VICTORIA UNIVERSITY OF WELLINGTON
*Te Whare Wananga o te Upoko o te Ika a Maui*

# *The influence of data management, organisation culture and organisation motivation on the likeliness of Business Intelligence adoption*

A Research Study presented to the

School of Information Management

Victoria University of Wellington

by

*Ria van den Berg*

300276435

in partial fulfilment of the requirements for the MMIM 592 course.

*31 October 2014*

**Declaration**

1. I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

2. I have used the APA convention for citation and referencing. Each contribution to, and quotation in, this *research study* entitled: T*he influence of data management, organisation culture and organisation motivation on the likeliness of Business Intelligence adoption* from the work(s) of other people has been attributed, and has been cited and referenced.

3. This paper is my own work.

4. I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work

5. I acknowledge that copying someone else's assignment, essay or paper, or part of it, is wrong, and declare that this is my own work.

Signature(s) Date 31/10/2014

Cornelia Maria van den Berg

Full name(s) of student(s)

**Abstract**

Business Intelligence has become a powerful business tool that describes the business environment, the organisation, its situation in terms of markets, customers, competitors and its financial situation. The objective of BI is to increase the overall performance of the organisation through an informed decision making process. This research study objective is to identify the organisational factors that will increase the likeliness of BI adoption by small-to-medium enterprises (SME's) in New Zealand. Existing research studies however, focus predominantly on the challenges and benefits of BI technologies adoption. Importantly this study do not define BI as purely a technology but defines it as methods, processes and technology that work together to gain intelligent insight from business information. The organisational factors identified that formed the hypotheses of the research model included data management, organisation culture and organisation motivation. These factors were identified through factor analysis that included technology adoption models and existing research studies specifically related to SME BI and technology adoption. The outcome of the research has identified that only organisation motivation in the context of competitiveness and perception of BI's value and benefits can significantly influence the likeliness of BI adoption. New Zealand SME's form the backbone of the country's economy and also operate in extreme competitive niche markets. The adoption of BI practice and the use of information as a strategic resource will enable SME's to be more innovative and competitive.

*Keywords: Business intelligence, data management, organisational culture, leadership, innovativeness, competitiveness, BI value and benefits, analytical maturity*

**Acknowledgements**

This research study is a product of previous studies, experience over my working career and very importantly my MIM journey. It was certainly not always easy to juggle the balance between life, work and studies. Through the strength of my religious faith, the support of so many people, the inspiring words of my Irish fridge magnet *"You won't get where you want to be, if you only travel on sunny days"*, my determination and long hours in my study, brought me to this point.

I was not able to do this on my own and I therefore would like to thank everybody that played a role. I would like to thank all my MIM lecturers for their wisdom and support with my studies. Special thanks go to Dr. Tiong Goh, my supervisor for this research study. Thank you for your wisdom, support and patience, guiding me through this journey. Also a special thank you to Tony Hooper for his advice and guidance.

A special thanks goes to Robyn Skrzynski who is a very special friend and also the person who did the proofreading for all my MIM papers including this research paper. Thank you for being there. Apologies for the last minute requests and fixing the same grammar mistakes over and over. I guess English grammar will forever stay "foreign" to me.

Thank you to all my friends and work colleagues and fellow MIM students who over the past 3 years enquired into my progress and patiently listened to my frustrations and victories. Special thanks then specifically to Paul and Carla Weyers for their personal interest, support and encouragement all along the way.

Lastly to the people very close to my heart. My sisters, Ina and Christa, for supporting me and encouraging me on the hard days. My husband, Ernie, who definitely had to play second fiddle when it came to time that we could have spent together. Thank you for your support and all the things you did for me to make this possible. Then to my parents, Louis and Susan La Grange. My parents from a very young age planted the seed of the importance of learning. Thank you for your unconditional love, support and encouragement to keep this seed alive. I will forever endeavor to make you all proud.

## Table of Contents


**1 Introduction ..... 1-1**

1.1 Background of the Study Research Question ..... 1-1

1.2 Research Objective and Question ..... 1-2

1.3 Research Contribution and Significance of the Study ..... 1-2

1.4 Outline of the Study ..... 1-3

**2 Review of Literature ..... 2-4**

**2.1 Small to Medium Enterprises (SME's) in New Zealand** ..... 2-4

2.1.1 SME Definition and Characteristics ..... 2-5

2.1.2 SME and Information Technology Adoption ..... 2-8

**2.2 Business Intelligence** ..... 2-10

2.2.1 Defining BI ..... 2-10

2.2.2 BI in Action ..... 2-13

2.2.3 BI Success ..... 2-15

**2.3 Data Management** ..... 2-18

2.3.1 Structure ..... 2-19

2.3.2 Uniqueness ..... 2-20

2.3.3 Integration ..... 2-20

2.3.4 Quality ..... 2-21

2.3.5 Accessible ..... 2-22

2.3.6 Privacy ..... 2-22

2.3.7 Governance ..... 2-23

**2.4 Organisational Culture** ..... 2-25

2.4.1 Innovative Capability ..... 2-25

2.4.2 Leadership Style ..... 2-29

**2.5 Organisational Motivation** ..... 2-33

2.5.1 Strategic Drive and Competitiveness ..... 2-33

2.5.2 Competitive Advantage ..... 2-33

2.5.3 Information as Strategic Resource ..... 2-34

2.5.4 Use of BI to Gain Competitive Advantage ..... 2-35

2.5.5 BI Business Value ..... 2-36

**3 Research Design and Methodology ..... 3-40**

3.1 Research Design ..... 3-40
3.2 Conceptual Framework and Hypothesis Development ..... 3-40
3.2.1 Exploratory Study ..... 3-40
3.2.2 Conceptual Framework ..... 3-45
3.2.3 Hypotheses ..... 3-45
3.3 Data Gathering ..... 3-48
3.4 Research Instrument ..... 3-49
3.5 Data Analysis Methods ..... 3-50
3.5.1 Descriptive Analysis ..... 3-50
3.5.2 Reliability Test ..... 3-50
3.5.3 Hypothesis Testing ..... 3-50
**4 Results ..... 4-52**
4.1 Data Preparation ..... 4-52
4.2 Data Reliability ..... 4-52
4.3 Descriptive Analysis ..... 4-52
4.3.1 SME Demographics ..... 4-53
4.3.2 Descriptive Results per SME's Analytical Maturity ..... 4-59
4.3.3 SME Profile per Maturity Level ..... 4-60
4.3.4 Descriptive Results per Research Constructs ..... 4-65
4.4 Hypothesis Testing ..... 4-71
**5 Discussion ..... 5-75**
**6 Challenges and Limitations of the Research ..... 6-82**
6.1 Research Limitations ..... 6-82
6.2 Research Challenges ..... 6-82
6.3 Future Research ..... 6-82
**7 Conclusion ..... 7-83**
**8 References ..... 8-84**
**9 Appendixes ..... 9-99**
9.1 Appendix 1: BI Definitions ..... 9-99
9.2 Appendix 2: Questionnaire ..... 9-101
**10 List of Figures ..... 10-109**

**11 List of Tables..... 11-110**

# 1 Introduction

## 1.1 Background of the Study Research Question

The information evolution is affecting the way in which organisations do business. It changes the industry and also changes the rules of the competition (Porter, 1985).

Information has become a strategic resource to achieve and sustain competitive advantage (Rubio & Aragon, 2009). Business intelligence (BI) practices become a powerful tool that enables organisations to gain an understanding and interpret business information. BI, however, is not new and existed long before BI technology and big data came on to the business scene. BI in its most simplistic form paints the picture in which an organisation operates. It describes the business environment, the organisation, its situation in terms of markets, customers, competitors and its financial situation (Lonnqvist & Pirttimakie, 2006). The importance of having the right picture to make the right decisions is described by Thomas (2001), using the analogy of the risk a pilot is facing when he loses contact with the control tower and his on-board radar. “Experience and knowledge of the flight path doesn't necessary reduce the risk if uncertainty in regards to the flight environment exists. The same applies to business leaders making decisions without knowing their business environment. It doesn't matter if the plane is big or small, the pilot must have information of the flight environment. Likewise regardless of an organisation’s size management needs to have information of the internal and external business environment to make the right business decisions.” This statement is then also supported by Fuld (1995) that highlights that all companies large or small have access to the same information and it will be those that convert information into actionable intelligence that will create opportunities for competitive advantage. BI practices provides the means for organisations to gain competitive intelligence and create competitive advantage.

This research study is particularly interested in Small-to-Medium Enterprises (SME) in New Zealand. SME’s worldwide are recognised as the spine of the world economy (Scholz, Schieder, Kurze, Gluchowski, & Boehringer, 2010), which is not any different in the context of New Zealand (NZ), where 97% of enterprises in NZ are within the SME sector. NZ SME’s operate in niche markets and target the same markets and customers

(Ministry of Business and Innovation [MBIE], 2014). SME's therefore are required to know their environment and use all resources strategically including business information to achieve and sustain competitive advantage. The reality is that SME's are facing difficult challenges to stay afloat with the onslaughts of the business world. Statistics over the past decade have shown that there was an increase in SME' "deaths" and a decrease in "births". Applying BI processes, methods and use of technology can enable SME's to strengthen their position in the market and create sustainable competitive advantage. The key potential benefits that can be derived from using BI practises can lead to the improvement and support of business decisions, improved data management practices and exploitation of new markets and opportunities. BI has the capability to positively impact the overall performance of the organisation.

## 1.2 Research Objective and Question

This research objective is to look at BI from an organisational perspective and explore the factors that can increase the likeliness of BI adopting. The research question this study aims to answer is: *What organisational factors may increase the likeliness of BI adoption?*

## 1.3 Research Contribution and Significance of the Study

The benefits and scientific value of the project is that it will add to the limited body of knowledge in regards to SME's and BI adoption from an organisational perspective. Research on SME's and BI is limited and the focus of existing studies are primarily technology focused and relates to the challenges and benefits of BI for SME's. This research study will explore the organisational factors that contribute to the adoption of BI practices. The New Zealand government has multiple initiatives that provide support to SME's. The knowledge gain from this study may have the potential to provide insight into how the New Zealand Government can further assist SME's achieving organisational objectives through using information strategically and practically.

## 1.4 Outline of the Study

This research report consists of nine parts. Part 2, the literature overview, will follow the introduction. The literature review reflects on the topics of the SME in New Zealand, Business Intelligence, Data Management, Organisational Culture and Organisational Motivation. Part 3 provides an outline of the research design and methodology. Part 4 outlines the results. Part 5 includes discussion of the findings. Part 6 outlines the challenges and limitations of the research and is followed by part 7 which contains the conclusion followed by the references and appendixes.

# 2 Review of Literature

## 2.1 Small to Medium Enterprises (SME's) in New Zealand

Small to Medium Size Enterprises are considered to be the spine of the world's economy (Scholz et al., 2010) and are therefore also major economic players that contribute to national, region and local economic growth (Taylor & Murphy, 2004). The European Commission (2008) indicates that 95% of enterprises are SME's. These facts also apply to New Zealand where 97% of enterprises are within the SME's sector and provide employment to 2,990,000 employees. SME Enterprises contribute to approximately 30% of New Zealand's GDP and are representative of every industry and every part of New Zealand. SME activities are visible throughout the value chain contributing either as primary or complementary contributors. The majority of SME's only contribute to the domestic economy with 75% of SME's not exploring overseas markets. Limited experience of overseas markets poses the most common barrier for overseas trading. SME's focus predominantly on the domestic market and produce a variety of products and services to niche markets instead of mass markets. This is therefore a highly competitive market and innovation is key for productivity growth and to being competitive. In comparison, with larger organisation SME's innovation is more focused on investment in innovative marketing. (MBIE, 2014). These observations in regard to New Zealand SME sector also correlate with the views of Wong and Aspinwall (2004) who highlight the roles and functions of SME's to ensure economic growth. The roles that SME's fulfil are:

- To explore opportunities. Individuals set-up their own businesses and become entrepreneurs and apply skills and abilities.
- To provide job opportunities to the wider workforce.
- To be a source of innovation that brings forward new products, service, processes and work practices.
- To provide a variety of products and services.
- To be specialist suppliers of parts, components and sub-assemblies and also to perform the role as sub-contractors to large companies.

SME's ensure that the economic system as a whole is working efficiently and play the role of a catalyst for healthier competition and positive influences on monopolies and market powers. Through their influence SME's prohibit large companies from driving prices to increase profit margins (Wong et al., 2004).

Over the past decade there were fewer SME "births" and there was an increase in "deaths". It is also the New Zealand government's objective to support SME's for the important role that they are fulfilling. More than a 100 governmental initiatives provide support to SME's in their quest for business success. These initiatives' focus is to help SME's to access key ingredients to grow and succeed and become productive and competitive. The focus is also to reduce costs, save time and increase SMEs' competitiveness and to provide opportunities for growth domestically as well as internationally. The New Zealand government has set the goal to increase the ratio of exports and aim for an increase in GDP from 30 to 40 percent by 2025. The goal is supported by rules, regulations and policies that will assist SME's to take advantage of international opportunities (MBIE, 2014).

### 2.1.1 SME Definition and Characteristics

Various definitions exist for SME's and the European Union describes SME's as an organisation with fewer than 250 employees with either an annual turnover not exceeding €50 or an annual balance sheet total not exceeding €43 million (European Commission, 2008). In New Zealand there is no official definition (MBIE, 2013), but as a guide the SME sector is defined by the following segmentation:

- Zero (0 employees)
- Micro (1-5 employees)
- Small (6-9) employees
- Small-medium (20-49 employees)
- Medium (50-99 employees)
- Large (100+ employees)

Figure 1 illustrates the number of enterprises for each segment (MBIE, 2014). It is clear from the visual illustration that the majority of SME's are enterprises that have no employees other than the owner.

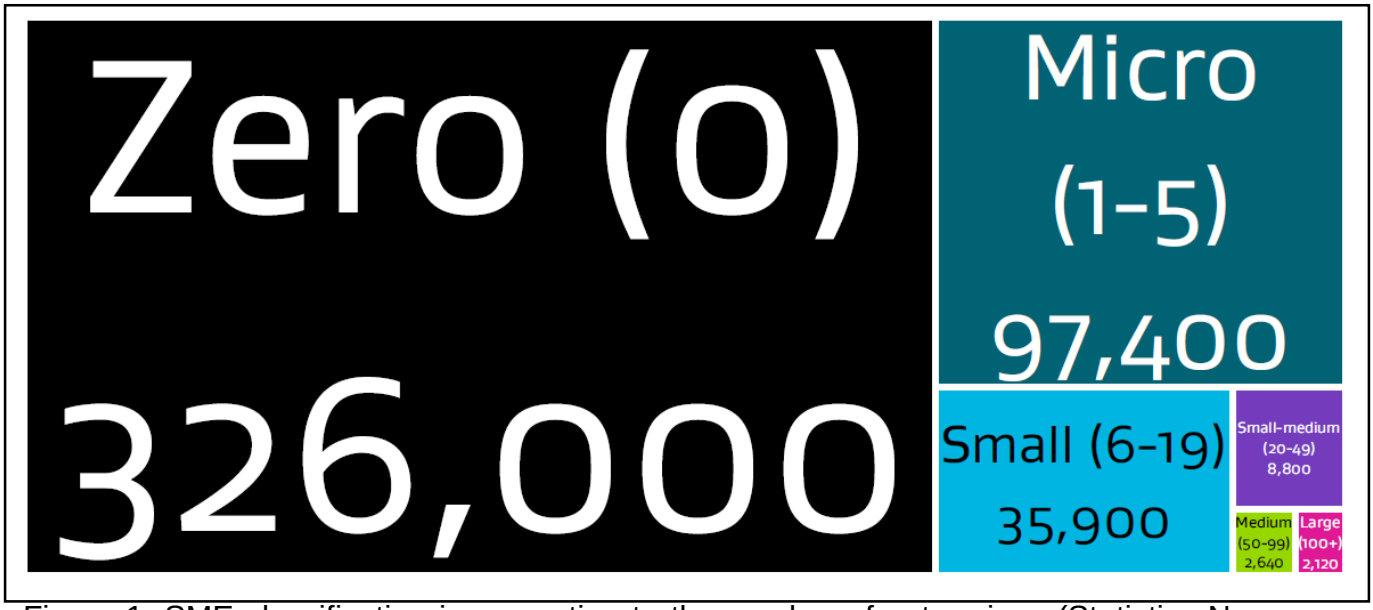



Figure 1: SME classification in proportion to the number of enterprises (Statistics New Zealand, 2013)

SME's then also have a set of distinct characteristics that describes these organisations in the context of ownership and management, structure, culture and behaviour, systems, processes and procedures, human resources, customers and market. Wong et al., (2004) summarise the characteristics of SME's as outlined in Table 1 as follows:

Table 1: SME characteristics

| Category | Characteristic |
|---|---|
| Ownership and management | • Mostly started, owned and dominated by entrepreneurs<br>• Owner is the manager at the strategic level<br>• Centrality of decision making (few decision makers)<br>• Directive and paternal management style more dominant<br>• Top management highly visible and close to the point of delivery<br>• Modest management skills and competency |
| Structure | • Simple and less complex structure<br>• Flat structure with few layers of management and hierarchy<br>• Flexible structure and information flows<br>• Multi-tasked owner-managers<br>• Division of activities limited and unclear<br>• Low degree of specialization - more generalist |
| Culture and behaviour | • Unified culture<br>• Organic and fluid culture<br>• Departmental/functional mind set less prevalent - corporate mind set<br>• Very few interest groups<br>• Operations and behaviour of employees influenced by owner-managers' ethos and outlook<br>• Results oriented |
| Systems, processes and procedures | • Simple planning and control systems<br>• Informal evaluation and reporting systems<br>• Flexible and adaptable processes<br>• Focus on operational processes and less focus on strategic processes<br>• Activities and operations are less governed by formal rules and procedures<br>• Low degree of standardization and formalization<br>• Mostly people dominated |

| | |
|---|---|
| Human resources | • Modest human resources<br>• Modest know how with less expert professionals<br>• Employees are more versatile<br>• Training and staff development is likely to be ad hoc and small scale<br>• Closer and informal working relationship<br>• Low incidence of unionization<br>• Low degree of resistance to change |
| Customers and market | • Normally dependent on a small customer base<br>• Mostly local and regional market - few international<br>• More frequent and closer contact with customers<br>• Many know customers personally and socially |

Source: Wong et al. (2004)

### 2.1.2 SME and Information Technology Adoption

Information technology (IT) is widely recognised as a business tool that can assist organisations to change its operations (Abouzeedan & Busler, 2006; Nguyen, 2008). It is also a means of how information is captured and distributed and used (Claessen, 2005; Currie, 2004). IT has the potential to reduce production and labour cost, create stronger links with customers, add value to products and services, innovate and facilitate niche marketing and increase competitive advantage (Abouzeedan et al., 2006; Carbonara, 2005; Levy, Powell & Yetton, 2001; Powell and Dent-Micallef 1997; Corso, Martini, Pellegrini & Paolucci, 2003; Nguyen, 2008). Abouzeeden et al. (2006) also highlight that IT can increase management effectiveness in the form of decision making and overall business performance.

The argument is made that IT is a resource that SME's can utilise to behave, like bigger organisations (Borch and Hartvigen, 1991). The drivers of IT adoption, however, are influenced by a SME's importance and maturity of business, new rivals in the market, the need to expand or invest in new business channels or ultimately when survival becomes vital (Nguyen, 2008).

SME's differ in many ways from larger corporate organisations, which influence and impact their information seeking practices. This is then also an indicator that the approach adopting IT will also be different and cannot be simply a miniature version of a larger organisation's approach (Ramdami, Kawalek & Lorenzo, 2009). Nguyen (2008) makes the statement that "many challenges and pitfalls await small businesses when it comes to IT adoption". This view is supported by multiple studies that show that within the SME sector there is a large percentage of unsuccessful IT implementations and that the adoption rate is low (Nguyen, 2008). It therefore requires a better understanding of the complex processes and differentiating factors that may have an influence on the adoption of IT by SME's (Ramdami et al., 2009). It was found that SME's are more influenced by technological and organisational factors and less by environmental factors (Lefebvre, 1991). The factors identified that have an influence on IT adoption by SME's include characteristics of the firm, competiveness and management strategies, the influences of internal and external parties as part of the adoption decision process and also the characteristics of the technology adopted. Strong SME owner influence has also been recognised as an underlying factor (Levy, Powell & Yetton, 2002; Lybaert 1998). At the more positive end of the spectrum SME's with a greater perceived relative advantage, greater ability to experiment, greater top management support, and of a larger size are predicted to become adopters of enterprise systems (Ramdami et al., 2009).

## 2.2 Business Intelligence

### 2.2.1 Defining BI

Business intelligence (BI) is a concept that has been around for decades. The earliest reference found was made by Hans Peter Luhn in 1958 (Luhn, 1958) who viewed BI as two independent concepts namely business and intelligence. Luhn (1958) defined business as “a collection of activities carried on for whatever purpose i.e. science, technology, commerce, industry, law, government, defence, et cetera.” Intelligence was viewed as “the ability to apprehend the interrelationship or present facts in such a way to guide action towards a desired goal” (Luhn, 1958). As years progressed these concepts were combined with technology and are referred to as BI system. The initial definition referred to BI systems as “the communication facility serving the conduct of a business (in the broad sense)” (Luhn, 1958). BI was re-introduced by Howard Dresner in 1985 and described as “an umbrella term that included concepts and methods to improve business decision making” (Negash & Grey, 2008, p. 175).

