. This will ensure that they are aware of what to do in changing environments.

Companies should make use of plans which can be implemented before or during environmental changes. This will result in companies being extremely flexible and successful to enable them to be very competitive in their market.

7.3.4 Incorporate scenarios and experimentation within a company is critical

Scenarios and experiments are useful to explore and conduct within a company. Scenarios and experiments being carried out within companies can enable company to test out different options, without actually involving a lot of risk.

The research results involving experiments and scenarios have shown that scarce or abundant resource and mindset environments do have a big impact on innovation. Ultimately stakeholders should understand that they have the



power within them to incorporate the recommendations from this research and to utilise it for their own benefit. Stakeholders should also make use of their own internal experimentations and scenarios to design and plan ways to increase their potential to innovate and be more successful.

7.4 Limitations of the research

The limitations of the research are discussed below.

7.4.1 More measures to enable more accurate analyses

The researcher indicates that more useful measurement could have been added to the questionnaire. There was a variety of measurements in the questionnaire, although more measurements around specific industry projects could have been added. This would have provided more insight into current problems companies are facing and also provided more accurate analyses to be conducted.

More responses concerning customers and suppliers for instance were also lacking and could indicate shortfalls that companies are not necessarily aware of. Only companies developing or manufacturing electronic engineering products were analysed. The end customer or the supplier could have been surveyed in order to provide responses on how they perceive affecting their customers' innovative products.

7.4.2 People know-how and company size

The respondents could have been surveyed only at management levels within electronic engineering companies. This would ensure that the respondents would know more about similar electronic engineering products or solutions.



Although in practice to find the enough management level respondents it is quite a challenge as there are always more engineers than there are managers.

The company sizes did vary between the responses and by limiting the company sizes to more specific levels, the results could have been even more specific. By analysing companies grouped into small, medium or large companies, the results could have been more directed and meant more for specific companies.

7.5 Future research

Future research on this subject could be completed in different industries such as automation, manufacturing or banking. Future research could also be conducted in real live situations, where companies could isolate sections of their business in order to develop or produce similar products. By then utilising different resource structures and mindset types, results could be recorded and compared to theory to enable feedback for even more future research.

7.6 Summary

The researcher has indicated that fewer connections with suppliers and customers along with less financial resources are needed to increase the confidence in innovation being successful. The researcher has then suggested that the profit from the company's sales could be spent on other strategic ventures rather than ploughing back into existing projects.

The researcher has also indicated that the greater the mindset of abundance does not necessarily increases the confidence that innovation will be successful. Therefore more research is needed on abundant mindset as well as scarcity mindset scenarios, which directly affect innovation.



Most importantly the researcher has indicated that scarce resource and abundant mindset environments do matter. In addition, the researcher has indicated that changing environments are constantly in companies pathways and that they should be ready to implement their best decision by making scenario planning part of the business strategies.

The researcher has also indicated that by having more measures in the questionnaire more accurate results could be achieved. This would better indicate how the confidence in innovation being successful can be achieved.

Another limitation of the research was proposed to have the research confined more to specific people in companies. By also segmenting companies and conducting research only aimed at them, more of the results could have been optimised.

This led the researcher to recommend that more research is needed on different industries as well as conducting research in real live situations to provide more meaningful results.



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2. Appendix-A

2.1. Scenario's



2.1.1. *Abundance Mindset - Abundance Resources (AM-AR)*

Memo from CEO

Re: Our innovative crash recorder project

Dear Colleague,

As you know our company, *InnoTron*, is involved in leading edge product design and development and we have been very successful in carving a niche for ourselves in the market.

Changes in the business environment globally have made it easy for companies from South Africa to compete internationally. This has enabled us to have access to customers from across the world, and even to universities and firms from other parts of the world. Companies are communicating freely and feel that to share information is nothing out of the ordinary. This means that we have, to a greater extent than ever before, access to cutting-edge resources of the leading companies in the world. In addition, government is welcoming international trade which is creating new opportunities for our company to succeed. We at *InnoTron* are feeling confident that all these opportunities can only benefit us!

I am therefore very excited to be able to ask you to review an opportunity for a project to develop two qualified innovative crash recorders.

The recorders must fit into as small as possible space, with each system having to comply with the following detail requirements:

- To have a total weight less than 11kg, whereas top of the range crash recorders currently weigh in excess of 12.5kg.
- To operate from a military spec power supply module that must utilise the aircrafts 115VAC 400Hz power as direct input, utilising less than 12VA. The latest crash recorders in the market currently use an already rectified DC power source that consumes less than 15VA of aircraft power.
- To utilise a control processor module which main function is to communicate from the aircrafts dual redundant serial communications interface as well as a dual redundant audio interface.
- To utilise a non-sequential storage system module used to log aircraft data, which would use solid-state storage capacity that could accommodate at least 2 hours of audio recording and 30 hours of flight data. This is 50% more than the capacity of current crash recorders.