As information technology advanced, so has BI been further explored and described from various viewpoints. In the context of what intelligence means in the business context and its part in the term BI, is possibly better understood in context of what it is not. Intelligence “is not reams of database printouts. It is not necessary thick, densely written reports. And most certainly it is not involve spying, stealing or bugging” (Fuld, 1995). In basic terms intelligence is the conclusion that is drawn from analysed information (Fuld, 1995).

Against the background of various viewpoints (Appendix 1), BI can be synthesised as: (a) The outputs and inputs of business processes to support, optimise and improve the “tools” used to drive the strategic direction and objectives of an organisation on all levels (b) A knowledge exploration and creation process that turns data into information and information into knowledge (c) Business activities driven by day to day processes that include the use of technology.

Table 2 summarises this view in context of (a) BI purposes (b) BI as knowledge exploration and creation processes and (c) BI as business operational processes and technology. This view is then also supported by Williams et al. (2007) who reflect on BI as not being a single product method or technology, instead describe BI as a combination of products, technology and methods to organise information that the management of an organisation can use to its benefit.

Table 2: Synthesise summarisation of various authors' definitions and descriptions of BI

| | |
|---|---|
| BI<br>Purpose | • Support, optimise and improve:<br>  ○ business decision making<br>  ○ business performance in terms of profitability and competitiveness<br>  ○ business strategies formulation<br>  ○ knowledge management<br>  ○ resource planning<br>• Reduce business uncertainty |
| BI as a<br>knowledge exploration & creation process | • Creating capabilities that turn data into information and information into knowledge through<br>  ○ reducing information ambiguity<br>  ○ fact base decision making<br>  ○ review of real time and historical data<br>  ○ extract actionable insight<br>  ○ assigning meaning to ongoing business events<br>  ○ exploitation of vertical and horizontal levels of the organisation<br>  ○ seeking "weak signals" |
| BI as<br>business operational processes & technology | • Achieved through the actions of<br>  ○ data gathering and storage<br>  ○ system and data mining<br>  ○ quantitative analysis<br>  ○ monitoring<br>• Through the use of:<br>  ○ infrastructure<br>  ○ applications<br>  ○ tools / methods<br>  ○ business processes |

Sources: Sadok & Lesca (2009); Blanco & Lesca (1998); Davenport & Harris (2007); Williams & Williams (2007, p. 2); Canes (2009); Molensky, Ketter, Collins, Bloemhof & van de Koppel (2010); Gardner (2013); Isik, Jones & Sidorova (2013)

### 2.2.2 BI in Action

The above illustrates that the ultimate purpose of BI is to be the “eyes and ears” of an organisation, and also the “preventative medicine” to ensure that the management of an organisation is not caught off guard with what is happening in the business environment (Thomas, 2001). One of BI’s primary goals is to transform an organisation from a re-active to a pro-active organisation (Ranjan, 2008; Davenport, Harris & Morison 2010, p. 81). This approach avoids surprises, by identifying threats and opportunities, creating an understanding for areas of vulnerability, decreasing reaction time to events that can either have a negative or positive impact and by improving competitive advantage by out-thinking the competition (Thomas, 2001). On reflection BI addresses the same managerial problems that in principle have not changed and have existed over decades (Akhavan & Salehi, 2013; Lonnqvist et al., 2006). BI creates the capabilities for an organisation to reason, plan and solve problems, think abstractly, comprehend ideas and learn from business data and information (Ranjan 2008). It presents complex business environment information in a timely way that can be easily consumed, understood and applied (Azoff & Charlesworth, 2004) and enables organisations to create value and competitive advantage (LaValle, Lesser, Shockley, & Kruschwitz, 2011).

BI in action can be best described by the following example of Fuld (1995). The example given by Fuld illustrates the lifecycle and relationship of data turned into information, then the information being analysed and turned into intelligence. This example highlights the power of analysed and actionable insight and the potential power of BI.

Table 3: Intelligence at work

| Concept | Definition | Example in business context |
|---|---|---|
| Data | Scattered bits and pieces of knowledge (numbers, or scattered data) | • 1990: "The Dun & Bradstreet report reflected that the competitor had 100 employees."<br>• 1993: "One of the sales reps passes the competitor's plant and spots only 30 cars in the parking lot." |
| Information | A pooling of these bits of knowledge | A subsequent Dun & Bradstreet report shows that the competitor has lost business. |
| Analysis | Distilled information | After gaining more operational information about the competitor it appears that the competitor is highly efficient, exceeds standards and has become a world class facility. |
| Intelligence | The implication that will allow you to make a decision. | The competitor would make a good acquisition candidate, its lean and mean structure will be a good fit with our current operations. |

Source: Fuld (1995)

As for the data in the example, organisations sit on a wealth of sources of BI that is confined to the masses of data that is not analysed and developed into intelligence (Fuld, 1995). The right questions need to be asked and the answers further analysed. If conclusions are drawn only from information produced by BI technology and further analysis is not conducted a business opportunity could be missed or the wrong solution could be applied to a problem (Fuld, 1995).

Apart from the most important source which is data and information interrogation, organisations also require technology to support analytical activities. The options available are vast and each will be used to serve the objectives of the level of analysis required. The tools and technologies include: ad hoc queries, data mining, BI portal,

dashboards, scorecards, data marts, data warehousing, real time data analysis and monitoring, visualisation, data integration, online analytical processing (OLAP), forecasting, reporting, charting and knowledge management (Ranjan, 2008; Molensky et al., 2010; Tutuea & Rus, 2012).

The successful practical application of BI can lead to the following outcomes: BI has the potential to (a) increase the effectiveness of strategic and operational planning, (b) measure the realisation of enterprise strategies, goals, tasks, trends and results, (c) identify problems that require action, (d) enable analysis of for example products, employees, (e) provide insight that can improved relationship with customers, (f) analyse and improve business processes and operational effectiveness, (g) provide knowledge and experience (Tvrdikova, 2013).

### 2.2.3 BI Success

BI success depends on various factors and building blocks that need to work holistically together. For BI to have meaning and contribute to a success outcome, it requires to target a specific business problem. (Clark, Jones & Armstrong, 2007).The business problems and objectives vary between organisations and likewise the success measures. Isik et al. (2013) put it in context with the example of Firm A who will apply BI to better manage its supply chain and Firm B who want to achieve better customer service. For each of the firms the benefits expected are different and therefore also the criteria to measure success. (Jourdan, Rainer & Marshall, 2008). BI is successful when the BI strategic approach aligns with an organisation’s business objectives (Isik et al., 2013).

To achieve success, however, depends on the existence of some elements. Davenport et al. (2010) refer to the elements as the DELTA acronym which represents the following key elements:

**D** Access to high quality data

**E** Must have an enterprise focus

**L** Requires analytical leadership

**T** Strategic target

**A** Must be analytical

Additional building blocks that can be added to put some of the elements in better contexts include (a) a focus on continuous process improvement (b) an information and decision process focused culture (c) technical abilities and (d) effective partnership between business and information technology (Williams, 2004).

It is highly unlikely that all of these elements and building blocks may exist in their entirety. It is therefore important that an organisation should determine its position in terms of its analytical maturity. If organisations know their analytical maturity, it will enable them to have a clear starting point for a BI roadmap (Davenport et al., 2010, p. 21). Davenport et al. (2010, p. 21) classify analytical maturity in the following categories and also provide pointers for how an organisation can progress from one level to another

Table 4: Analytical maturity classification

| Maturity Level | Criteria for each level |
|---|---|
| Analytical impaired | The organisation lacks critical prerequisites for analytical work i.e. data, analytical skills or senior management support. |
| Localised analytics | There are some analytical activities within the organisation but they are not coordinated or do not focus on strategic objectives. |
| Analytical aspirations | The organisation envisages an analytical future, has the capabilities and has some initiatives underway but momentum and progress are slow. |
| Analytical companies | The organisation has all the building blocks i.e. skills, technology and achieves benefits. The approach, however, does not have a strategic focus and does not focus on using analytics to achieve competitive advantage. |
| Analytical competitor | The organisation uses analytics as a key business capability, has an enterprise wide focus, committed leadership and achieves continuous benefits from being analytical. |

Source: Davenport et al. (2010, p. 21-22)

Achieving success through applying BI is described by Ranjan (2008) as an iterative approach. An organisation should start by defining discrete small scale projects that can be easily prioritised and socialised. In conjunction it should be supported by implementing smarter business processes that have a positive impact on revenue and exhibit value. This approach helps long term initiatives to sustain momentum and progressively get buy-in from stakeholders and contribute to meeting business objectives.

## 2.3 Data Management

The importance of business data being transitioned into information and being used to make intelligent business decisions has been illustrated by the previous section. Ranjan (2008) supports this view and used the analogy to describe data as the “soil that grows BI, which in turn creates the capability to reason, plan, solve problems, think abstractly, comprehend new ideas and learn from. To realise these capabilities, a coordinated effort between users, technology, business processes and data is required (Bharadwaj, 2000). The challenge that organisations face is not lack of data but rather the challenge to manage the vast amount of data. With the introduction of the web, big data, social media and mobile devices, data has grown drastically. Almost every aspect of life can be tracked by data today. Examples include: web behaviour, mobile phone usage, in-store shopping activities, public surveillance, GPS tracking, automotive driving patterns, physical fitness data, social media data, satellite imagery, video streams and the list and variety continues (Isson & Harriot, 2013, p. 52). The prediction is made that the world wide data set will expand from 2.8 trillion gigabytes in 2012 to 40 trillion gigabytes by 2020 (International Data Corporation, 2013). To keep in pace with the data growth organisations increasingly invest in technology and human resources to collect, store and process these vast quantities of data. This enables organisations to gain access, prioritise and translate the data into meaningful insights to improve business processes, support decision making and create strategic advantages. (Zhue, Madnick, Lee & Wang, 2012, p. 16-1). The success outcomes are reliant on the quality of data types and sources and the management thereof (Kokin & Wang, 2013).

The management of data is made up of a collective set of activities that involves the collection, storage, processing and presentation of data (Weber, Otto & Osterle, 2009). The data that forms the basis for reasoning, discussion or calculation (Williams et al., 2007, p. 201) require compliance with certain standards. Davenport, et al. (2010, p. 23) identify the fundamental attributes as outlined by Table 5 that support BI.

Table 5: Data attributes that support BI

| Attribute | Description |
|---|---|
| Structure | The ability to classify data as either structured i.e. transaction application data or unstructured i.e. social media, web pages or blogs and to apply the applicable analysis tools |
| Uniqueness | The identification of unique data to exploit opportunities |
| Integration | The integration capability of data to enable data from multiple sources to be integrated and consolidated |
| Quality | Data quality to ensure it can be relied on for decision making |
| Accessibility | The availability or ease in which data can be retrieved |
| Privacy | The protection of data |
| Governance | The extent to which data is managed to ensure usefulness |

Source: Davenport et al. (2010, p. 23)

The attributes of data quality, integration and the role of accessibility in BI success were confirmed by a study of Isik et al. (2013) who explored the relationship between BI capabilities and BI success. The findings illustrated that BI success is significantly related to data quality, the extent of data integration between systems, and the accessibility to data. In reality organisations may find it impossible to manage data to the level of achieving all attributes to its full extent. The objective, however, should be to focus on how close to the ideal they can come (Davenport, et al., 2010, p. 23). The sections to follow will describe each of these attributes in more detail.

### 2.3.1 Structure

How data is structured will determine analysis activities that can be performed to support BI. Davenport et al. (2010) make a distinction between three types of data structures which include; data cubes, arrays and nonnumeric data structures.

*Cubes*: Data in transactions systems are normally stored in database tables. Although tables support transaction processing and listing of data, it is to a lesser extent practical for analysis if it contains only one dimension. To support analytical activities data is extracted from database tables and stored in data warehouses in the format of cubes. Data cubes represent a collection of pre-packaged multidimensional tables i.e. sales by

region by quarter. Although cubes are useful for reporting and “slicing and dicing of data”, it can be less useful for exploration purposes, if the variables used to build the cube are limited (Davenport et al., 2010, p. 24).

*Data arrays*: Spreadsheets are a specialised form of arrays. Arrays are structured content such as numbers in rows and columns. Storing data in this format enables the analysis of variables and is also the most flexible method of analysis (Davenport et al., 2010, p. 24).

*Nonnumeric data*: Unstructured data, for example, data that is recorded through web pages, social media and blogs is data in nonnumeric data format. Other examples can also include analysis and reporting on customer complaint letters, text fields in transaction databases. The analysis of this kind of data requires intensive data mining (Davenport et al. (2010, p. 24).

### 2.3.2 Uniqueness

A key objective of BI is to use data to exploit opportunities. It is therefore important for an organisation to identify data that is unique and can be used to its competitive advantage. The identification of unique data can either derive from organisational business activities or can be obtained from commercially available data (Davenport et al., 2010, p. 25). External data sets are also available for free as per initiative of the Open Government Information and Data Program of New Zealand (Department of Internal Affairs [DIA], n.d.). The website https://data.govt.nz/ (DIA, n.d.) contains a directory and links to publically available, non-personal New Zealand held datasets. One of the key objectives of this government initiative is to enable private and community sectors to grow the economy by exploiting the opportunities that may exist within the datasets (DIA, n.d.). An organisation could use these datasets and combine them with their business data to exploit opportunities.

### 2.3.3 Integration

Integration of data from internal and or external sources is an important capability of an analytical organisation. Transaction systems may only addresses one part of an organisation and to enable it to obtain a holistic view or exploit a particular business

problem, it may require to combine the data sets of multiple transaction systems to achieve the desired outcome. It is it therefore important that data from multiple sources have the ability to be integrated with other data sets i.e. order management integrated with human resource or customer relationship data (Davenport et al., 2010, p. 25).

### 2.3.4 Quality

The quality of data is one of the key data attributes most referred to in the literature and is defined as "data that are fit for use by data consumers" (Wang & Strong, 1996). Flawed or misleading data have the potential of having serious impacts on an organisation if used to support decision making. Users are becoming increasingly disconnected from data and the knowledge to judge the appropriateness of data for decision making diminishes (Fisher, Smith & Ballou, 2003). It is therefore important that BI practices that support decision making are based on quality data. In addition Davenport et al. (2010, p. 31) highlight that matured BI orientated organisations do not necessary have perfectly clean data but they actively addresses data quality problems. The dimensions to be taken into account for achieving quality data can be best described by Table 6 (Pipino & Lee, 2002).

Table 6: Data quality dimensions

| Dimension | Definition |
|---|---|
| Appropriate amount of data | The extent to which the amount of data is appropriate for the task at hand |
| Believability | The extent to which data is regarded as true and credible |
| Completeness | The extent to which data is not missing and is of sufficient breadth and depth for the task at hand |
| Concise Representation | The extent to which data is compactly represented and in the same format |
| Ease of manipulation | The extent to which data is easy to manipulate and apply to different tasks |
| Free-of-Error | The extent to which data is correct and reliable |
| Interpretability | The extent to which data is in appropriate languages, symbols, units, and has clear definitions |
| Objectivity | The extent to which data is unbiased, unprejudiced, and impartial |

| | |
|---|---|
| Relevancy | The extent to which data is applicable and helpful for the task at hand |
| Reputation | The extent to which data is highly regarded in terms of its source or content |
| Security | The extent to which access to data is restricted appropriately to maintain its security |
| Timeliness | The extent to which the data is sufficiently up-to-date for the task at hand |
| Understandability | The extent to which data is easily comprehended |
| Value-Added | The extent to which data is beneficial and provides advantages from its use |

Source: Pipino et al. (2002)

### 2.3.5 Accessible

Data needs to be available or easily and quickly retrievable (Pipino et al., 2002). Davenport et al. (2010, p. 32-33) recommend that data must be separated from the transaction-orientated application and stored in a location which is easily accessible for analysis purposes. Enterprise data warehouses (EDW) are used for these purposes. EDW will contain all data that is available for analysis and will include internal current and historical data as well as data from 3rd parties. An alternative to the EDW and less overwhelming is data marts, which is a smaller departmental view of the EDW and limits data to homogeneous sets, for example, financial, customer or human resources sets of data. A limitation to this approach is that it could limit the integration abilities for analysis. However, if the business problem to be solved is only finance related then all data required for analysis could possibly be confined within the financial data mart and be suitable for analysis purposes (Davenport et al., 2010, p. 32-33).

### 2.3.6 Privacy

Certain data sets could be sensitive and contain data related to individuals i.e. customers or employees data. Access to this level of data needs to be controlled to ensure no unauthorized use. Different privacy regulations in different jurisdictions may have different requirements that an organisation needs to comply with. A breach of these regulations

could violate privacy regulation and could have significant impact on an organisation (Zhu et al., 2012). Best practices that can be applied to ensure data is guarded as required can include having defined privacy policies in regards to customer and employee data, being sensitive not to breach the privacy laws of the industry in which an organisation operates, securing data against hackers and careless mistakes and not selling or giving data away without the consent from the party involved i.e. customer or employee (Davenport et al, 2010, p. 34).

### 2.3.7 Governance

Governance is the activity that is assigned to various roles within an organisation to ensure that data is useful for analysis and that the data is consistently defined, is of sufficient quality, standardised, integrated and accessible (Davenport et al., 2010, p. 35). Davenport et al. (2010, p. 35) also identify role players within an organisation to ensure data is managed appropriately for BI purposes and make a distinction between executive decision makers, owners/stewards and analytical advocates. *Executive decision makers* are responsible for the identification of information to be defined, managed and analysed across the business. This role also has the responsibility of ensuring it aligns with the strategic and analytical targets of the organisation (Davenport et al., 2010, p. 35)

*Analytical Advocate* is the role of a person that is the liaison between the data infrastructure and the users of data for analytical purposes. The primary purpose of the role is to ensure that information is easily accessed and analysed (Davenport et al., 2010, p. 36).

*Owners / Stewards* manage individual data sets, for example, financial data, customer data or product data. This role will take responsibility for all factors that make data useful for analysis. The responsibilities include definition of business data objects and standards, management of data quality, protection and lifecycle. Table 7 outlines each of the responsibilities (Davenport et al., 2010, p. 36).

Table 7: Responsibilities of data owner and stewards

| Task | Description |
|---|---|
| Business definition and standards | Consistent interpretation of information and the ability to integrate data |
| Information quality | Ensure data accuracy, consistency, timeliness, validity and completeness of information |
| Information protection | Manage the appropriate controls to address security and privacy requirements |
| Information lifecycle | Manage information from creation or collection through to retention or disposal |

Source: Davenport et al. (2010, p. 36)

## 2.4 Organisational Culture

Organisational culture is a term that is well explored and studied by multiple authors (Furnham, 2011, p. 615). Alternatively it is also associated with “climate” which is described as the “feeling in the air” when you visit an organisation and it is visible through its business practices, procedures and rewards (Tucker, 2002). This view is also supported by Eldridge & Combie (as sited in Furnham, 2011, p. 615) who defines organisational culture as a characteristic that all organisations have. It is evident through the individuality and uniqueness of how things get done and is expressed through norms, beliefs and ways of behaviour. Organisation culture is also identified as a variable or concept that is based on three assumptions: “(a) Culture is one of multiple organisational variables (bi) Culture consist of a set of components, which are visible and manifest in artifacts as well as collective behavior (c) Culture serves multiple functions that contribute to the success of organisations” Sackman (as sited in Furnham, 2011, p. 617). Diamond (1991) puts it in an organisational context and includes management philosophies as well as organisational leadership personalities as dimensions that have an impact on organisational culture. The components as referred to by Sackman and the dimensions as identified by Diamond (1991) are then also evident in the findings of several research studies that reflect that leadership, innovativeness and information sensitivity in the decision making process are key components or dimensions forming part of an organisation’s culture (Gamero, Marinez-Roman & Tamayo, 2011; Ratam & Mazzarol, 2004; Sarros, Cooper and Santora, 2008; Amabile, Laghzaoui, Peignot, Peneranda & Boudrandi, 2013).

### 2.4.1 Innovative Capability

Organisational culture has been identified as one of the cornerstones of innovation and in turn innovativeness is viewed as one of the key factors that enables organisations to survive, grow and compete in a competitive market (Kmieciak, Michna & Meczynska 2012). Innovation is described by Tucker (2002) as a process of problem solving through the means of introducing a new product, process or system into an organisation. Real innovation however, is not a matter of doing things differently but introducing a new idea, service or product that separates an organisation from its competitors. Innovativeness

can be evident from the skills, knowledge, commitment and innovative capabilities of the organisation as a whole. To be competitive through innovation requires an organisation to provide customers with a value proposition better than yesterday by responding to customer needs and by employing new technologies to reduce costs and be responsive to change (Tucker, 2002). The value of innovation lies ultimately in the wealth it is creating (Hunter, 2008, p.14) and as defined by Tucker (2002) innovation is the process of generating wealth from new ideas

Innovation is driven by external and internal forces and an organisation's overall innovative capability. The positive influence of innovation capability on innovation outcomes was confirmed by Gamero et al. (2011). Overall innovativeness can be described by the level to which an organisation can exploit the various areas in which innovation within an organisational context can occur. Wang & Amed (2004) make a distinction between five types of innovativeness. Product – and market innovativeness is externally focused and process – and behavioral innovativeness is internally focused. Strategic innovativeness is seen as the mediator between internal and external innovativeness and its focus is to identify external opportunities and match it with internal capabilities in order to deliver innovative products and explore new markets. Ultimately product and market innovativeness are the outcomes derived from process, behavioral and strategic innovativeness (Wang et al., 2004). Table 8 outlines the focus of each of the innovativeness areas.

Table 8: Innovativeness types

| Type of Innovativeness | Description |
|---|---|
| Product | Introduction of new products and or services to the market |
| Market | Change in approach to enter and exploit new market opportunities |
| Process | Introduction of new production methods, new management approaches and new technology to improve production and management processes. Process innovation enables an organisation to exploit resources and capabilities. |
| Behavioral | Behavioral innovativeness is demonstrated through individuals, teams and management support to an innovative organisational culture by being open and receptive to new ideas and implementing it. |
| Strategic | The development of new competitive strategies that can create value, by managing ambitious organisational objectives and creating a balance between existing resources and stretching or leveraging limited resources creatively. |

Source: Wang et al. (2004)

#### 2.4.1.1 Organisational innovative attributes

From the literature on the topic of innovative capability various organisational attributes have been identified that contribute to the innovation process and build an innovative organisation culture. Forsman (2011) has explored the innovation organisational attributes, which include knowledge exploitation, entrepreneurial capabilities, risk management, networking capabilities, development capacity, change management and market and consumer knowledge. The next section will explore each of these capabilities in more detail.

*Knowledge* exploitation: Innovation is a complex process of ongoing organisational learning (Gamero et al., 2011) and the acknowledgment of and recovery from failure (Tucker, 2002). Knowledge exploitation enables organisations to recognise and

internalise information in order to exploit new opportunities (Forsman, 2011; Salavou Baltas & Lioukas 2004). *Entrepreneurial capabilities* is the ability to recognise new opportunities, the scoping of it and developing new solutions to generate new profitable business (Forsman, 2011). *Risk management:* An innovative organisation should be prepared to take risks in order to be innovative (Forsman, 2011; Sarros et al., 2005). The organisation therefore should be able to have the capabilities to assess the risk and have the willingness and abilities to take on the risk and manage it (Forsman, 2011). *Networking Capabilities* relate to the ability of the organisation to have a networking orientation in order to exploit networks in business and create collaborative relationships (Forsman, 2011). *Development capabilities* relate to the ability of the organisation to create the competitive advantage that differentiates them from the competitors either by improving existing products or services or exploiting innovations developed by others (Forsman, 2011). *Change management capabilities* is to use innovation as the engine of change. Innovative organisations are required to be flexible and adapt to the needs of the innovation process and quickly implement change (Forsman, 2011) and take quick advantage of opportunities (Sarros et al., 2008). *Market and customer knowledge* reflects on how much an organisation values the importance of its customers and their buying power and also the potential of other stakeholders including competition when exploiting market information (Hult, Hurley & Knight, 2004; Salavou et al., 2004). This capability will enable organisations to acquire new customers, expand to new markets and also increase sales to existing customers (Forsman 2011).

All of the above mentioned capabilities work holistically together to create an innovative culture. The one is either the input or the outcome as the result of the other. Market information and networking capabilities stimulate organisation learning that leads to applying entrepreneurial and development capabilities that in turn leads to producing a new product or service to the benefit of the organisation's performance. The organisational attributes to support innovation come down to an organisation that can be described as more information and learning orientated, flexible, adaptive, entrepreneurial, open to risks and taking responsibility (Erez & Naheh, 2004).

### 2.4.2 Leadership Style

Leaders' authority give them the freedom to decide how the organisation will be run and therefore plays an important factor in the culture of an organisation (Mishra, 2012). Kotter (1998) made the statement that "only through leadership can one truly develop and nurture culture that is adaptive to changes". Strategic leadership research found that top management has the ability to drive an organisation's culture, influence the organisational climate and build the capacity for innovation and change (Damanpour & Schneider, 2006). Leadership is also identified as an evolving process that is driven by the organisational culture (Sarros et al., 2008). It has also being determined that an innovation orientated organisation is promoted by transformational leadership style, which in turn can ensure long-term survival (Sarros et al., 2008). These statements confirm the interconnected nature of leadership with organisational culture and innovation. In addition the connection has then also been made to the need for leaders to be more sensitive to information for decision making (Amabile et al., 2013). The section that follows will explore the attributes of a transformational leader and also the requirements for information sensitivity in the decision making process

#### 2.4.2.1 Transformational Leadership

Private sector organisation's focus is centrally based on profit, competition and performance (Sarros et al., 2008). The perception is that private sector leaders will display transformational leadership styles that will have a positive influence on a competitive, performance-orientated organisational culture, which in turn can establish an organisational climate for innovation (Sarros et al., 2008). The transformational leader characteristics can be summarised as a leader with charisma, who is inspirational, enables intellectual stimulation and shows individual consideration (Bass, 1990). Table 9 expands on the characteristics of a transformational leader and highlights examples of how these characteristics are visible in a business context.

Table 9: Transformational leader characteristics and behaviour

| Transformation Leader Characteristics | Leader Behavior |
|---|---|
| Charisma | • provides vision and a sense of mission with the aim of identifying new opportunities<br>• instills pride<br>• gains respect and trust<br>• fosters group behavior with the aim of working together towards a common goal |
| Inspirational | • inspires others with vision<br>• has high performance expectations with the focus on excellence and quality<br>• uses symbols to focus efforts<br>• expresses important purposes in simple ways |
| Intellectual Stimulation | • promotes intelligent, rational and careful problem solving<br>• challenges solutions |
| Individual Consideration | • gives personal attention through support<br>• treats each employee individually as a form of respect and is concerned about their feelings and needs<br>• coaches and advises |

Source: Bass (1990); Podsakoff, MacKenzie, Moorman & Fetter (1990)

A transformational leader will, instead of working within the organisational culture, aim to challenge and change the culture (Bass, 1990). Changing the culture of an organisation will have an influence on all employees and has the potential to increase individual effectiveness and ultimately increase the effectiveness of the whole organisation (Mishra, 2012). Transformational leadership has then also been identified as a key catalyst to make change happen, because it requires enormous energy and commitment to achieve outcomes (Sarros et al., 2008).

A transformational leader also has the qualities that enable employees to see and use the “big picture” and understand the importance of their contributions. This type of leader values creative solutions that supports an organisational vision (Bass, 1990). This attitude stimulates employees to look for new ways to solve old problems and to use difficulties as challenges, and find rational solutions with calculated risks (Bass, 1990).

#### 2.4.2.2 Information Sensibility

Drucker (1992) makes the following statement “*not many executives are information literate. They know how to get data. But most still have to learn how to use data. Few executives yet know how to ask: What information do I need to do my job? When do I need it? In what form? And from whom should I be getting it” Fewer still ask: What new tasks can I tackle now that I get all these data? Which old tasks should I abandon? Which tasks should I do differently? Practically no one asks “What information do I owe? To whom? When? In what form?”* This statement could potentially be explained by the trend that managers are in charge of their own destiny. Managers are rarely instructed in how they are required to execute their task. Their direction comes from targets, objectives and constraints (Chapman, 1993). The challenges that leaders face exponentially expand as a result of the velocity of a variety of information that leaders are being exposed to on a day-to-day basis as they go about formulating strategies and making decisions (Auster & Choo, 1994).

The leader who wants to embrace the benefits of using information to his/her benefit needs to have the skills and qualities of an information sensitive and sensible leader. A research study has revealed that a leader’s sensibility towards information plays an important role in the diffusion of BI practices (Amabile et al., 2013). Hannabus (1987) summarises the qualities of an information sensible leader as:

- Leaders who understand how information flows and how it is used throughout the organisation.
- Leaders that have the ability to select information well and demonstrate the application of it.

- Leaders that establish and use information networks and actively seek out information.
- Leaders that are effective information givers
- Leaders that are open minded about the validity of sources, opportunity costs that go with searching out information and the trade-ability of information.

The acquisition and use of information can be described as a dynamic process (Choo, 1996), which involves the steps of expression of needs, research and selection of information, exploiting or using the information and as a last step the diffusion throughout the organisation (Amabile et al., 2008). The statement is made that leader's challenges are derived from the inability to step away from daily duties and really participate in the dynamic process to turn information into business intelligence (Caron-Fasan & Lesca, 2008). The observation made by Dishman & Calof (2008) is that the management of information is an organisational characteristic that develops over a period within the firm. This potentially originates from a leader who on a personal level searches, uses and disseminates information (Amabile et al., 2008).

Amabile et al., (2008) study explored the sensitivity to information of exporting SME. The authors have established that "the level of sensitivity to information varies with the nature of the information sought". SME leaders surveyed were more sensitive to information in regards to the market, competitors and customers (Amabile et al., 2008). The outcome of the study indicates that leadership that has a sensitivity and sensibility towards information creates a favourable organisational environment for diffusion of BI practices (Amabile et al., (2008).

## 2.5 Organisational Motivation

### 2.5.1 Strategic Drive and Competitiveness

Organisations are in competition with each other because they target the same markets and customers. The rivalry between organisations is influenced by market forces, customer demands and organisational capabilities (Pearlson et al., 2010, p. 27). Research also highlights that organisations are required to be more flexible, adaptive, entrepreneurial and innovative to meet the challenges in the business world (Sarros et al., 2008). Pearlson et al. (2010, p. 27) refers to Porter who claims that the key survival tool over the long run for above average performance in the marketplace is sustained competitive advantage.

### 2.5.2 Competitive Advantage

Competitive advantage can be described as the "extent to which an organisation is able to create a defensible position over its competitors" (Li, Ragu-Nathan, Ragu-Nathan & Rao, 2004). Competitive capabilities enable organisations to drive lower prices, higher quality, higher dependability and short time frames on delivery and the flexibility to implement innovation (Li et al., 2004). Sigalas, Economou & Georgopoulos (2013) describe competitive advantage in the context of performance and sources as a means to create competitive advantage. Performance relates to how an organisation compares against it rivals (Barney, 1991). The strategic resources that can contribute to competitive advantage are identified as the organisation's technological position, innovation, product and service quality, human resource management and management capabilities (Rubio & Aragon, 2009).

Strategic resources are resources that are "more likely to contribute to the creation and protection of economic rents" (Amit, 1993). Barney (1991) identifies that resources that adds to competitive advantage must have four attributes: (a) it must be valuable in the sense that it can exploit opportunities and or neutralises threats, (b) it must be rare and not available to an organisation's current and potential competitors (c) it must be difficult to imitate and (d) no equivalent substitutes are available. These attributes can describe

the uniqueness of an organisation's resources and thus how useful these resources can be to create competitive advantage (Barney, 1991).

### 2.5.3 Information as Strategic Resource

The resource-base view (RBV) theory is used by many studies to analyse strategic resources to sustain competitive advantage (Rubio & Aragon, 2009). The RBV is useful in determining whether the strategies applied add value. The view also maintains that information is a source of competitive advantage. The application of it in terms of Information Systems (IS) has identified two types of information resources: those that enable an organisation to achieve competitive advantage and those that enable an organisation to sustain competitive advantage (Pearlson et al., 2010, p. 62-63). There is a growing source of literature that supports the view that IS can sustain competitive advantage. IS are deeply embedded in formal and informal management decision making processes. The key benefits that can derive from IS include the continuous flow of information, the ability to quickly utilise large volumes of information and share information efficiently (Barney, 1991).

Information as a source of competitive advantage (Guarda, Santos, Pinto, Augusto & Silva, 2013) is acknowledged by Porter & Millar (1985) as a key component of the value chain. The value chain "creates the measure of the amount buyers are willing to pay for products and services" (Porter et al., 1985). A product or service is profitable if the value it creates exceeds the cost of all activities combined to produce it. To achieve competitive advantage over rivals an organisation has two options i) produce products and services at a lower cost or ii) diversify and create a premium product for which consumers are prepared to pay a premium price. (Porter et et al., 1985). An organisation's value chain consists of a series of interdependent activities that are linked to produce a product or service. A linkage between activities cause the output of one activity to affect the costs or effectiveness of the next or other connected activities. The careful management of linkages can be a powerful source of competitive advantage, and could potentially be difficult to be imitated by rivals (Porter et al., 1985).

The use of Information technology can intersect the value chain at every linkage point and can transform the activities performed. Every activity in the value chain has a physical and information processing component. The physical side includes the physical tasks whereas the information component includes the steps required to capture, manipulate and channel data necessary to perform the activity. Every activity either creates or uses information (Porter et al., 1985). The data created as part of the production process creates the opportunity for the data to be used and analysed. The outcome has the potential to change the industry in which organisations operate, support competitive advantage and lead to new businesses (Porter et al., 1985). The important role of information technology has been confirmed by Drucker (as sited in Williams et al., 2008, p. 11) with the statement that BI is bringing a powerful new tool to businesses, which will enable businesses to compete better against each other and leverage from information to improve profits and performance.

### 2.5.4 Use of BI to Gain Competitive Advantage

"The use of BI for competitive advantage is a paradigm shift from how information originally was used by organisations. The shift requires organisations to think how they use information in general and how that same information can be used for BI" (Williams et al., 2008, p. 12). This view is also supported by Davenport et al (2007) that states that competitive advantage can be achieved through the exploitation of BI and predictive analytics. BI creates the capabilities to gather and store data and management knowledge through the use of analytical tools and to present complex information to decision makers (Venter & Tustin, 2009).

BI, however, requires a change in how management uses information. Most organisations use information within management in an unstructured and ad hoc manner and the degree of decision support until recent times was limited. BI presents the opportunity for more structured use of information on management level (Williams et al, 2007. p. 12). BI presents the following business opportunities: (a) identification of business information that is required (b) the application of business information to specific analysis tasks (c) support specific business decisions (d) change core business processes for the better (e)

deliver value (f) achieve change in areas of behaviour, processes and use of technology (Williams et al., 2007, p. 26). Table 10 highlights examples of BI value creation opportunities.

Table 10: Business-driven BI value creation opportunities

| Business-Driven BI Value Creation Opportunities | | |
|---|---|---|
| **Management Processes** | **Revenue generating processes** | **Resource consumption processes** |
| Planning, Budgeting, Performance Monitoring / Assessment, Process Improvement, Cost Analysis, Optimisation etc. | Customer Segmentation, Campaign Management, Channel Management, Sales Management etc. | Product / Service Development, Order Management, Manufacturing, Operations Management, Supply Chain, Purchasing etc. |

Source: Williams et al. (2008. p. 29)

### 2.5.5 BI Business Value

Business value is described by Williams (2004) "as the ability to improve the effectiveness of core business processes that drive performance". Business value is also depends on the individual organisational objectives (Weill & Broadbent, 2008, p.49). Measuring the value of BI in practice is complex and intangible and cannot be measured through financial means (Williams et al, 2008, p.12; Lonnqvist & Pirttimaki, 2006). An organisation's investment in BI creates an asset that generates income over time (Williams et al., 2007, p.12).

To put the value of BI in perspective, the benefits can be evaluated against the Information Technology Business Value Model of Macada, Beltrame, Dolci & Becker (2012). The model distinguishes between strategic, information transactional and transformational benefits. The various benefit dimensions can be described as follows:

#### 2.5.5.1 Strategic Benefits

Strategic benefits refer to the benefits of IT on a strategic level that supports the organisational objectives of competitive advantage, strategic alignment, and better customer relationships. The benefits can be achieved through business activities of product innovation, process innovation, renewed service, increased sales and better market positioning (Weill et al., 2008, p.28; Macada et al., 2012).

#### 2.5.5.2 Information Benefits

Information benefits deal with the benefits that IT brings as a result of improved information management that leads to the accessibility, quality and flexibility of information (Macada et al., 2012) to support management control, decision making, planning, communication and accounting. Benefits can be achieved through activities that enable increased control, better information, better integration, improved quality and support for decision making (Weill et al., 2008, p.27).

#### 2.5.5.3 Transactional Benefits

Transactional benefits focus on the benefits that IT brings through automation of operational transaction or repetitive activities. The objective is to cut costs by substituting human labour with technology, to increase the volumes and speed of transaction processing and ultimately reduce unit costs (Weill et al., 2008, p. 27).

#### 2.5.5.4 Transformational Benefits

Transformational benefits refer to the benefits that are derived from organisational structure changes as a result of IT investment. The changes enable the development and improvement of assets for further future benefits (Macada et al., 2012). The benefits can be derived from improved business processes, new skills and new organisational structures (Gregor, Martin, Fernandez, Stern & Vitale, 2006) and are in the form of new business plans and or improved business models (Macada et al., 2012).

BI benefits can then also be classified against each of the benefits' dimensions as outlined above. Table 11 categorises the multiple BI benefits in context of the benefit dimensions identified by Macada et al. (2012).

Table 11: BI Benefits in context of business benefit dimensions

| Benefit dimension | BI Benefits |
|---|---|
| Strategic Benefits | • Create competitive advantage through:<br>○ Right decision at the right time<br>○ Increase in competitive culture<br>○ Stimulation of innovation<br>○ Anticipation of changes in market conditions<br>• Increase in business performance through:<br>○ Improved customer service<br>○ Increased revenues<br>○ Increased profitability<br>○ Overall organisation performance that is more transparent and measurable through operational dashboards or performance management i.e. economic and marketplace shifts influences<br>• Risk mitigation through:<br>○ The identification of problem areas in time for corrective actions to be taken pro-actively<br>○ Avoiding extra costs in regards to product development and or investments |
| Information Benefits | • Improved data management practices that enable:<br>○ Better quality information<br>○ More flexible reaction to new information needs<br>○ Faster and more accurate reporting<br>○ Rich reporting capacity<br>○ Discovery and verification of insights through data analytical tools<br>• Improved decision support visible through:<br>○ Increased efficiency and effectiveness of decisions<br>○ Enterprise wide data driven decision making capability<br>○ Promotion of faster decision making |
| Transactional Benefits | • Cost savings through:<br>○ The application of powerful tools that enables data analysis and visualisation to reduce the cost of decision making |

| | |
|---|---|
| | ○ Improved efficiency that leads to improved profitability<br>○ Optimisation of resource allocations<br>○ The use of BI tools to reduce the cost of information analysis |
| Transformational Benefits | • Uniformity across BI environment promotes better and faster business collaboration<br>• Improved decision making processes through better collaboration |

Sources: Tutunea et al. (2012); Scholz et al. (2010); Gong & Xia (2012); Khan, Amin & Lambrou (2009); Meredith, Reminton, O'Donnell & Sharma (2012); Kokin et al. (2013); Sciff (2012); Lonnqvist et al. (2006); Canes (2009); Davenport et al. (2010, p.3)

# 3 Research Design and Methodology

## 3.1 Research Design

The research study is based on a research model and hypothetical statements that consider factors that will contribute to the likeliness of BI adoption by SME's. The model's definition originated from an exploratory study using 12 existing research studies relating to BI and technology adoptions specific to SME's. Through the review of the existing literature a deeper understanding was obtained of the range of factors and the correlation between factors that may influence BI adoption. The identified factors were further analysed against technology adoption models using a factor analysis approach. This approach enabled factors to be identified and grouped into homogeneous sets and then each set was described by one representative factor (Garret-Mayer, 2006). The outcome of this analysis formed the basis of the research model and hypothetical statements. Hypothesis testing was supported by a structured online questionnaire. The sections to follow will in more detail outline the process followed for the execution of the study.

## 3.2 Conceptual Framework and Hypothesis Development

### 3.2.1 Exploratory Study

The exploratory study included 12 research studies whose focus was primarily SME BI and technology adoption. Factor analysis was performed to explore the range of factors that may influence BI adoption. The process started with the identification of existing adoption models and the factors that are associated with each model.

The adoption models and their respective factors that were included for the factor analysis were: Technology-organisation-environment model (TOE); Resource-based theory (RBT); Diffusion of Innovation (DOI) and Intellectual Capital (IC) model. Each model's focus and factors considered are summarised by Table 12: Models used for factor analysis

Table 12: Technology adoption models used in factor analysis

| Model | Model's focus and factors |
|---|---|
| Technology-organisation-environment model (TOE) (Ramdani & Kwalek, 2009 ; Oliviera & Martins, 2011) | The model focuses on three aspects that influence the technology adoption:<br>• technological context (current technological practices)<br>• organisation context (scope, size and managerial structure)<br>• environmental context (arena in which the organisation conducts its business) |
| Resource-based theory (RBT) (Parker & Castleman, 2009) | This theory focusses on how sustainable competitive advantage can be maintained by developing or acquiring resources that are unique and cannot be recreated by competitors. These unique resources can include: competencies, assets, know-how and capabilities. |
| Diffusion of Innovation (DOI) (Oliviera & Martins, 2011) | This model explores the speed of technology adoption by an organisation. The adoption rate can be influenced by the innovation technology, social systems, communication channels and timing. In turn innovation adoption can be influenced by:<br>• leadership attitude towards changes<br>• internal characteristics (degree of power and control by individuals, complexity, formalization, interconnectedness, organisational slack and size)<br>• external characteristics in the context of system openness |
| Intellectual Capital (IC) – Economic Growth (Pita-Castelo & González-Loureiro, 2012) | This model considers the combination of activities and intangible resources that are used to create value for internal and external stakeholders. The intangible resources are broken down into:<br>• human capital (values, attitudes, qualifications and skills held by employees)<br>• structural capital (the worth and value created that will remain when employees depart) |

| | |
|---|---|
| | • relational capital (relationship with suppliers, customer, competitors, stakeholders, shareholders and society in general) |

The research findings of the existing studies were evaluated against the factors of each technology adoption model and the number of occurrences indicated. The factors were ranked to determine the factors with the most occurrences. For the purpose of the study occurrences 5 times and higher were considered. However, if a factor had a lower score but could have been grouped with a high score factor the factor was included. The next step grouped the factors across all models in groups of similarity under the umbrella of an overall descriptor for each group that formed the basis for the research model. The key factors identified that may influence the likeliness of BI adoption by SME's include data management practices, organisational culture and an organisational motivation to adopt BI. Table 13 summarises the factors identified from the 12 existing research studies and factors that correlate with each technology model. Included is the number of occurrences of the factor and the overall descriptor for each homogenous set that formed the basis of the research model.