The two qualified crash recorders must be able to achieve the following qualification criteria:

- To be equipped with an underwater locator beacon that must be capable of sending a signal out for up to 40 days, as opposed to the industry standard of 30 days.
- To be able to be immersed up to a depth of 7500 meters for 30 days.
- To be resistant to being immersed in aircraft fluids including jet fuel, lubricants and fire-extinguisher chemicals for 24 hours (i.e. meet the current standard for crash recorders).
- To be able to record data at the market standard, a rate of 64 words per second.
- To have a real time playback capability of all channels. This is new to crash recorder technology as current playback is limited to only one channel at a time.

If we get the contract, we need to develop the two crash recorders within about 10 months from now.

We have R4.8 million in cash available for development projects. More financial resources are available as we have received positive feedback from our banks and loan departments regarding additional finance.

As you know, our workforce consists of 60 personnel with experience on similar projects. We expect that close to half of them will be available to be deployed on this project. In addition, we have a strong contractor base, and I am quite sure that we will be able to access some good additional people if we need to.

I think you will agree that we also benefit from very involved customers who are loyal to our products and with whom we communicate with on a regular basis. A number of them have indicated that they may be interested in the crash recorders and that they will be happy to help brainstorm with us about the project.

In addition, our suppliers (currently standing at about 30) are becoming a core part of our project teams. We have increasingly been benefiting from our strategy to develop cooperative relationships with suppliers, and we have received important help from them in the past year about how to address engineering problems. We are certain that we can continue to draw on their insights.

I am putting together a proposal for the crash recorder project, and I would like some indication from you, my staff, about the resources required to complete this project successfully. Please complete the attached questionnaire to give me an idea of the resources you think we will need.

Regards,

Mike Simmons
InnoTron CEO



2.1.2. Abundance Mindset - Scarce Resources (AM-SR)

Memo from CEO

Re: Our innovative crash recorder project

Dear Colleague,

As you know our company, *InnoTron*, is involved in leading edge product design and development and we have been very successful in carving a niche for ourselves in the market.

Changes in the business environment globally have made it easy for companies from South Africa to compete internationally. This has enabled us to have access to customers from across the world, and even to universities and firms from other parts of the world. Companies are communicating freely and feel that to share information is nothing out of the ordinary. This means that we have, to a greater extent than ever before, access to cutting-edge resources of the leading companies in the world. In addition, government is welcoming international trade which is creating new opportunities for our company to succeed. We at *InnoTron* are feeling confident that all these opportunities can only benefit us!

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If we get the contract, we need to develop the two crash recorders within about 10 months from now.

We have R3.2 million in cash available for the project. Given the tight financial situation right now, I am not sure how easy we will find it to access additional debt from our banks and loan departments.

As you know, our workforce consists of 30 personnel with experience on similar projects. We expect that about a third of them will be available to be deployed on this project. If we can find contractors with the right type of specialised skills, we can of course bring them in. However, in the light of our resource constraints, we want to avoid bringing in people who will learn at our expense on the job!

I had hoped to get inputs from a number of existing customers who have indicated that they may also be interested in the crash recorders. However, most of them indicate that they are currently not in a position to help us even brainstorm on the project.

I have found a similar response from suppliers. Although we have a strategy to develop cooperative relationships with our about 20 suppliers, they still seem very concerned that we may “abuse” their inputs. So I would not assume that we can draw too much on the skills of our customers or suppliers to get this project done.

I am putting together a proposal for the crash recorder project, and I would like some indication from you, my staff, about the resources required to complete this project successfully. Please complete the attached questionnaire to give me an idea of the resources you think we will need.

Regards,

Mike Simmons
InnoTron CEO



2.1.3. Scarce Mindset - Abundant Resources (SM-AR)

Memo from CEO

Re: Our innovative crash recorder project

Dear Colleague,

As you know our company, *InnoTron*, is involved in leading edge product design and development and we have been very successful in carving a niche for ourselves in the market.