Table 13: Factor analysis findings

| Research study findings that correlates with factor | Model | Factor | Number of occurrences | Research Model Factors |
|---|---|---|---|---|
| • Guarda, Santos, Pinto, Augusto, & Silva (2013)<br>• Malladi (2013)<br>• Ramdani (2013)<br>• Sadok & Lesca (2009)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Isık, Jones & Sidorova (2013)<br>• Awa & Ukoha (2012)<br>• Beal (2002)<br>• Kokin & Wang (2013)<br>• Gamero, Martınez-Roman & Tamayo (2011) | RBT | Capabilities | 20 | **Data Management Practices** |
| • Malladi (2013)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Kokin & Wang (2013) | IC | Structural Capital | 6 | |
| • Guarda, Santos, Pinto, Augusto, & Silva (2013)<br>• Malladi (2013)<br>• Ramdani (2013)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Awa & Ukoha (2012)<br>• Gamero, Martınez-Roman & Tamayo (2011) Ramdani & Kawalek (2009). | TOE | Organisational Readiness | 9 | |
| • Kokin & Wang (2013)<br>• Ramdani (2013)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Isık, Jones & Sidorova (2013) | TOE | Compatibility | 7 | |

| | | | | |
|---|---|---|---|---|
| • Guarda, Santos, Pinto, Augusto, & Silva (2013)<br>• Malladi (2013)<br>• Sadok & Lesca (2009)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Beal (2002)<br>• Gamero, Martınez-Roman & Tamayo (2011) | IC | Human Capital | 6 | |
| • Guarda, Santos, Pinto, Augusto, & Silva (2013)<br>• Malladi (2013)<br>• Sadok & Lesca (2009)<br>• Alam & Noor (2009) | RBT | Know-how | 5 | |
| • Sadok & Lesca (2009)<br>• Awa & Ukoha (2012)<br>• Ramdani & Kawalek (2009) | DOI<br>TOE | Leadership attitude / Characteristics & Management Support | 6 | **Organisational Culture** |
| • Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Martınez-Roman & Tamayo (2011) | RBT | Competencies | 3 | |
| • Guarda, Santos, Pinto, Augusto, & Silva (2013)<br>• Malladi (2013)<br>• Ramdani (2013)<br>• Sadok & Lesca (2009)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010)<br>• Alam & Noor (2009)<br>• Ramdani & Kawalek (2009). | TOE | Relative Advantage | 10 | **Organisational Motivation** |
| • Ramdani (2013)<br>• Awa & Ukoha (2012) | TOE | Competitive Pressure | 3 | |
| • Ramdani (2013)<br>• Beal (2002)<br>• Scholz, Schieder, Kurze, Gluchowski, & Boehringer (2010) | IC | Market Scope | 4 | |

### 3.2.2 Conceptual Framework

The outcome of the exploratory study formed the basis for the research model. Figure 2 illustrates the model in the context of the three primary factors which include data management, organisation culture and organisation's motivation and also the attributes that will be considered for each of the factors.

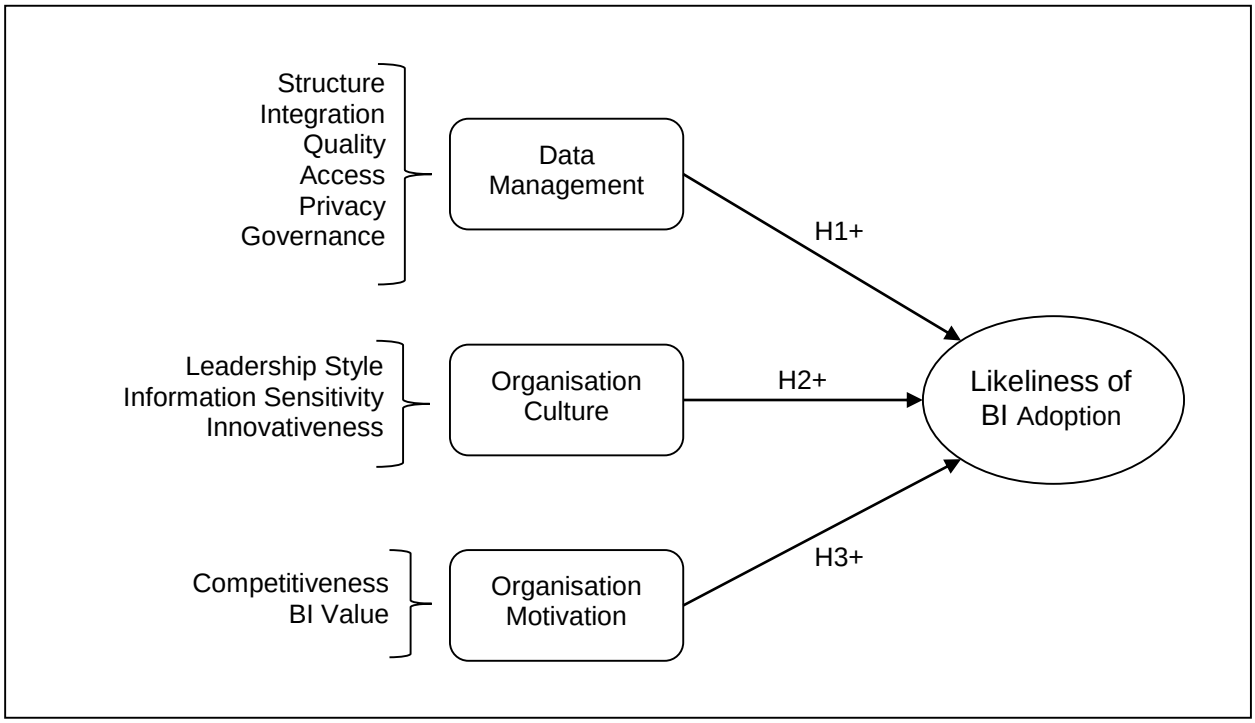



Figure 2: Likeliness of BI adoption research model

### 3.2.3 Hypotheses

By putting the preceding literature review in regards to data management, organisation culture and organisation motivation in the context of the likeliness of BI adoption the following hypotheses statements can be made.

#### 3.2.3.1 Data Management Practices

BI requires a coordinated effort between users, technology, business processes and data (Bharadwaj, 2000). Data is then also a key component of BI and a pre-requisite for analytical activities (Davenport et al., 2010, p. 23). BI success is then determined to be

reliant on the quality of data types and sources (Kokin & Wang, 2013) that require well managed data practices,

Data management refers to the collection, storage, processing and presentation of data (Wende & Otto, 2009). The fundamental attributes of data to support BI practices require: (a) data to be available in either structured i.e. transaction application data or unstructured formats i.e. social media, web pages or logs (b) data uniqueness to support the exploitation of opportunities (c) the integration capability of data from various sources (d) quality data that can be relied on (e) accessibility to data (f) the ability to protect data (g) the governance of data to ensure usefulness (Davenport, et al., 2010, p. 23-38). Isik et al. explored the relationship between BI capabilities and BI success and the findings were that BI success is significantly and positively related to i) data quality, ii) the extent to which data between systems can be integrated, and iii) the accessibility to data. Against this background the hypothesis statement is made that:

*H1 – SME's whose data management practices correlate with the BI requirements of data availability; uniqueness; integration capabilities; quality; accessibility and usefulness will increase the likeliness of BI adoption.*

#### 3.2.3.2 Organisation Culture

Strategic leadership research has found the organisation performance is directly related to management qualities that create an organisational culture that embraces change and innovation (Damanpour & Schneider, 2006). Several research studies have found that innovativeness, leadership involvement and information sensitivity in the decision making process are key factors in the adoption of ICT technologies (Gamero et al., 2011; Ratam et al., 2004; Sarros et al., 2008; Amabile et al., 2013). The adoption of BI which is made up of the adoption of technology, methods and processes (Williams et al, 2007, p.2) will be an innovative decision for SME's not already applying these practices or SME's becoming more innovative as SME's step up the ladder of BI maturity. SME's will therefore require innovative capabilities and as confirmed by Gamero et al. (2011) innovative capabilities have a positive impact on innovative outcomes. Ratam et al. (2004) have examined the relationship between leadership style and

innovative behavior and found that SME leadership is the most important factor that influences organisation innovativeness and innovative leaders enable innovation. An observation also made by Ratam & Mazzarol (2003) is that SMEs with transformational leaders displayed a strong commitment to innovation and are supportive of innovative organisational cultures. Seah, Hsieh & Weng (2010) also confirmed that leadership plays a key role implementing BI systems through their strong and committed approach that in turn supports and guides the organisation through resistance to intelligence sharing and change. Sarros et al. (2008) who explored innovation adoption in context of transformational leadership and organisational culture. The findings identified that three of the six transformational factors namely articulating vision, providing individual support and setting high performance expectations are positively related to an innovative organisational culture. The connection between leadership sensitivity to information and sensible use of information is also being identified and studies found that it creates a favourable organisational environment for diffusion of BI practices (Amabile et al., (2008). From the literature it is then possible to define the following hypothesis: *H2 - SME's with an organisation culture with characteristics of innovativeness, transformational leadership style and a sensitivity to information as part of the decision making process will increase the likeliness of BI adoption.*

#### 3.2.3.3 Organisational Motivation

The important role of information technology has been confirmed by Drucker (sited in (Williams et al., 2007, p. 11) with the statement that BI is bringing a powerful new tool to businesses, which will enable businesses to compete better against each other and leverage from information to improve profits and performance. Existing research studies have also highlighted that the competitive pressures that SME's experience from rivals and the perceived increase in service quality positively affect the likeliness of information technology adoption (Awa & Ukoha, 2012). Information technology has been confirmed as a key factor in achieving competitive advantage through BI (Drucker, 2001). This enables businesses to compete better against each other and leverage from information to improve profits and performance (Williams et al., 2008, p. 11). The key potential benefits that can be derived from using BI practices can lead to the improvement and

support of business decisions, improved data management practices and exploitation of opportunities. In the context of the literature the hypothesis statement can be made: *H3 – SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption.*

## 3.3 Data Gathering

The data collected to support the research study was obtained using an online survey tool named Qualtrics. The choice to use a survey was for the following reasons (Chauvel & Despres (2002) :

- A survey brings a concept into focus and enables the inclusion of various elements, that respondents can particularly focus their attention on;
- The results of a survey are quantifiable and open for statistical analysis;
- The results obtained from statistical analysis of a sample can be extended to a larger population, and thus allow for the more generalisation of more global statements;
- Surveys in comparison with other survey methods are faster and more direct.

In addition online surveys have the potential to collect more reliable data, since the respondent has the opportunity to go back and forth to change responses. Online surveys also enable the researcher to configure the survey to ensure that all questions are answered by the respondent and that no out-of-range responses are accepted. The outcome leads to less data editing and more complete responses. The tool also allows for analysis of data electronically (Cavana, Delahaye & Sekaran, 2001, p. 240-241). Although online questionnaires are easy to administer and respondents can respond at their convenience, this data gathering method can lead to a low response rate. Responses can also be biased because the respondents can potentially not be representative of the target population. It, however, has the potential to reach a wide audience very quickly.

The initial objective was to post a request to the LinkedIn NZ SME group. After various unsuccessful attempts to make contact with the group's administrators the approach has changed and the following methods were used to reach as many as possible SME's.

- Sent individual personalised email requests to members of the NZ SME LinkedIn group. Also used the Yellow Pages to identify SME's. The total number of potential respondents reached with this method were 120.
- Requested my LinkedIn connections and fellow MIM students to forward the request to SME's they may know. The total number of potential respondents reached with this method were 260.
- Targeted other SME networks of which only Small Business Voice accepted to post the request to their network members. The total number of potential respondents reached with this method were unknown.

## 3.4 Research Instrument

The questionnaire includes nominal and interval scale type of questions. Nominal questions were utilised to obtain some basic, categorical information (Cavana et al., 2001, p. 195). The nominal questions gathered information in regard to respondent demographics and SME's current BI activities and BI maturity levels. Interval scale questions measure the difference between two points on a scale (Cavana et al., 2001, p. 196) and were used to gather data in regard to data management practices, organisation culture and organisational motivation. For the purpose of this research, five point Likert Scale questions were used to measure how strongly the SME's either agreed or disagreed with the statements (Cavana et al., 2001, p. 205). Appendix 2 outlines the research questions included for the research study. The interval scale questions were compiled from questions in existing research studies on similar topics. This approach provided a level of certainty around the reliability of questions and saved time on pre-validation of the questionnaire. The questionnaire was completed by two persons in the SME sector and feedback was incorporated for the final questionnaire.

## 3.5 Data Analysis Methods

The data was analysed using either Excel or the software package SPSS (Statistical Package for Social Sciences) for Windows. The objectives of the analysis were to i) obtain a feel for the data ii) test the reliability of the data and iii) test the hypotheses developed for the research (Cavana et al., 2001, p. 319). Various methods or tests were used to achieve the objectives which included descriptive analysis to obtain a feel for the data, Cronbach alpha to test the reliability and multiple regression to test the hypotheses.

### 3.5.1 Descriptive Analysis

For the purpose of obtaining a feel for the data descriptive statistics were used, which included the calculations of maximum, minimum, means, standard deviations and variances (Cavana et al., 2001, p. 325). It enabled an understanding of SME's demographic distribution, current use of BI tools, data management practices, leadership, innovativeness, competitiveness and understanding of the value of BI. The mean value was predominantly used for the interpretation of the interval-scaled questions.

### 3.5.2 Reliability Test

The goodness of the data was tested using the Cronbach alpha measure. It measures the internal consistency of the interval-scale questions and is expressed as a number between 0 and 1. It is an indication of the extent to which a test measures the same concept or construct and therefore an indication of the inter-relatedness of the questions measuring a particular concept. There are, however, different views of acceptable values that can range from 0.70 to 0.95. A low alpha score may be the result of poor correlation between items or low number of questions (Tavakol & Dennick, 2011) for the concept or construct.

### 3.5.3 Hypothesis Testing

For the purpose of hypothesis testing the questionnaire used interval scaled type of questions. The recommended statistical test for more than one independent variable and scaled measurement is the Multi Regression analysis test (Cavana et al., 2001, p. 416). This test is used when a study wants to predict a dependent variable from a number of

independent variables. This test is a descriptive tool and can be used for three types of situations as described by Cooper & Schindler (2003, p. 613-614): (a) “To develop a self-weighting estimation equation by which to predict values for a criterion variable (DV) from the values for several predictor variables (IV’s) i.e. predict housing sales on the basis new housing starts, new marriage rates and annual disposable income; (b) To control variables to better evaluate the contribution of other variables i.e. control the brand of a product and the store of purchase to study the effects of prices as indicator of quality; (c) To test and explain causal theories by describing and entire structure of linkages that have originated from a causal theory.” The situation that best fits the purpose of this study is option 1, where the likeliness of BI option (dependent variable) is predicted based on the independent variables of data management practices, organisational culture and organisation motivation.

The acceptance or rejection of the hypothesis is determined by the significance level. The significance level can either be set at 1 per cent, 5 per cent or 10 percent. The most common level in business and management research is at a level of 5 percent. A 5 percent significance level will indicate that the confidence level is 95 per cent. (Cavana et al. 2001, p. 415)

# 4 Results

## 4.1 Data Preparation

A total of 47 online surveys were started, however only 26 were completed and used for the research. In preparation the data was exported from the online questionnaire into Excel, where it was manipulated for further analysis. The nominal scale type of questions data output was given as a number and had to be translated into the respective categories as per the questionnaire to support further analysis and interpretation. Minimal data correction was required as a result of all questions being configured to be mandatory and validated on entry.

## 4.2 Data Reliability

The Cronbach alpha test was performed for all the interval scale type questions to confirm the data reliability. The results of the Cronbach Alpha test are as per Table 14. The acceptable range is from 0.70 to 0.95 (Tavakol & Dennick, 2011) and all sets of questions obtained a result within the range. Four out of the 5 questions sets had a value of 0.8 and higher with only competitiveness that was slightly below 0.8. Based on this result all questions were used for further descriptive and statistical analysis.

Table 14: Alpha Cronbach results

| Question Sets | Cronbach Alpha | Number of Items |
|---|---|---|
| Data Management Practices | 0.828 | 12 |
| Leadership | 0.898 | 7 |
| Innovativeness | 0.925 | 8 |
| Competitiveness | 0.785 | 5 |
| BI Value | 0.955 | 10 |

## 4.3 Descriptive Analysis

The descriptive analysis provides an overview and feel for the results. The approach followed was to analyse and report on the results in four categories: SME demographics; usage of BI tools; descriptive results for data management, innovativeness, leadership, competitiveness, BI value that also includes a breakdown per analytical maturity level.

### 4.3.1 SME Demographics

#### 4.3.1.1 Industry Types

For the purpose of the study the questionnaire made provision for 19 SME industry types. As illustrated by Figure 3 the research responses indicate that Information Technology is the largest industry represented with 7 (28%) of the SME's responding. It is followed by Information Media & Telecommunication, Public Administration & Safety and Other industry types with 3 (12%) SME respondents each. Professional Scientific and Technical Services, Manufacturing with 2 (8%) SME respondents. Lastly only with 1 (4%) SME from the Electricity, Gas, Water & Waste Services, Arts & Recreation and Transport, Postal & Warehousing industry types. The SME's that indicated other, business activities related to importing and human resources and one respondent did not indicate at all.

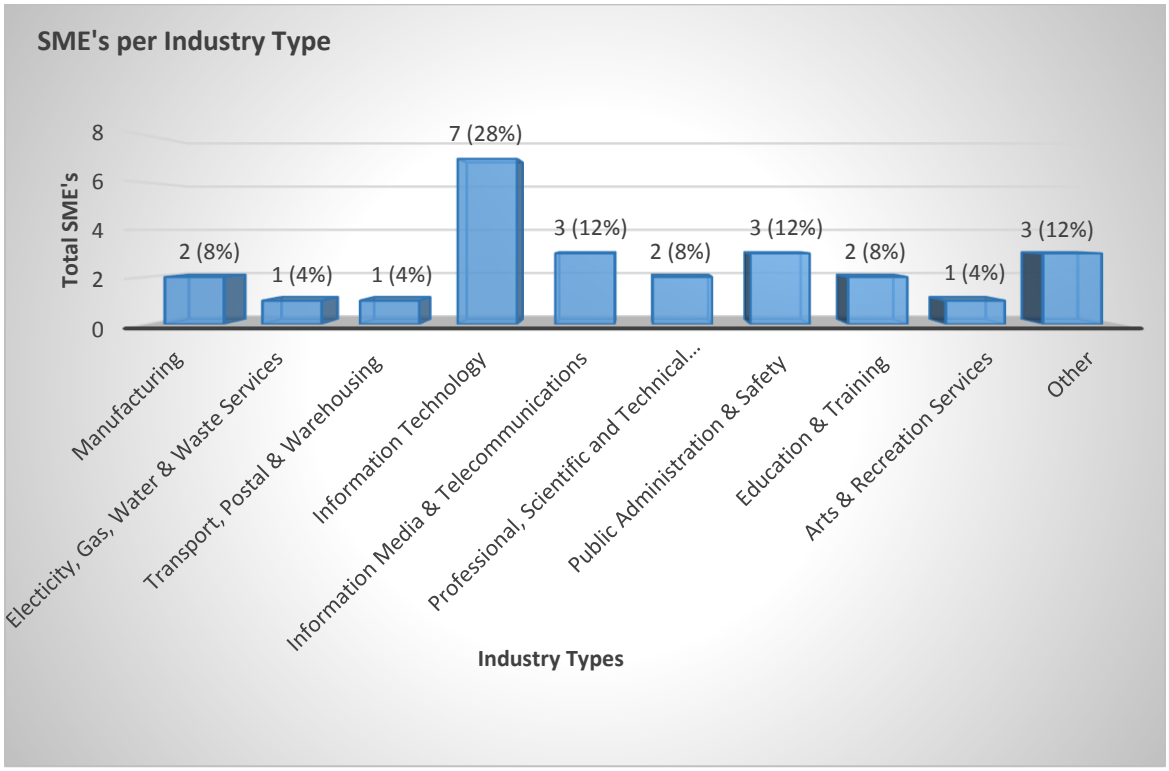



Figure 3: Number of SME's per industry types

4.3.1.2 Number of Years in Operation

As illustrated by Figure 4 the responses were well distributed across the nominal scale for the number of years in operation. The largest group of 13 (50%) SME's have been in operation for 16 or more years. The remainder of SME's was well distributed across all other year groupings as per graph.

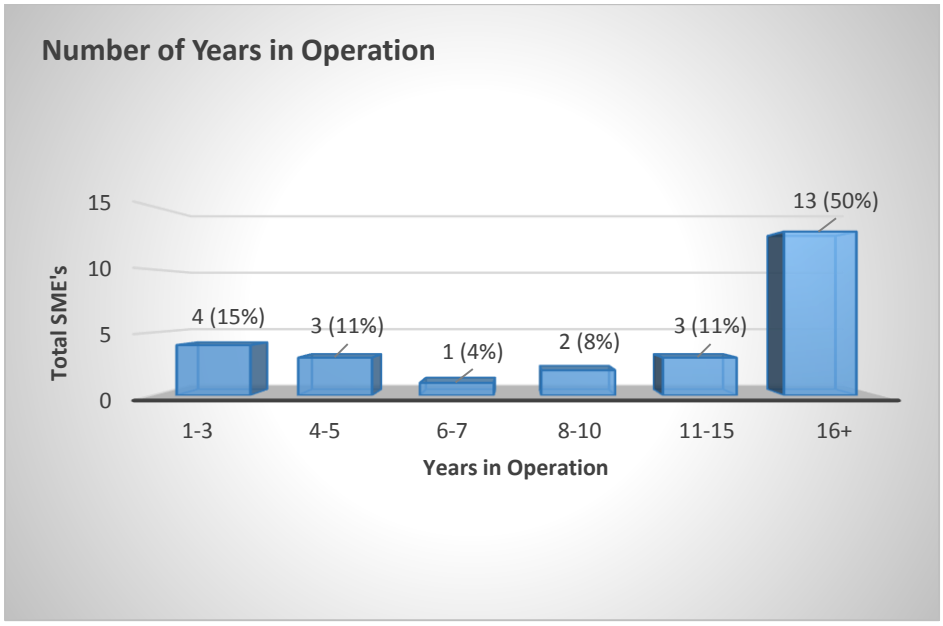



Figure 4: Number of years SME's are in operation

#### 4.3.1.3 Number of Employees

All size categories according to the New Zealand classification (Statistics New Zealand, 2013) were represented although some were in the minority. As per the graph in Figure 5 8 (31%) of the SME responses are from large SME's with 100+ employees. The second largest classification represented is small SME's (6-19 employees) with 6 (23%) responses followed by medium (50-99 employees) with 5 (19%) responses, Micro (1-5 employees) with 4 (15%) responses and zero SME's (1 employee) with only 1 (4%) SME's response.

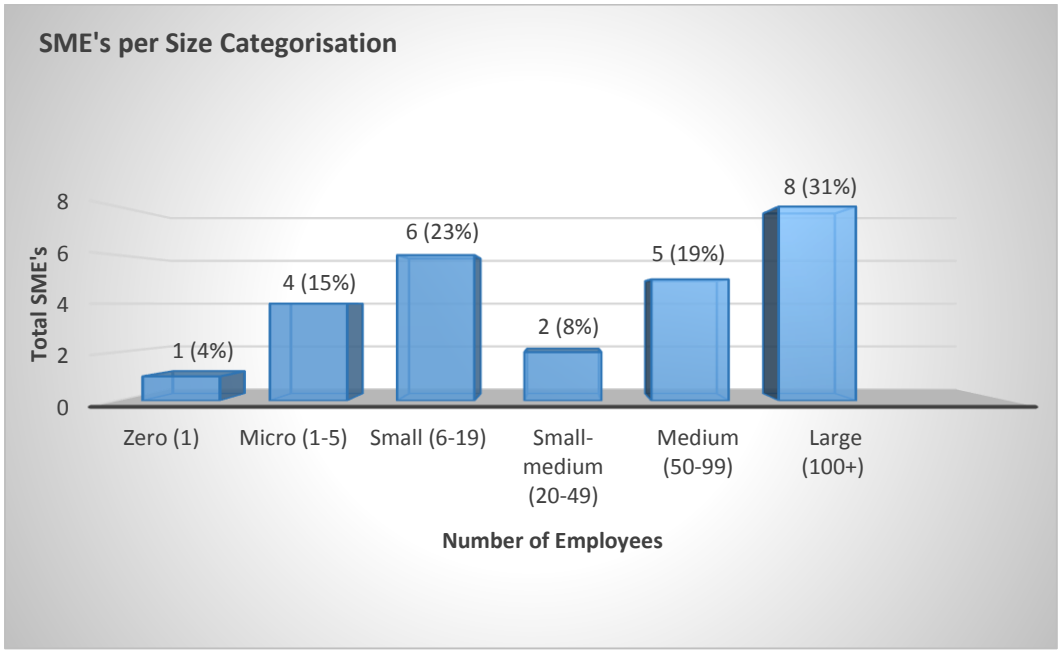



Figure 5: SME's per New Zealand size categorisation

#### 4.3.1.4 Respondent Age

As illustrated by Figure 6 all age groups are represented with the majority of 10 (38%) of the SME's in the age group 50-59 years, followed by 8 (31%) SME's between 40-46 years. Overall 20 (76%) of SME respondents are 40 years and older, with only 6 (24%) SME's in the younger age groupings of 20-39.

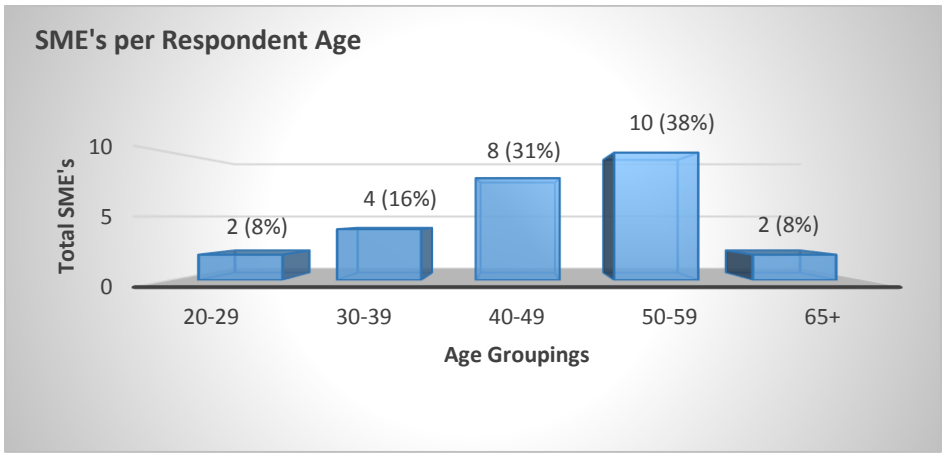



Figure 6: Distribution of SME's per respondent age

#### 4.3.1.5 Respondents Roles

As illustrated by the graph in Figure 7, the majority of the respondents who have completed the questionnaire were either the owner (5), CEO (3) or senior manager (8); 2 of the respondents were in management roles and 8 respondents were employees.

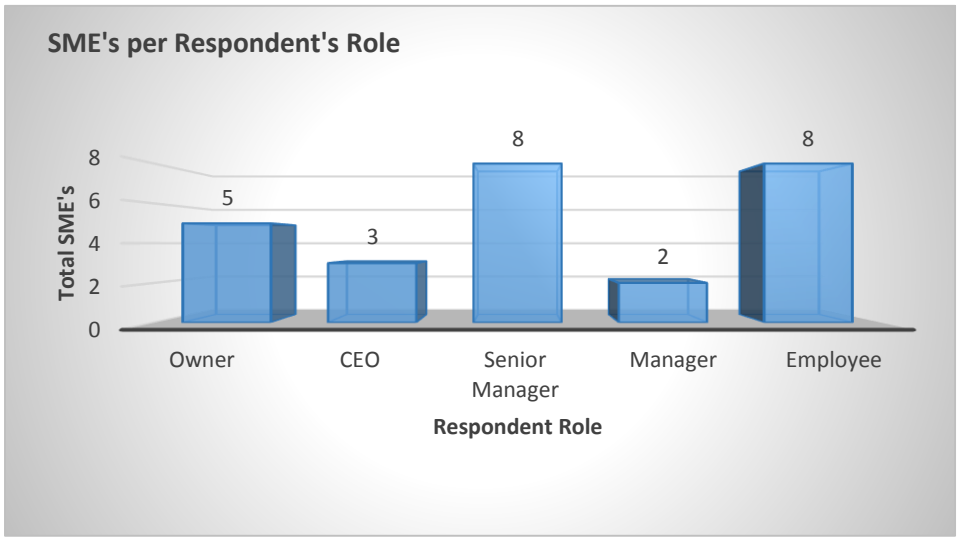
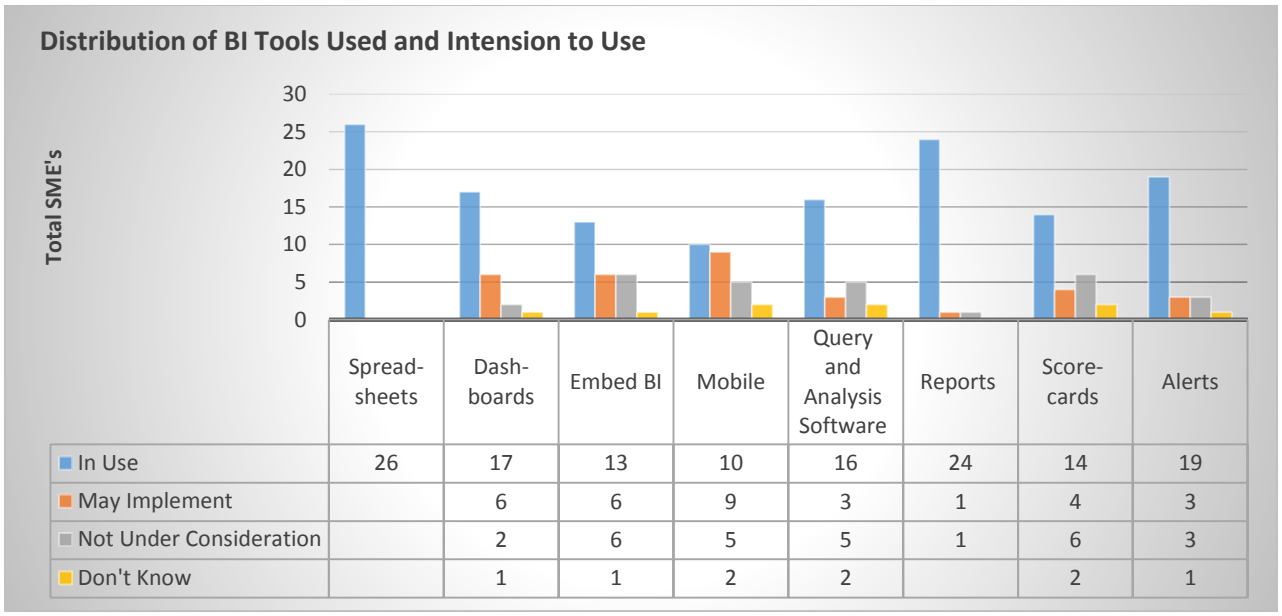



Figure 7: SME per respondents role within the organisation

#### 4.3.1.6 SME BI Tools Usage

##### 4.3.1.6.1 SME usage of BI Tools

The questionnaire measured the use and likeliness of use of the following BI tools: spreadsheets, dashboards (drillable / interactive data visualisation interfaces), embedded BI (charts / data visualisation), mobile (smartphones- or tablet based) dashboards / data visualisation), query and analysis software (i.e. in memory what-if planning, OLAP cubes etc.), reports (application generated, formatted PDF / HTML sent by email or accessed online), scorecards (comparing performance to pre-defined goals) and alerts (e-mail, SMS etc. for exceptions / thresholds). As illustrated by Figure 8, all BI tools included for the questionnaire are used by 13 or more (50% or more) of the SME's, with the exception of mobile tools that were only used by 10 of the SME's. The tool used by all of the SME's is spreadsheets. Reports are used by 24 SME's. Other popular BI tools in order of usage are Alerts (19 SME's), Dashboards (17 SME's), Query and analysis software (16 SME's). To the lower end were embedded BI (13 SME's) and mobile (10 SME's). The tools with the highest likeliness of implementation in future are dashboards (6 out of remaining 9) and mobile (9 out of remaining 16). Embedded BI, alerts and reports were equally distributed between the number of SME's that indicated that they may implement them or were not considering these tools. In regards to query and analysis software and scorecards, more SME's indicated that the tools were not under consideration for implementation in comparison with SME's that may implement them. Apart from spreadsheets and reports, the responses indicated that there were only 1 to 2 SME's who were uncertain if tools were used.




| | Spread-sheets | Dash-boards | Embed BI | Mobile | Query and Analysis Software | Reports | Score-cards | Alerts |
|---|---|---|---|---|---|---|---|---|
| In Use | 26 | 17 | 13 | 10 | 16 | 24 | 14 | 19 |
| May Implement | | 6 | 6 | 9 | 3 | 1 | 4 | 3 |
| Not Under Consideration | | 2 | 6 | 5 | 5 | 1 | 6 | 3 |
| Don't Know | | 1 | 1 | 2 | 2 | | 2 | 1 |

Figure 8: Distribution of BI tools used and intention to use

4.3.1.6.2 Primary Purpose of BI Tools

The primary use of reporting, modelling, analysis, and decision support (BI) tools as illustrated by Figure 9 was predominantly for the purpose of performance analysis and monitoring (73% or 19 SME's) and the extraction and reporting of transaction data (65% or 17 SME's). The use of BI tools to automatic trigger processes, perform predictive modelling and simulations and what if decision support was on average used by 35% to 39% (9 to 10) of the SME's. There were 27% (7) SME's that indicated that they were not active users of BI tools for the activities outlined by the questionnaire.

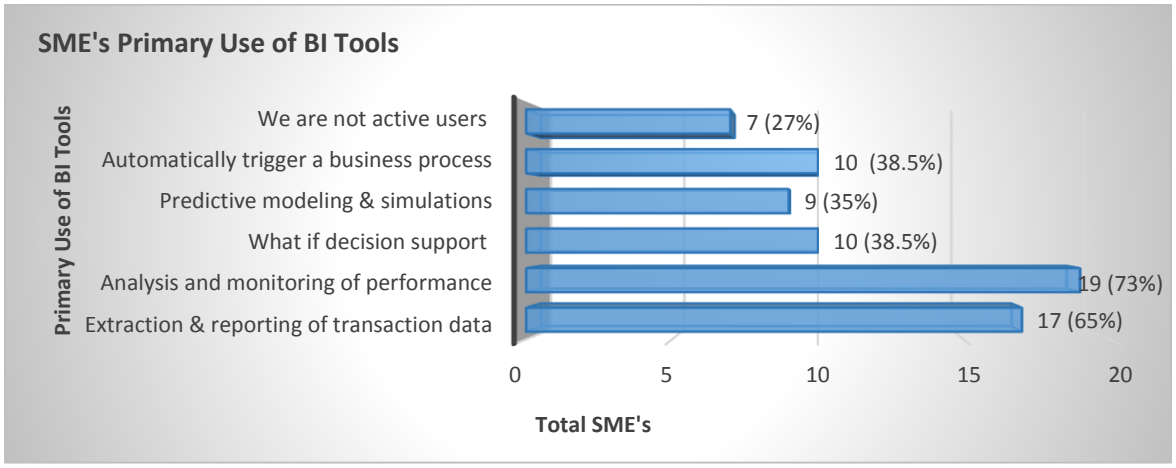



Figure 9: Primary use of BI tools

### 4.3.2 Descriptive Results per SME's Analytical Maturity

#### 4.3.2.1 SME's Analytical Maturity Levels

The majority of the SME's as illustrated by the graph in Figure 10 positioned their organisations analytical maturity at levels 3 to 5, which are towards the top end of the maturity scale. From this group 8 (31%) SME's were at level 3 which represents an organisation with analytical aspirations, 9 (35%) of the SME's identified the organisation on level 4, which represents an analytical organisation and 3 (11%) of the SME's classified the organisations as analytical competitors. For level 1 to 2, 5 (19%) of the SME's indicated that their analytical activities within the organisations were localised (Level 2) and only 1 SME indicated that the organisation is analytical impaired (Level 1).

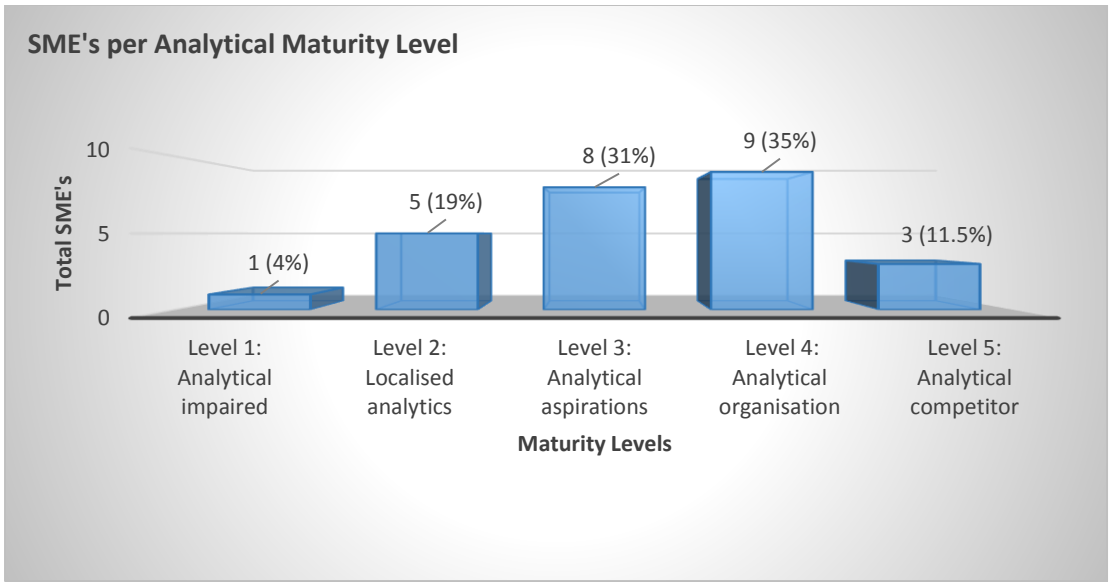



Figure 10: SME's per analytical maturity level

### 4.3.3 SME Profile per Maturity Level

#### 4.3.3.1 Level 1: Analytical Impaired

Only 1 SME belonged to this category so the organisation can be classified as a Micro SME and operational for 1 to 3 years. The response was completed by the owner. The only analytical tool currently used by the organisation is spreadsheets as illustrated by Figure 11 and other tools under consideration for use are dashboards and mobile. Embedded BI, query and analysis software, reports, scorecards and alerts are not under consideration. In the context of the variables included for this research study this SME's strength (Figure 12) is in their innovativeness. Their competitiveness was their lowest rating. Data management, leadership and BI value were approximately equally ranked. This SME's aim is to use BI in future.

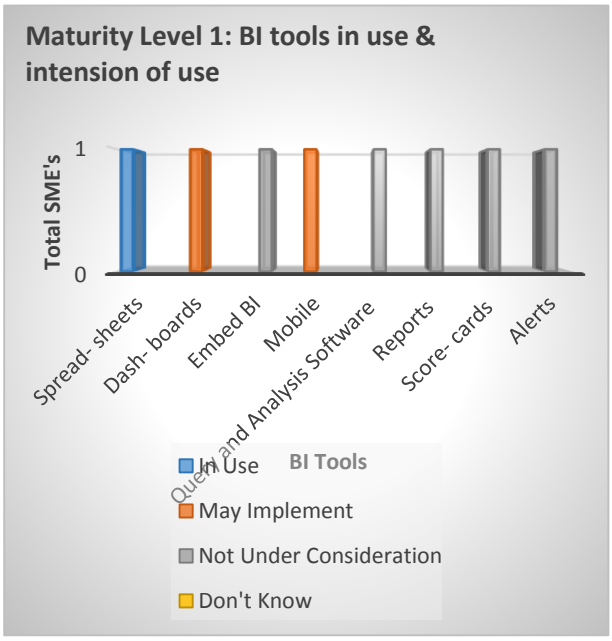



*Figure 11: Maturity Level 1 BI tools in use and intention of use*

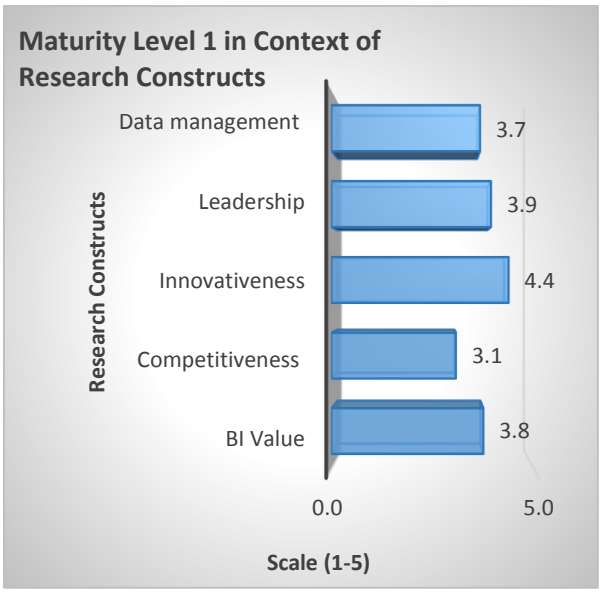



*Figure 12: Maturity level 1 performance in context with research constructs*

#### 4.3.3.2 Level 2: Localised Analytics

The results for level 2 organisations labelled as localised analytics are the responses of 5 SME's in 4 different industry types. 4 out of the 5 responses come from medium to large SME's (50 – 100+ employees), with the exception of 1 micro SME (1-5 employees). All of the SME were in business for more than 11 years. The responses predominantly came from the owner or senior manager, but also from employees. The majority of the SME's didn't consider the organisations as active users of BI practices. As illustrated by Figure 13 Spreadsheets and reports were used by all SME's in this level and alerts by 4 of the 5. Across all of the other BI tools there was an even distribution between tools that were in use, may use, not considering, or uncertainty if the tools were used. These SME's ranked (Figure 14) their organisational competitiveness the lowest and had a neutral view which borders on uncertainty in regards to their competitiveness.

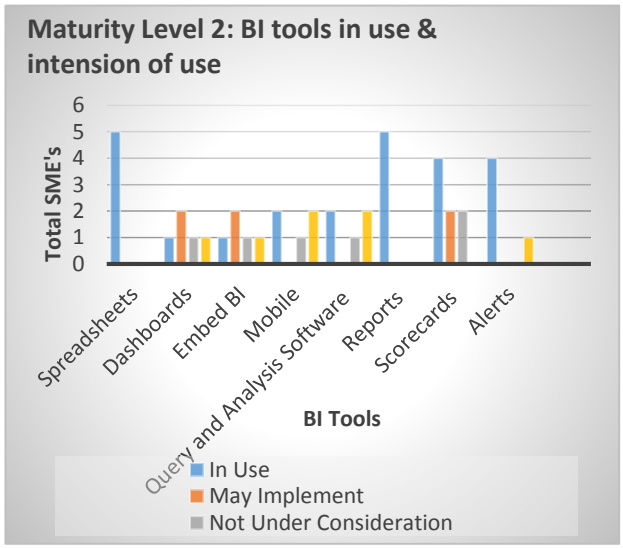



*Figure 13: Maturity level 2 BI tools in use and intention of use*

Their leadership and innovativeness were equally ranked the strongest with BI value and data management slightly weaker. All of the results were on the borderline of being neutral (no firm view) or agreeingwith the statements (3 to 4 on interval scale).