As you are no doubt aware, the current downturn is fundamentally challenging companies around the world. Giants in business like GE are floundering, and small businesses like ours find ourselves in a very difficult situation. We play in a global market place, and most of our competitors' governments have started providing additional support to companies. We, however, are on our own – we are not getting any additional support from our government, making it even harder to compete effectively. The firms that are developing cutting-edge technology realise that the technology will determine their survival, and they are very unwilling to share it. The rest of the companies find themselves in a brutal price war where they are asked to provide more and more at ever lower prices.

To try and get ourselves out of this “race to the bottom”, we have decided to pursue an opportunity for a project to develop two qualified innovative crash recorders.

The recorders must fit into as small as possible space, with each system having to comply with the following detail requirements:

- To have a total weight less than 11kg, whereas top of the range crash recorders currently weigh in excess of 12.5kg.
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I think you will agree that we also benefit from very involved customers who are loyal to our products and with whom we communicate with on a regular basis. A number of them have indicated that they may be interested in the crash recorders and that they will be happy to help brainstorm with us about the project.

In addition, our suppliers (currently standing at about 30) are becoming a core part of our project teams. We have increasingly been benefiting from our strategy to develop cooperative relationships with suppliers, and we have received important help from them in the past year about how to address engineering problems. We are certain that we can continue to draw on their insights.

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Regards,

Mike Simmons
InnoTron CEO



2.1.4. Scarce Mindset - Scarce Resources (SM-SR)

Memo from CEO

Re: Our innovative crash recorder project

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Regards,

Mike Simmons
InnoTron CEO



2.1.5. Questionnaire Consent

Questionnaire Consent

I am doing research on innovation in an electronic engineering environment. You are asked to read a scenario and complete a questionnaire about it within that context. This will help us better understand the resources needed to support innovation, and should not take you longer than 15 minutes to complete. Your participation is voluntary and you can withdraw at any time without penalty. Of course, all data will be kept confidential. By completing the questionnaire, you indicate that you voluntarily participate in this research. If you have any concerns, please contact me or my supervisor. Our details are provided below.

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3. Appendix-B

3.1. Questionnaire



Proposal to CEO

No.	Question	No.	Response			
Project related questions		<i>Fill in appropriate box with tick.</i>				
1	Estimate the budget to produce the crash recorders to spec and on time? EXCLUDE the cost of human resources. The budget should consist of materials, technical equipment, qualified testing etc.	1	R			
2	How many internal people do you estimate are needed to develop the crash recorders?	2	internal people			
3	How many contractors do you estimate are needed to help <i>InnoTron</i> develop the crash recorders?	3	contractors			
4	Estimate the budget (cost to company) for the salaries of the human resources involved in developing the crash recorders, including contractors over the 10 months?	4	R			
5	Estimate how many hours customers will contribute to help <i>InnoTron</i> develop the crash recorders?	5	hours			
6	Estimate how many hours suppliers will contribute to help <i>InnoTron</i> develop the crash recorders?	6	hours			
7	Do you feel that to develop the crash recorders that there will be adequate resources available?	7	Yes	No		
8	Are you optimistic at developing the 2 crash recorders within 10 months?	8	Agree Strongly	Agree Moderately	Agree Slightly	Disagree Slightly
9	How much time (in months) do you think you will overshoot (+) or undershoot (-) the delivery of the 2 crash recorders?	9	months			
10	Based on the information you proposed, do you feel that the conditions, which I described before are easy in order to develop the 2 crash recorders?	10	Agree Strongly	Agree Moderately	Agree Slightly	Disagree Slightly
11	Do you feel that there are a lot of opportunities for this project to succeed?	11	Agree Strongly	Agree Moderately	Agree Slightly	Disagree Slightly



Demographics						
12	What is your current age?	12	less than 21	21 to 29	30 - 39	40 - 49
13	What is your race?	13	Black	Asian	Coloured	Indian
14	What is your gender?	14	Male	Female		
15	How many years have you been at your current company?	15	less than 2 years	2 to 4 years	5 years	6 - 8 years
16	What is the closest match to your current job position?	16	Assistant	Technician	Engineer	Manager
17	Approximately how many people work for the company you work for?	17	less than 20 people	21 to 35 people	36 to 50 people	51 to 65 people
General information about you						
18	Do you generally find something positive in even the most difficult situations?	18	Most of the time	Often	Sometimes	Rarely
19	When you are feeling down do you focus on the good things in your life instead of the bad?	19	Most of the time	Often	Sometimes	Rarely
20	When you have a difficult problem to solve do you look at it from different angles in order to come up with a solution?	20	Most of the time	Often	Sometimes	Rarely
21	No matter what life throws at you do you believe that you can deal with it?	21	Strongly agree	Agree	Sometimes	Disagree