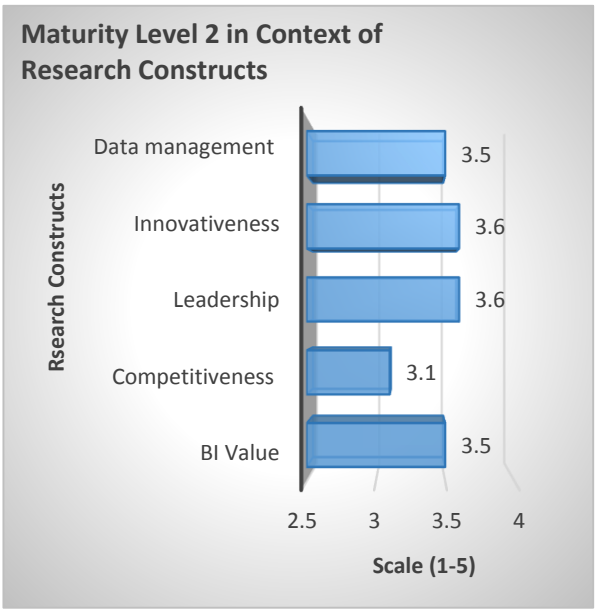



*Figure 14: Maturity level 2 performance in context with research constructs*

#### 4.3.3.3 Level 3: Analytical Aspirations

The level 3 type of SME's which are categorised as analytical aspiration included 8 SME's. This group was represented by 7 industry types. Three of the SME's were in operation for 1 to 10 years and 5 were in business for more than 16 years. There was an even distribution among the sizes of organisations. The majority of the responses came from the owner or senior managers. The split between SME's using BI was approximately even with 5 indicated that they are BI users and 4 not actively using BI. As shown by Figure 15 all BI tools included in the questionnaire are in use by this group, spreadsheets again are in use by all, followed by reports and to a lesser extent dashboards, alerts, embedded BI, query and analysis, scorecards and mobile. Of all tools not in use, mobile is the tool with the highest indication of future implementation followed by embedded BI.

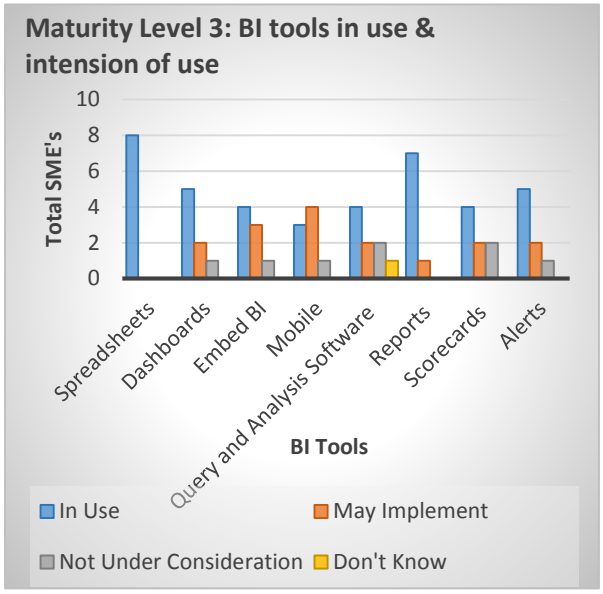



*Figure 15: Maturity level 3 BI tools in use and intention of use*

Data management practices, leadership, innovativeness and perception of BI (Figure 16) were all approximately equally weighted close to 4 on the interval scale of agreeing with the statements of these attributes, with competitiveness at 3 which is an indication of the SME's not having a firm view in regards to the organisation's competitiveness.

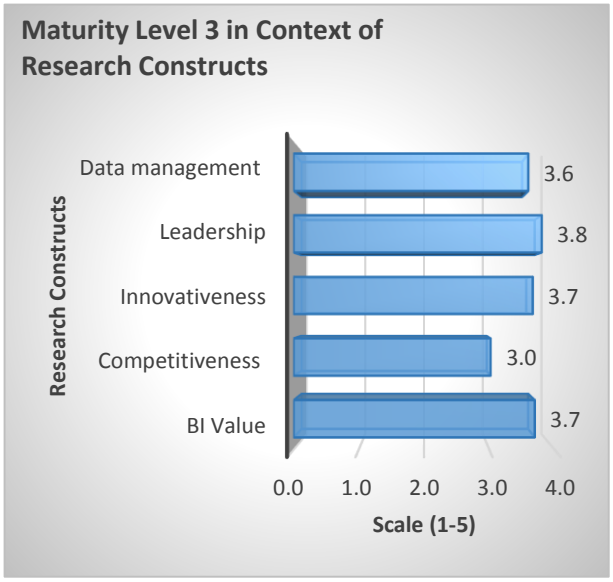



*Figure 16: Maturity level 3 performance in context with research constructs*

#### 4.3.3.4 Level 4: Analytical Organisation

Level 4 SME's are classified as analytical organisations and are made up 9 of the 26 responses. This group is represented by 7 industries. This group has an even distribution across all the categories of years in business and ranges from 1 to 16+ years. There was almost an even distribution between micro to small (5) and medium to large (4) SME's. The majority of the responses came from owners and management roles. There was also almost an even split between BI users (5) and those with BI (4) not actively used. As indicated by Figure 17, all BI tools as per questionnaire were in use to a large extent by this group with only a minority of SME's not using some tools. There was almost an even split between tools considered for future implementation and tools not considered.

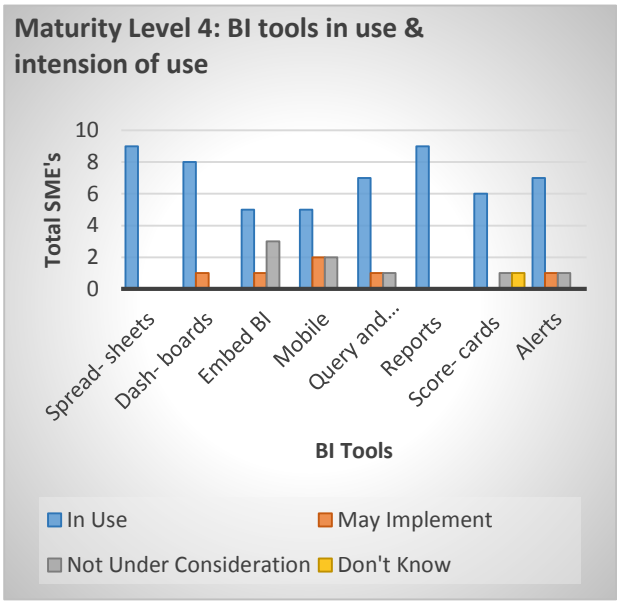



*Figure 17: Maturity level 4 BI tools in use and intention of use*

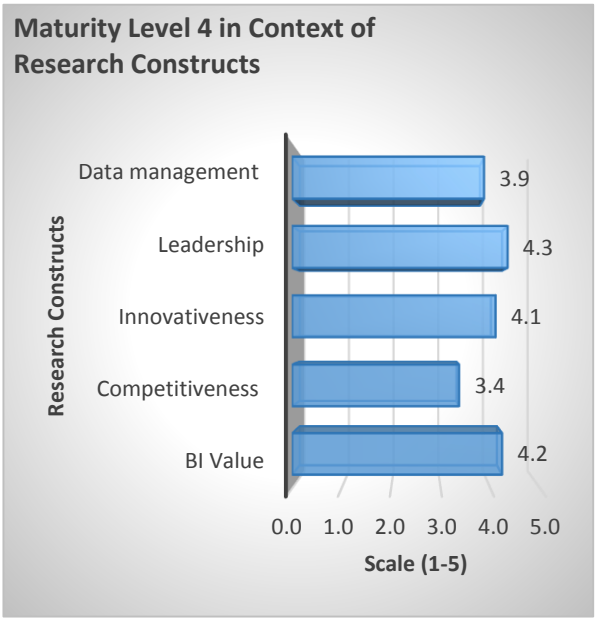



*Figure 18: Maturity level 4 performance in context with research constructs*

Data management practices, leadership, innovativeness and perception of BI value (Figure 18) were all approximately equally weighted close to 4 on the interval scale of agreeing with the statements of these attributes. Leadership and BI value were ranked slightly higher than innovativeness, followed by data management. Competitiveness was ranked at 3.4 which is an indication of uncertainty in regards to the organisation's competitiveness.

#### 4.3.3.5 Level 5 Analytical Competitors

Level 5 represents the SME's that categorises their organisation as the organisation that strengthen their position through analytics. This group represents 3 out of the 26 responses received and was an interesting representative of 1 industry namely Information Technology. This group was represented by small to lower end medium sized (40 to 59 employees) SME's. The years in operation varied from relatively new in business (1-3 years) to being in business for a number of years (11+). Responses were all from either the owner or management roles. As would naturally be the assumption all of the SME's indicated that they were active BI users. As reflected by Figure 19 all BI tools as per questionnaire were in use by all of the SME's, with the exception of Mobile that is under consideration for use in future by the SME's not already using it. Data management practices, leadership, and perception of BI Value (Figure 20) were all approximately equally weighted close to 4.6 on the interval scale and were a firm indication that these organisations comply with the various attributes of a BI organisation. Innovativeness and competiveness ranked lower closer to the 4 mark on the scale.

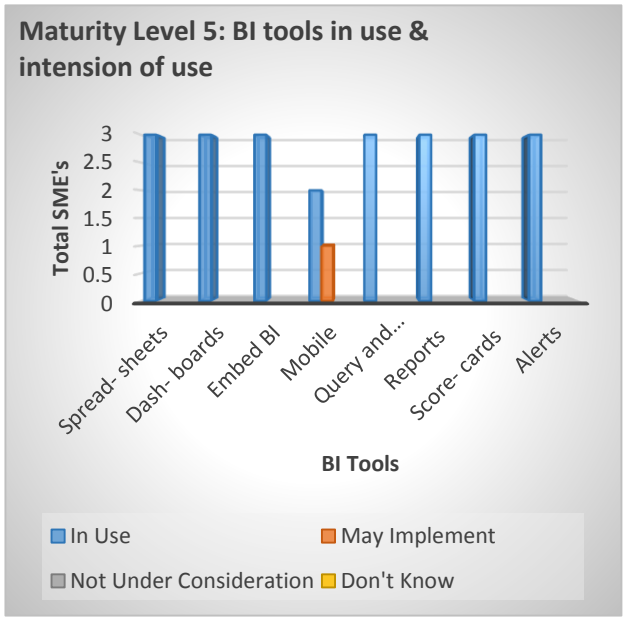



*Figure 19: Maturity level 5 BI tools in use and intention of use*

*Figure 20: Maturity level 5 performance in context with research constructs*

### 4.3.4 Descriptive Results per Research Constructs

#### 4.3.4.1 Data Management Practices

In the context of data management practices, the questionnaire objective was to obtain SME's views in regards to statements that related to data management factors, which included: source and structure of data, data uniqueness, data integration capability, data quality, data accessibility, privacy and governance in place to manage data. The responses are ranked on a 1 to 5 point Likert scale (1 Strongly Disagree, 3 Neutral and 5 strongly agree). As illustrated by Figure 21 the average of all responses is predominantly in the 3–4 scale range that implies a view between neutral and agreeing with the statements. The attributes with the highest rankings are data uniqueness and privacy. The SME's overall view is that their organisational data is unique and has the potential to give them a competitive edge and adds value to the organisations operations. SME's then all show a degree of responsibility towards their data to ensure its security and that access is restricted. Accessibility overall ranking was 3.7 which indicated that data is reasonably accessible to enable data to be extracted, downloaded or uploaded for analysis. Integration capability and data structure were equally ranked at 3.6, which reflect that SME's are in agreement that they have reasonable integration capabilities to enable the comparison between data sets. The same applies to data structures that relate to an indication by SME that their data originates from a combination of structured i.e. transaction applications and databases and unstructured sources that include for example social media, emails etc. Data quality had the second lowest score of 3.5 and the conclusion can be drawn that the view of SME's is that their organisation's data was reasonable accurate, flawless and reliable and that error could be easily identified and data is believable and can be trusted.

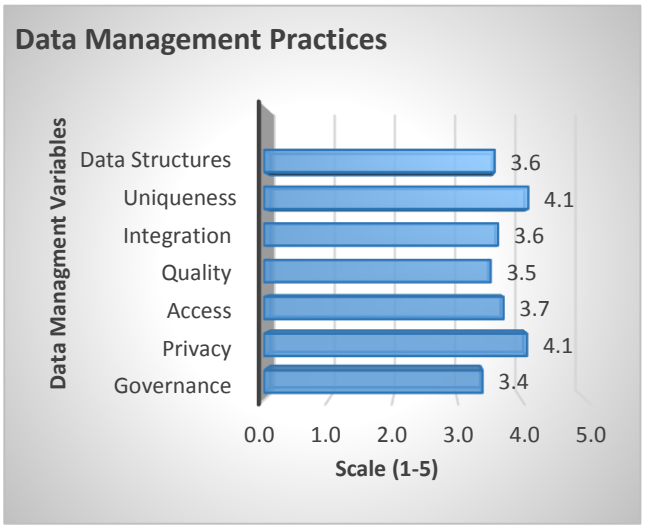



*Figure 21: SME data management practices*

Data governance had the lowest score of 3.4, which possibly implies that having a person assigned with a clear responsibility for data is not a high priority.

Data management practices in the context of the various maturity levels can be summarised by the graph in Figure 22. The graph illustrates that there is an upward trend in data management practices as the maturity levels increase. It can be interpreted that the respective maturity levels are an indication of more the sophisticated data management practices as the levels increase. The SME's on level 1, which is analytical impaired showed uncertainty in terms of their understanding of their data management practices, whereas levels 2 to 5 progressively showed more maturity in respect to the various data management practices related to structure and source of data, data uniqueness, data integration capabilities, data quality, data accessibility, data privacy and governance to manage data.

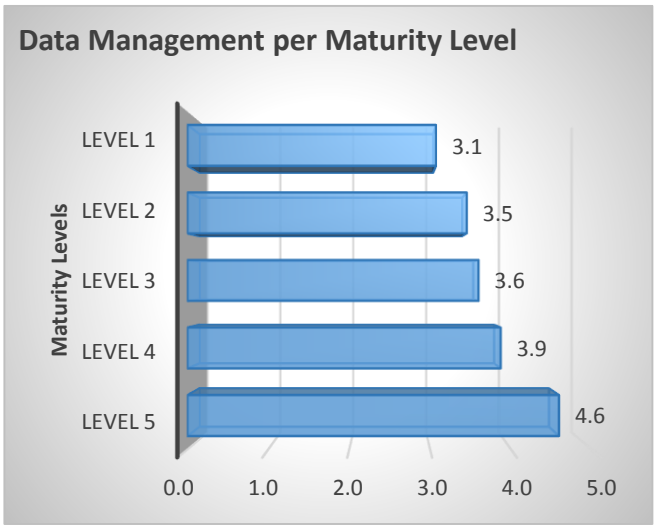



*Figure 22: SME data management practices per analytical maturity level*

#### 4.3.4.2 Leadership

Leadership was a construct used to get a feel for organisational culture. As per literature review it was determined that there is a close relationship between leadership, innovation and organisational culture. It has also been determined by previous research studies that an innovation orientated organisation is promoted by transformational leadership style. The questionnaire therefore measured the SME's leadership styles against the characteristic of a transformational leader. The questions focused on the attributes of having vision, providing individual support to employees, having high performance expectations and basing decisions on information. As reflected by the Figure 23 the average of all responses indicates that there is a strong presence of a transformational leadership style.

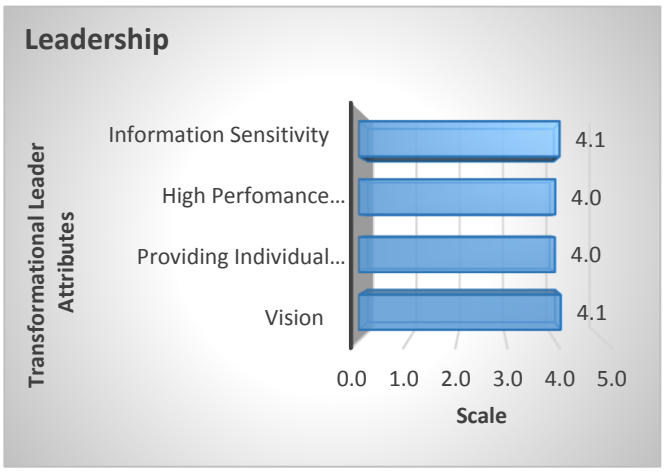



*Figure 23: SME transformational leadership*

The summarised view of leadership per maturity level as illustrated by the graph in Figure 24, shows that the level 1 SME, which was the response of only 1 SME owner ranked him/her close to being a transformational leader. The level 2 to 4 SME's agreeing that their leadership have transformational qualities, and the level 5 SME's show strong transformational leadership characteristics. Within the leadership data set there is again, with the exception of level 1, an upward trend in the view of the transformational leadership qualities. This illustrates a correlation between transformational leadership qualities as analytical maturity levels increase.

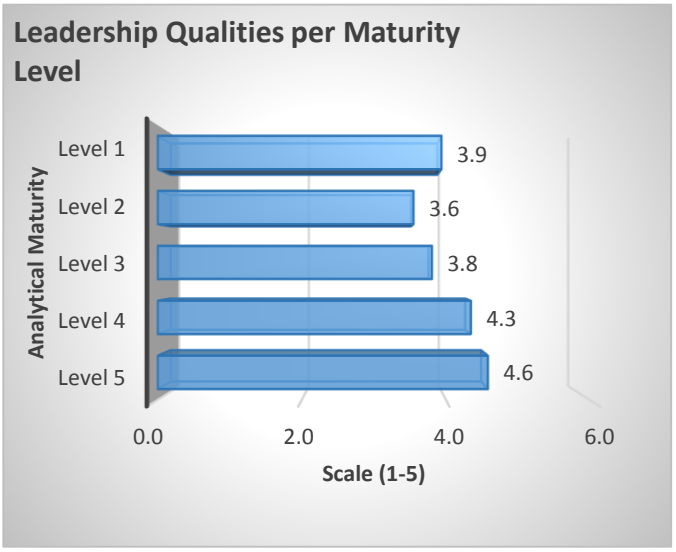



*Figure 24: SME transformational leadership per analytical maturity level*

#### 4.3.4.3 Innovativeness

Innovativeness was the second construct used to obtain an understanding of SME's organisation's culture. Questions in relation to Innovativeness were used to determine SME's ability to be innovative in context of taking "new things" onboard, take advantages of opportunities, quickly adapt to change and preparedness to take risks. As illustrated by Figure 25 the overall response in terms of the innovativeness attributes does not vary significantly and SME's overall view is that they perceive their organisations to be innovative. Risk taking was slightly lower ranked, which could possibly imply that SME's might be to some extent be risk averse.

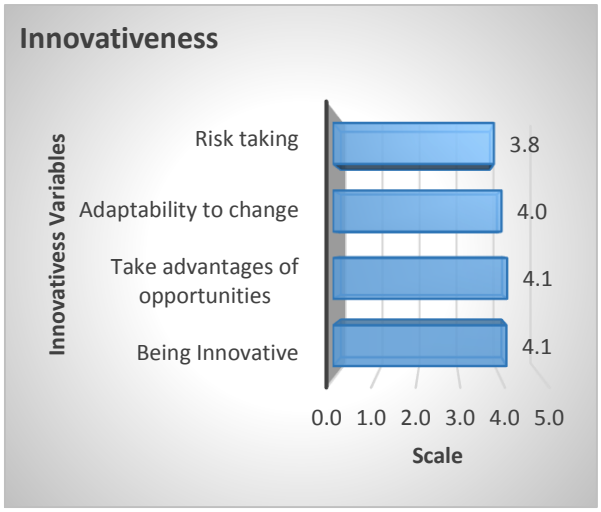



*Figure 25: SME innovativeness*

In terms of the result per maturity level the graph in Figure 26 shows, with the exception of level 1, an upward trend from levels 2 to 4. Levels 2 and 3 are closely ranked and the same for levels 4 and 5. There were no SME's that regarded their organisation as exceptionally innovative.

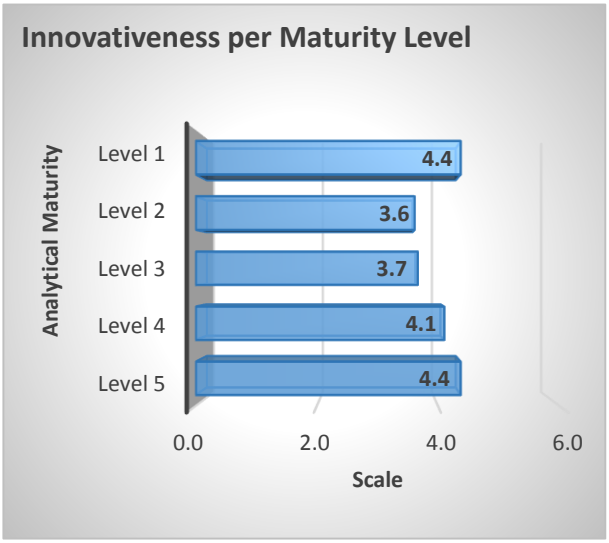



*Figure 26: SME innovativeness per analytical maturity level*

#### 4.3.4.4 Competitiveness

SME's are in competition with each other because they target the same markets and customers. SME's therefore need to have a strong focus on competitiveness to defend themselves in the market and ensure long term survival. To determine the SME's competitiveness in the market the questionnaire focused on attributes, which included opportunity exploitation, cost competiveness and the use of technology to build competitive capabilities. Figure 27 highlights that technology is considered as part of SME's plans to build competitiveness and the focus is also to be cost competitive. Opportunity exploitation overall response was ranked the lowest. The overall response indicates that SME's do not have a firm view that they exploit all market opportunities that are presented in their industry.

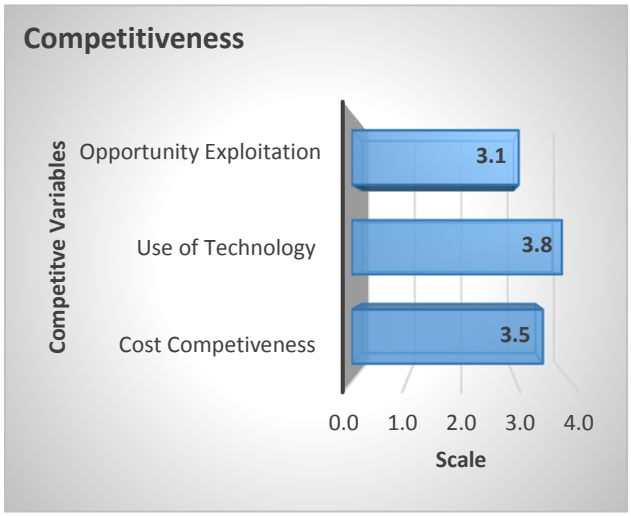



*Figure 27: SME competitiveness*

The overall view of competitiveness and the difference between SME's that operate on different levels of analytical maturity shows as per Figure 28 that there is uncertainty between levels 2, 3 and 4 of how competitive their organisations are. The level 1 and 5 SME's indicated with their responses that they view themselves as competitors in their market. None of the SME's views their organisation as highly competitive.

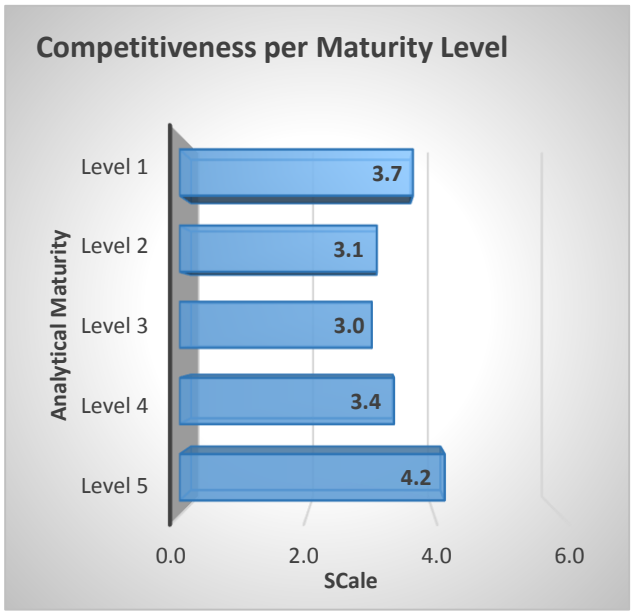



*Figure 28: SME competitiveness per analytical maturity level*

#### 4.3.4.5 BI Value

BI value can originate from the various benefits that come with the application of process, methods and the use of technology to change data into information and information into knowledge, when it is applied to the benefit of the organisations. As identified by the literature the different types of benefits can include strategic -, information -, transactional - and transformational benefits. The questionnaire focus was to obtain the SME's view on the value that BI has or may have for their organisations. As per the results in illustrated in Figure 29, all SME's recognise that BI can creates value for their organisations. BI can lead to strategic benefits which can include the delivering of better products and services and improve client relationship. BI has the potential to provide information benefits by enabling faster and easier access to information and improving information accuracy. SME's then also believe that BI has the ability to improve the skill levels of employees, which can support the transformation of organisations. The only benefit SME's might be more skeptical of is the transactional benefits in terms of BI's ability to reduce operation and communication costs. The view per analytical maturity level illustrated by Figure 30 indicates that, with the exception of level 1, there is upward trend in a better understanding of the value of BI as analytical maturity increases. There is a significant increase of 0.5 increase in the view of BI value from levels 3 to 5.

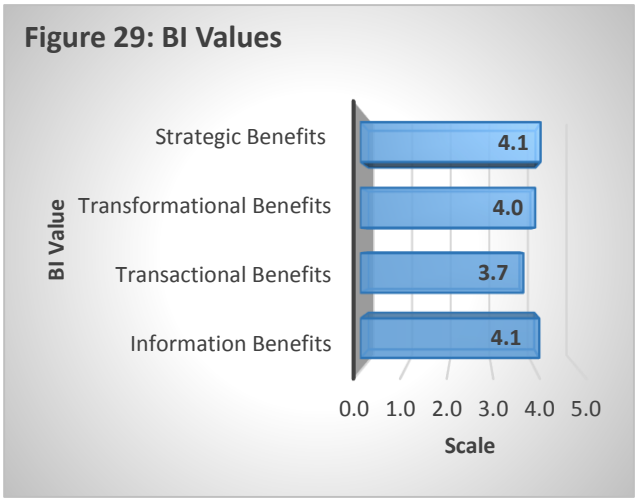



*Figure 29: SME BI value*

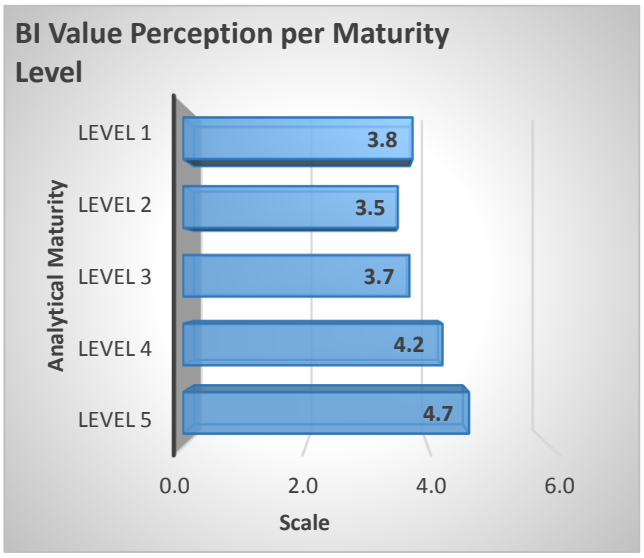



*Figure 30: SME BI value perception per analytical maturity level*

## 4.4 Hypothesis Testing

The research model as illustrated by Figure 31 tested the likeliness of BI adoption. The model aims to verify the relationship between data management practices, organisational culture and organisational motivation to increase the likeliness of BI adoption.

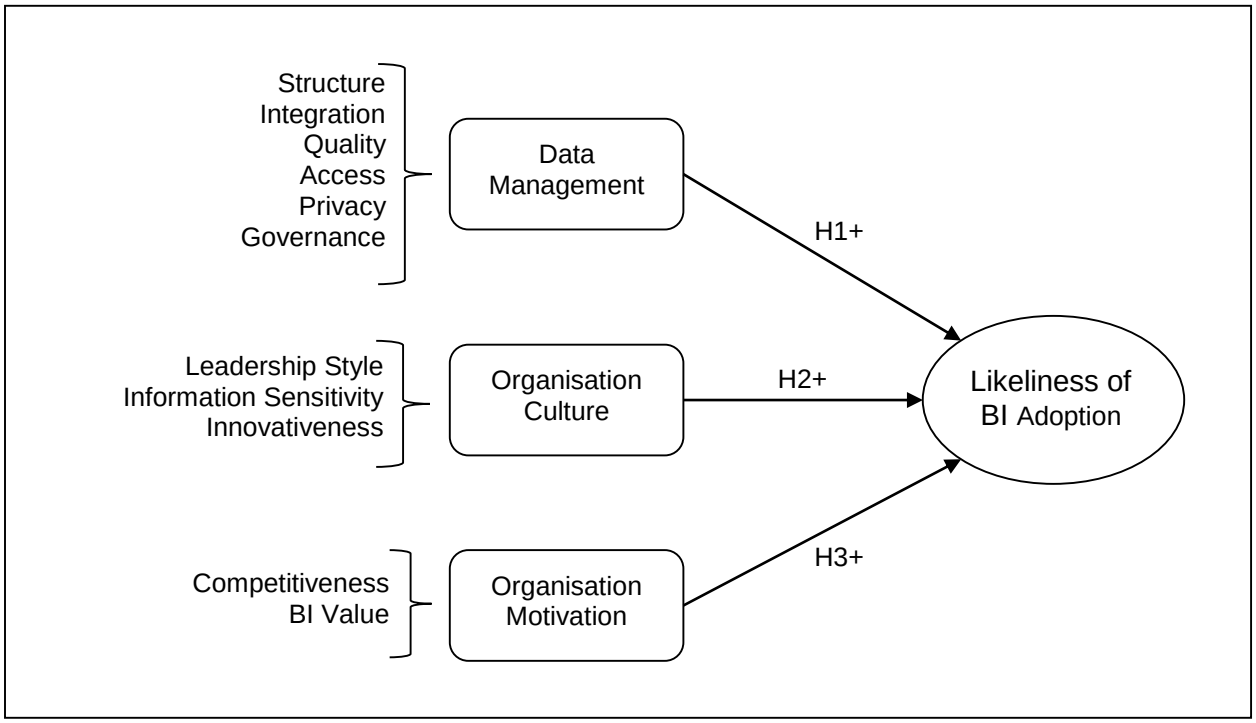



Figure 31: Research Model

The following null and alternate hypothesis statements are associated with the model.

*Hypothesis 1: Data Management*

$H1_0$ = SME's whose data management practices correlate with the BI requirements in relation to data availability; uniqueness; integration capabilities; quality; accessibility and usefulness will increase the likeliness of BI adoption.

$H1_A$ = SME's whose data management practices correlate with the BI requirements in relation to data availability; uniqueness; integration capabilities; quality; accessibility and usefulness will not increase the likeliness of BI adoption.

*Hypothesis 2: Organisation Culture*

$H2_0$ = SME's with an organisation culture with characteristics of innovativeness, transformational leadership style and a sensitivity to information as part of the decision making process will increase the likeliness of BI adoption.

$H2_A$ = SME's with an organisation culture with characteristics of innovativeness, transformational leadership style and a sensitivity to information as part of the decision making process will not increase the likeliness of BI adoption.

*Hypothesis 3: Organisational motivation*

$H3_0$ = SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption.

$H3_A$ = SME's competitiveness and their understanding of the benefits and value of BI will not increase the likeliness of BI adoption.

The hypotheses were tested using the multiple regression test and the responses of 24 of the respondents. The dependent variable was Likeliness of BI Adoption and the independent variables included data management, organisation culture and organisation motivation. The significance level was set to 5 percent ($\alpha = 0.05$). The implication of the test outcome is that if hypothesis significance value (p-value) is equal or less than the significance level ($\alpha = 0.05$) the hypothesis is accepted. If $p > 0.05$ the null hypothesis is rejected and the alternate hypothesis accepted.

As per results in Table 15, the following observations can be made. The R Square ($R^2$) value is an indicator of how good the overall model is. $R^2$ can be a value between 0 and 1 and the closer it is to 1 is an indication of how well the model fits the data (Cavana et al., 2001, p. 435). In this instance the $R^2 = 0.420$. Although lower that 50% the value was acceptable for this research study. The Beta ($\beta$) value is an indication of the independent variable that has the biggest impact if changed on the dependent variable (Cavana et al., 2001, p. 435). As an early indicator organisation motivation had the biggest value of 0.699

and stands out as an independent variable that, if changed, can have the biggest impact on the likeliness of BI adoption.

Table 15: Multiple regression hypothesis testing results

| **Model Summary** | | | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | .648[a] | .420 | .333 | .63316 |

a. Predictors: (Constant), Motivation, Data Management, Organisation Culture

| **ANOVA[a]** | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 5.815 | 3 | 1.938 | 4.835 | .011[b] |
| | Residual | 8.018 | 20 | .401 | | |
| | Total | 13.833 | 23 | | | |

a. Dependent Variable: BI Future Use

b. Predictors: (Constant), Motivation, Data Management, Organisation Culture

| **Coefficients[a]** | | | | | | |
|---|---|---|---|---|---|---|
| | | Unstandardised Coefficients | | Standardised Coefficients | | |
| Model | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 1.350 | 1.041 | | 1.296 | .210 |
| | Data Management | .006 | .331 | .005 | .019 | .985 |
| | Organisation Culture | -.093 | .332 | -.074 | -.279 | .783 |
| | Motivation | .850 | .404 | .699 | 2.103 | .048 |

a. Dependent Variable: BI Future Use

The significance level results for the respective hypotheses have the following outcome as illustrated by Table 32.

*Hypothesis 1*, that relates to data management, significance value $p = 0.985$ with $p>0.5$. The null hypothesis is being rejected and SME's whose data management practices correlate with the BI requirements in relation to data availability; uniqueness; integration capabilities; quality; accessibility and usefulness will not increase the likeliness of BI adoption.

*Hypothesis 2* that relates to organisation culture p=0.783 with p>0.05. The implication is the null hypothesis is rejected. The outcome leads to the acceptance of the alternate hypotheses that states: SME's with an organisation culture with characteristics of innovativeness, transformational leadership style and a sensitivity to information as part of the decision making process will not increase the likeliness of BI adoption.

*Hypothesis 3* that relates to organisation motivation, and the result obtained for p = .048. This value is ≤ 0.05 which confirm that the alternate hypothesis is rejected and the null hypothesis accepted. The statement can therefore be made that SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption.

As illustrated by Figure 32 the only variable that is statistically proven to have an impact on the likeliness of BI adoption is organisation motivation.

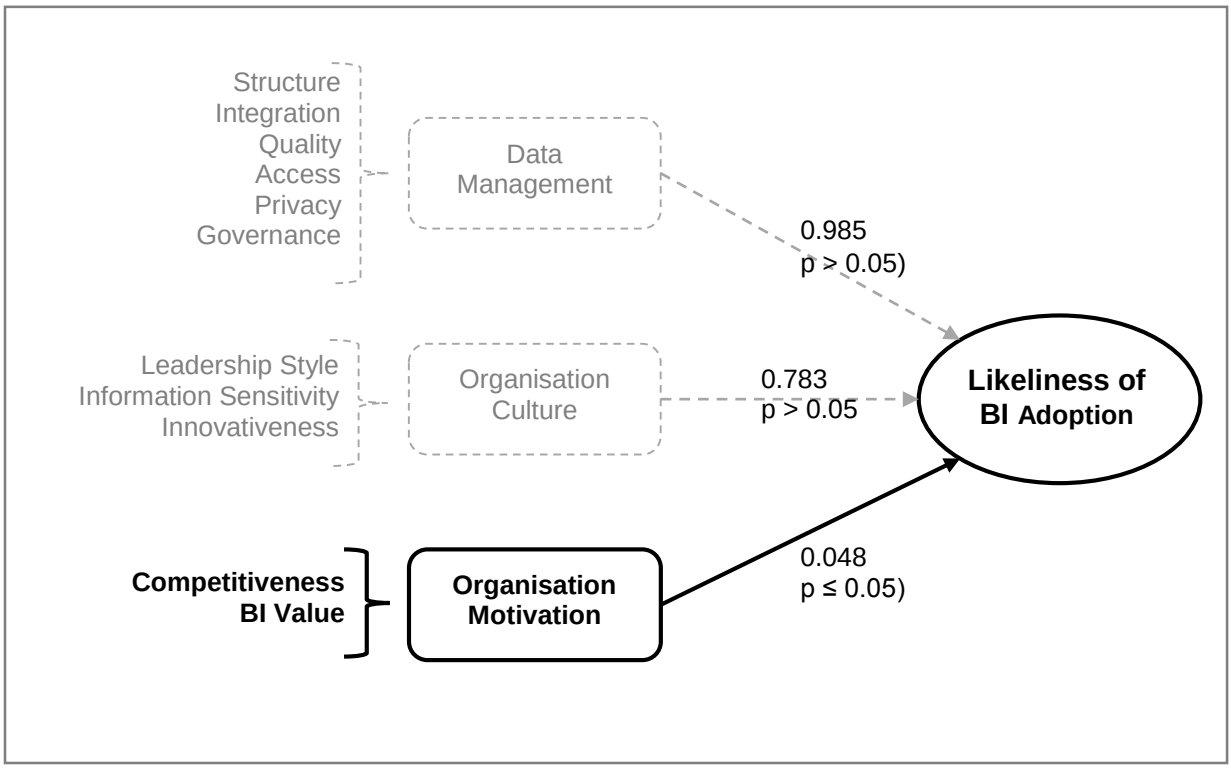



Figure 32: Research Model Outcome: Organisation Motivation has been identified as only factor with significant influence

## 5 Discussion

The primary objective set out by the proposed research model was to determine the influence of data management practices, organisational culture and organisational motivation on the likeliness of BI adoption by SME's. The research model was the outcome of a factor analysis exercise that reviewed technology adoption models and the outcome of SME BI and technology adoption research studies. The factor analysis led to the identification of the model's constructs and supporting factors as illustrated by the research model.

The hypothesis statements tested were:

*H1 – SME's whose data management practices correlate with the BI requirements of data availability; uniqueness; integration capabilities; quality; accessibility and usefulness will increase the likeliness of BI adoption.*

*H2 - SME's with an organisation culture with characteristics of innovativeness, transformational leadership style and a sensitivity to information as part of the decision making process will increase the likeliness of BI adoption.*

*H3 – SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption.*

The hypothesis testing outcome only confirmed $H3_0$ - *SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption.* Data management (H1) and Organisational culture (H2) was statistically ruled out as factors that will not influence the likeliness of BI adoption.

A summary of other findings includes: i) As SME's analytical maturity levels increase so does the number and extent of BI tools used, data management maturity increases, stronger transformational leadership qualities are observed, there is an increase in innovativeness, competiveness and view of BI value increases. ii) Results show that SME's use a wide variety of BI tools which is in contrast to previous studies. iii) SME's primarily use BI tools for the purpose of performance analysis and monitoring, which correlates with the behavior of private sector organisations and transformational

leadership. iv) SME's ranked competitiveness as the lowest of all constructs that made up the research model. This contradicts to some extent the expectations set-out by the literature. v) SME's are in agreement with the strategic, transformational and information benefits that BI can bring to the organisation. Transformational benefits showed a lower ranking which may imply that that SME's may be a bit uncertain in terms of these benefits. Each of these findings will be discussed in more detail in the section to follow.

Based on the analytical maturity levels as identified by Davenport et al. (2010), the results enabled the creation of a maturity profile for each of the levels in the context of the constructs that were measured by the questionnaire. Davenport et al. (2010) maturity model focuses purely on analytical activities and included levels 1 to 5 that comprises analytical impaired, localised analytical, analytical aspirations, analytical organisations and analytical competitors. Davenport et al. (2010) also make recommendation as to what is required to be done by the organisation to progress to the next level. Since this research did not purely measure their analytical behavior, these recommendations may not directly apply. Through the use of the model, however, it was possible to determine the impact on BI tools used, data management practices, innovativeness, leadership, competitiveness and the perception of BI value as the analytical maturity levels increased. The results have shown that as the maturity level increases there is an increase in the number of and the extent to which BI tools are used, data management practices becomes more mature, stronger transformational leadership qualities are observed, SME innovativeness and competitiveness increase and there is an increase in the perception or experience of BI benefits and value. To some extent an inter connectedness can be observed. As the maturity level increases it leads to the introduction of i.e. new data management practices or use of new BI tools, which effectively increases the innovativeness in how the organisation do these task and possibly make decisions. "New ways" have the potential to lead to better or innovative outcomes. It may in turn lead to the potential increase in competitiveness. The end result leads to business benefits i.e. increase in BI value. Every positive experience as a result of the application of processes, methods and technology to support a successful decision making process strengthens the perception and experience of the benefits and value that can be derived from BI. This

observation then also correlates with the result of the confirmed hypothesis, which states that SME's competitiveness and their understanding of the benefits and value of BI will increase the likeliness of BI adoption. This statement in the context of an increase in maturity level will imply that as the level increases another cycle of BI adoption is entered where new and improved processes, methods and technology are adopted which in turn lead to the increase in innovativeness, competiveness and value gain from BI. This discussion then also highlights that although data management practices, leadership and innovativeness (organisational culture) were statistically ruled out these factors do play a key role in achieving benefits and value for BI.

Results show that SME's use a wide variety of BI tools which is in contrast to research studies that highlight that cost and complexity of BI technology are barriers for BI adoption (Sangar & Iahad (2013); Khan, Amin & Lambrou (2009). The results also showed that even organisations that do not regard themselves as active users if BI practices have access to BI tools. The assumption is made that too much focus is put on BI technology. The application of BI does not need to start with expensive BI tools. As Davenport et al. (2010) indicate spreadsheets are a specialised form of analysing structured content. This is a tool accessible to all SME to start their BI journey with. SME's can start on the lowest maturity level and as success is achieved with BI practices can step up to more advance BI tools. SME's should be in the position to achieve benefits from BI practices with the use of basic tools such as spreadsheets.

Sarros et al. (2008) draw the conclusion that a private sector organisation's focus is centrally based on profit, competition and performance. The perception is then also that private sector leaders will display transformational leadership styles that will have a positive influence on a competitive, performance-orientated organisational culture, (Sarros et al., 2008). These statements are then also confirmed by this study. The results have highlighted that the SME's primary use of BI tools are for the purpose of performance analysis and monitoring and that SME's have also shown strong transformational leadership qualities.

Another observation made from the results is that SME's who are active users of BI practices ranked competitiveness the lowest of all the factors that make-up the constructs of the research model. This contradicts to some extent the expectations set-out by the literature and by hypothesis 3. Davenport et al. (2007) stated that competitiveness can be achieved through the exploitation of BI and predictive analytics. The explanation for this finding can possibly be based on the limited use of BI tools for the purpose of predictive modelling, simulations and what if decision support. In addition it may also be explained by the finding in terms of innovativeness. The overall ranking of innovativeness was good but exploitation of opportunities has the lowest ranking in terms of the constructs that made up innovativeness. As identified by the literature innovation is driven by internal and external forces. These results may imply that SME's to a lesser extent focus on strategic, product and market innovativeness, and put more focus on internal behavioral and process innovativeness that relates to new production and management approaches, new technology or process innovation or building innovative organisational culture through leadership support. Through this behaviour less focus is put on exploiting opportunities to strengthen their competitive position in the market.

The last finding to highlight the research results relates to BI benefit. SME's agree with the strategic, transformational and information benefits that BI can bring to the organisation. Transactional benefits, however, showed a lower ranking which may imply that SME's may be less convinced by these benefits. Transactional benefits relate to benefits that IT brings through automation of operational transaction or repetitive activities with the objective of cutting costs by substituting human labour with the technology. If this finding is compared with the primary purposes of BI tools used by the SME's then the observation can be made that the use of BI tools to trigger automatic processes was employed by a limited number of SME's. Most SME's, therefore, would not have experienced the value that can be derived from BI in this context, which can possibly explain the view in terms of transactional benefits.

The conclusion that can be drawn from the results is that SME's show the right signs in terms of BI adoption. BI tools are widely used. SME's have a good understanding of the benefits and value. More analytical mature SME's show stronger characteristics in terms of data management practices, transformational leadership style, innovativeness, competitiveness, which are all key elements of a strong and healthy business. These are all signs that BI is in operation within the SME sector. One of the key value gains from BI is to build a sustainable competitive organisation. Competitiveness, as already pointed out, has proved to be the weakest of all the factors. This raises the question why? A possible reason could lie in Fuld's (1995) statement that points out that intelligence is the conclusion drawn from analysed information, as per the example used by Fuld (1995) that describes the process of data that becomes information that is analysed and turned into intelligence.

Are the last two steps the possible missing links from getting the competitiveness gains from BI? The results have also shown that there is a limited number of analytical competitors but a large number of analytical organisation. As Davenport et al., (2010) point out, these organisations do not use analytics to achieve competitive advantage. Competitiveness comes from outthinking your competition (Thomas, 2001). SME decision makers must ask the right questions to take actions at the right time. This requires skills to interpret a situation in the context of what you can see and can't see, weigh-up options and understand the implications and risks.

The results also showed that the organisations that were analytical competitors came from small to medium sizes organisations which implies that organisation size is not a given constraint. These organizations, however, had the technical skills, but they also seem to have the analytical and more importantly the interpretational skills. The development of these skills does not require advance technology, it is just the drive to outthink the competition.

To summarise the value that can be derived from BI starts with data, which is the raw element that forms the foundation of BI. Data's value will expand when it is applied and aligned with business performance objectives (Ranjan, 2008). The organisation will experience benefits and value when better data management practices are followed to enable the management of larger volumes of data, better quality of data and data that can be better utilised (Scholtz et al., 2010). Business process improvements and effectiveness are another area where organisations can derive value (Williams, 2004). New data management requirements will lead to new systematic processes to collect and analyse data (Thomas, 2001; Malladi, 2013). The value is also hidden in the ability to ask the right questions in the context of the information needed and presented, as a pre-cursor to deriving value from intelligent decisions. To obtain the perceived value opportunities and problems need to be aligned with business strategies, goals and objectives and that is supported by the implementation of key business processes to meet goals and objectives. The ultimate level of value is hidden in BI's ability to improve profitability, reduce costs, improve efficiency and create a completive advantage over competitors (Isik et al., 2013; Kokin et al., 2013). Organisations that offer similar products and services can create distinctive capabilities through extensive data analysis that can drive change in processes to create differentiation and lead onto competitive advantage (Davenport, 2006; Davenport & Harris, 2007).

What is in the meaning of this research for SME's, NZ Government and BI vendors? SME's need to gain an understanding of the organisation's analytical maturity and develop as proposed by Davenport et al., (2010) their organisational BI roadmap. This roadmap must include:

i) A purpose, for example, improved decision making, improved performance and competitiveness or knowledge management.

ii) A focus to create capabilities that turn data into information and information into knowledge through gaining actionable insight, seeking "weak signals", fact base decision making or assigning meaning to business events.

iii) Actions that include data gathering and storage, quantitative analysis, monitoring, systems and data mining through the use of technology, tools, methods and business processes.

The NZ government have many initiatives underway to support and assist SME's to make their enterprises successful and competitive. These initiatives must first gain an understanding of an organisation's analytical maturity level, and build a support plan for the future from that point of view. Having this information may determine the assistance that may be required to help SME's to become productive and competitive.

Likewise BI technology vendors must gain an understanding of the client's current capabilities and BI maturity level, propose and implement solutions that meet their maturity level but also have the capability to scale as the organisation grows.

# 6 Challenges and Limitations of the Research

## 6.1 Research Limitations

- The NZ SME sector consists of 7 SME size categories and the research is not representative of all categories.
- The complete sample may be too small which could possibly compromise the data relationships and statistical calculations.

## 6.2 Research Challenges

- It was a challenge to engage with a big enough sample to ensure a significant number of responses.
- Better response rates were experienced when research participation requests were sent via email and were personally addressed to the potential respondent. This resulted in a time consuming process.
- For some sources used to identify potential respondents not enough personal information was available to allow for personalised requests.
- An objective was to request SME networks to post the request to their network members. Three network owners' feedback stated that the questionnaire was too much in "corporate language" and small SME's did not understand the questions.

## 6.3 Future Research

- Repeat the research study with a bigger sample.
  - Either focus on a specific SME size and customise the questionnaire to be suitable for the category or
  - If multiple size categories are targeted ensure that the questionnaire is in suitable language for all categories.
- Perform a research study with the objective of analysing each maturity level in more detail. Also identify the next step actions SME's are proposing to take to move from one maturity level to another.

# 7 Conclusion

The research question the project set out to answer was: *What organisational factors may increase the likeliness of BI adoption?* A factor analysis exercise identified that data management practices, organisational culture (transformational leadership, and innovativeness) and organisational motivation (competitiveness and perception of BI value and benefits) were organisational factors that have the potential to increase the likeliness of BI adoption. The outcome of the proposed research model identified that only organisational motivation had the potential to increase the likeliness of BI adoption. Organisational motivation consisted of two components and the perception of the value and benefits of BI had more impact than the SME's competiveness. This outcome illustrates that, if the organisation understands what is in it for them and has a clear understanding of the value that can be obtained, it fuels the motivation to be innovative and implement new methods, processes and technology that can increase the competitiveness in a competitive market.

## 8 References


Abouzeedan, A., & Busler, M. (2006). Information Technology (IT) and small and medium-sized enterprises (SMEs) management: The concept of 'firm impact sphere'. *Global Business Review, 7*(2), 243-257. doi: 10.1177/097215090600700204

Akhavan, P., & Salehi, S. (2013). Critical factors of Business Intelligence: Case of an It-based company. *World Applied Sciences Journal, 22*(9), 1344-1351. doi: DOI: 10.5829/idosi.wasj.2013.22.09.364

Alam, S. S., & Mohammad N., & Mohd K. (2009). ICT Adoption in Small and Medium Enterprises: an Empirical Evidence of Service Sectors in Malaysia. *International Journal of Business and Management, 4*(2). doi: 10.5539/ijbm.v4n2p112

Amabile, S., Laghzaoui, S., Peignot, J., Peneranda, A., & Boudrandi, S. (2013). Business intelligence practices for exporting SMEs. *International Business Research, 6*(2), 101-111. doi: 10.5539/ibr.v6n2p101

Amit, R. (1993). Strategic Assets and Organizational Rent. *Strategic Management Journal, 14*(1), 33-46. doi: 10.1002/smj.4250140105

Auster, E., & Choo, C. W. (1994). CEOs, information, and decision making: Scanning the environment for strategic advantage. *Library Trends, 43*(2), 206.

Awa, H. O., Ukoha, O., & Emecheta, B. (2012). *Integrating TAM and TOE frameworks and expanding their characteristic constructs for E-Commerce adoption by SMEs.* Paper presented at the Proceedings of Informing Science & IT Education Conference

Azoff, M., & Charlesworth, I. (2004). The new business intelligence: A European perspective Butler Group. White Paper.

Barney, J. (1991). Firm resources and sustained competitive advantage. *MA Journal of Management, 17*(1), 99-120.

Bass, B. M. (1990). From transactional to transformational leadership: Learning to share the vision. *Organizational Dynamics, 18*(3), 19-31. doi: http://dx.doi.org/10.1016/0090-2616(90)90061-S

Beal, R. M. (2000). Competing effectively: Environmental scanning, competitive strategy, and organizational performance in small manufacturing firms. *Journal of Small Business Management, 38*(1), 27.

Bharadwaj, A. S. (2000). A Resource-Based perspective on Information Technology capability and firm performance: An empirical investigation. *MIS Quarterly, 24*(1), 169-196.

Blanco, S., & Lesca, H. (1998). Business intelligence : Integrating knowledge into the selection of early warning signals. Retrieved from http://www.veille-strategique.org/docs/1998-Blanco-Lesca-Articlewksp.pdf

Borch, O. J., & Hartvigsen, G. (1991). Knowledge-based systems for strategic market planning in small firms. *Decision Support Systems, 7*(2), 145-157. doi: 10.1016/0167-9236(91)90053-e

Caldeira, M. M., & Ward, J. M. (2003). Using resource-based theory to interpret the successful adoption and use of information systems and technology in manufacturing small and medium-sized enterprises. *European Journal of Information Systems, 12*(2), 127-141. doi: 10.1057/palgrave.ejis.3000454

Canes, M. (2009). Business intelligence for the SME (Vol. 142, pp. 46). Toronto.

Carbonara, N. (2005). Information and communication technology and geographical clusters: Opportunities and spread. *Technovation, 25*(3), 213-222. doi: http://dx.doi.org/10.1016/S0166-4972(03)00095-6

Cavana, R. Y., Delahaye, B. l., Sekaran, U. (2001). *Applied business research: quantitative and qualitative methods* (First ed.). Australia: John Wiley & Sons Australia Ltd

Chapman, P. (1993). Information in the management process. *Logistics Information Management, 6*(2), 17.

Chauvel, D., & Despres, C. (2002). A review of survey research in knowledge management: 1997-2001. *Journal of Knowledge Management, 6*(3), 207.

Choo, C. W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International Journal of Information Management, 6*(5), 329-340.

Claessen, E. M. B. (2005). Strategic use of IC reporting in small and medium-sized IT companies. *Journal of Intellectual Capital, 6*(4), 558-569. doi: 10.1108/14691930510628825

Clark, T. D., Jones, M. C., & Armstrong, C. P. (2007). The dynamic structure of management support systems: Theory development, research focus, and direction. *MIS Quarterly, 31*(3), 579-615.

Cooper, D. R., & Schindler, P. S. (2003). *Business research methods* NY: McGraw-Hill.

Corso, M., Martini, A., Pellegrini, L., & Paolucci, E. (2003). Technological and organizational tools for knowledge management: in search of configurations. *Small business economics, 21*(4), 397-408. doi: 10.1023/a:1026123322900

Currie, W. L. (2004). The organizing vision of application service provision: a process-oriented analysis. *Information and Organization, 14*(4), 237-267. doi: http://dx.doi.org/10.1016/j.infoandorg.2004.07.001

Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organizations: Effects of environment, organization and top managers. *British Journal of Management, 17*(3), 215-236. doi: 10.1111/j.1467-8551.2006.00498.x

Davenport, H., & Harris J. G. (2007). Competing on analytics. *Computerworld, 41*(38), 52-55.

Davenport, H., Harris, G., & Morison, R. (2010). *Analytics at work: Smarter decisions better results*. Boston MA: Harvard Business School Publishing Corporation.

Department of Internal Affairs. (n.d.). *Government datasets online* Retrieved from https://data.govt.nz/.

Diamond, M. A. (1991). Dimensions of organizational culture and beyond. *Political Psychology, 12*(3), 509-522. doi: 10.2307/3791759

Dishman, P. L., & Calof, J. L. (2008). Competitive intelligence: a multiphasic precedent to marketing strategy. *European Journal of Marketing, 42*(7/8), 766-785. doi: 10.1108/03090560810877141

Drucker, P. F. (1992). Be data literate: Know what to know. *The Wall Street Journal*. Retrieved from http://online.wsj.com/articles/SB113208395700897890

Educause. (2009). *Instiututional data management survey questionnaire* Retrieved from http://www.educause.edu/SurveyInstruments/1004.

Eldridge, J., & Crombie, A. (1974). *A sociology of organisations*. London Allen & Urwin.

Erez, M., & Naveh, E. (2004). Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other. *Journal of Organizational Behavior, 25*(2), 175-199. doi: 10.1002/job.237

European Commission. (2008). *The new SME definition: User guide and model declaration*. Retrieved from http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf.

Fisher, C. W., Chengalur-Smith, I., & Ballou, D. P. (2003). The impact of experience and time on the use of data quality information in decision making. *Information Systems Research, 14*(2), 170.

Forsman, H. (2011). Innovation capacity and innovation development in small enterprises. A comparison between the manufacturing and service sectors. *Research Policy, 40*(5), 739-750. doi: http://dx.doi.org/10.1016/j.respol.2011.02.003

Fuld, L. M. (1995). *The new competitor intelligence* (2 ed.): John Wiley & Sons, Inc.
Furnham, A. (2011). *The psychology of behavior at work* (2 ed.). NY: Psychology Press.

Gamero, J., Martínez-Román, J. A., & Tamayo, J. A. (2011). Analysis of innovation in SMEs using an innovative capability-based non-linear model: a study in the province of Seville (Spain). *Technovation, 31*(9), 459-475. doi: 10.1016/j.technovation.2011.05.005

Gardner. (2013). Business Intelligience (BI). Available from Gardner IT Glossary http://www.gartner.com/it-glossary/business-intelligence-bi/

Garreth-Mayer, E. (2006). Statistics in psychosocial research: Lecture 8 factor analysis I. Retrieved from http://ocw.jhsph.edu/courses/statisticspsychosocialresearch/pdfs/lecture8.pdf

Gong, P., & Xia, B. S. (2014). Review of business intelligence through data analysis. *Benchmarking, 21*(2), 300-311. doi: 10.1108/bij-08-2012-0050

Gregor, S., Martin, M., Fernandez, W., Stern, S., & Vitale, M. (2006). The transformational dimension in the realization of business value from information technology. *Journal of Strategic Information Systems, 15*(3), 249-270. doi: 10.1016/j.jsis.2006.04.001

Guarda, T., Santos, M., Pinto, F., Augusto, M., & Silva, C. (2013). Business Intelligence as a Competitive Advantage for SMEs. *International Journal of Trade, Economics and Finance, 4*(4), 187-190. doi: 10.7763/ijtef.2013.v4.283

Hannabuss, S. (1987). Information and decision making. *Industrial Management and Data Systems, 87*(5/6), 11-14. doi: 10.1108/eb057476

Hult, G. T. M., Hurley, R. F., & Knight, G. A. (2004). Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management, 33*(5), 429-438. doi: 10.1016/j.indmarman.2003.08.015

Hunter, I. (2008). *Imagine innovation*. North Shore, New Zealand: Penguin Books.

International Data Corporation. (2013). IDC's 'Big Data and Analytics Forum 2013' set for timely arrival in Abu Dhabi as CIOs gear up to tackle explosive data growth, Retrieved from http://www.idc.com/getdoc.jsp?containerId=prAE24418813

Işık, Ö., Jones, M. C., & Sidorova, A. (2013). Business intelligence success: The roles of BI capabilities and decision environments. *Information & Management, 50*(1), 13-23. doi: http://dx.doi.org/10.1016/j.im.2012.12.001

Isson, J. P., & Harriott, J. (2013). *Win with advanced business analytics: Creating business value from data*. Hoboken, NJ: John Wiley & Sons.

Jaworski, B. J., & Kohli, A. K. (1993). Market orientation: Antecedents and consequences. *Journal of Marketing, 57*(3), 53.

Jourdan, Z., Rainer, R. K., & Marshall, T. E. (2008). Business Intelligence: An Analysis of the Literature. *Information Systems Management, 25*(2), 121-131. doi: 10.1080/10580530801941512

Khan, A. M., Amin, N., & Lamboru, N. (2009). *Drivers and barriers to business intelligence adoption: A case of Pakistan*. Paper presented at the European and Mediterranean Conference on Information Systems Abu Dhabi.

Kmieciak, R., Michna, A., & Meczynska, A. (2012). Innovativeness, empowerment and IT capability: evidence from SMEs. *Industrial Management & Data Systems, 112*(5), 707-728. doi: 10.1108/02635571211232280

Kokin, S., & Wang, T. (2013). Development of Business Intelligence success evaluation framework. *Journal of Applied Sciences, 13*(9), 1657-1660.
Kotter, J. (1998). Cultures and coalitions. *Executive Excellence, 15*(3), 14-15.

LaValle, S., Lesser, E., Shockley, R., Hopkins, M.S. and Kruschwitz, N. (2011) Big Data, Analytics and the Path from Insights to Value, *MIT Sloan Management Review*, 52, 2, 21-31.

Lesca, N., & Caron-Fasan, M. (2012). How managers interpret scanning information. *Information & Management, 49*(2), 126-134.

Lefebvre, L. A. (1991). Technological experience and the technology adoption decisions in small manufacturing firms. *R and D Management, 21*(3), 241-249. doi: 10.1111/j.1467-9310.1991.tb00761.x

Levy, M., Powell, P., & Yetton, P. (2001). SMEs aligning IS and the strategic context. *Journal of Information Technology, 16*(3), 133-144.

Levy, M., Powell, P., & Yetton, P. (2002). The dynamics of SME information systems. *Small business economics, 19*(4), 341-354. doi: 10.1023/a:1019654030019

Li, S., Ragu-Nathan, B., Ragu-Nathan, T.S., & Rao, S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega, 34*, 107-124.

Lönnqvist, A., & Pirttimäki, V. (2006). The measurement of business intelligence. *Information Systems Management, 23*(1), 32-40. doi:10.1201/1078.10580530/45769.23.1.20061201/91770.4

Luhn, H. P. (1958). A business intelligence system. *IBM J. Res. Dev., 2*(4), 314-319. doi: 10.1147/rd.24.0314

Lybaert, N. (1998). The information use in a SME: Its importance and some elements of influence. *Small business economics, 10*(2), 171-191. doi: 10.1023/a:1007967721235

Maçada ,A. C. G., Beltrame, M. M., Dolci, P. C., & Becker, J. L. (2012). IT business value model for information intensive organizations. BAR: Brazilian Administration Review, 9, 44-65.

Malladi, S. (2013). *Adoption of business intelligence & analytics in organizations: An empirical study of antecedents*. Paper presented at the Proceedings of the Nineteenth Americas Conference on Information Systems, Chicago, Illinois.

Menguc, B., & Auh, S. (2006). Creating a Firm-Level Dynamic Capability through Capitalizing on Market Orientation and Innovativeness. *Academy of Marketing Science. Journal, 34*(1), 63-73.

Meredith, R., Remington, S., O'Donnel, P., & Sharma, N. (2012). *Transforming organizations with Business Intelligence: Comparing theory with the vendor perspective*. Paper presented at the International Conference on Decision Support Systems

Ministry of Business Innovation & Employment. (2013). *Small businesses in New Zealand: How do they compare with larger firms*. Retrieved from http://www.med.govt.nz/business/business-growth-internationalisation/pdf-docs-library/small-and-medium-sized-enterprises/2013-stats-factsheet.pdf.

Ministry of Business and Innovation & Employment. (2014). *The small business sector report*. Retrieved from http://www.mbie.govt.nz/what-we-do/business-growth-agenda/sectors-reports-series/pdf-document-library/the-small-business-sector-report-2014.pdf

Mishra, S. (2012). Trivariate analysis of organizational culture, leadership and organizational effectiveness: An exploratory study. *International Journal of Scientific and Research Publications, 2*(7).

Molensky, L., Ketter, W., Collins, J., Bloemhof, J., & van de Koppel, H. (2010). *Business intelligence gap analysis: A user, supplier and academic perspective*. Paper presented at the Proceedings of the 12th International Conference on Electronic Commerce: Roadmap for the Future of Electronic Business, Honolulu, Hawaii. http://dl.acm.org/citation.cfm?id=2389393&dl=ACM&coll=DL&CFID=290260483&CFTOKEN=38886718

Negash, S., & Gray, P. (2008). Business Intelligence. In F. Burstein, & Holsapple, C. W. (Ed.), *Handbook on Decision Support Systems 2* (pp. 175-193). Berlin Heidelberg.

Nguyen, T. H. (2009). Information technology adoption in SMEs: an integrated framework. *International journal of entrepreneurial behaviour & research, 15*(2), 162-186. doi: 10.1108/13552550910944566

Niehoff, B. P., Moorman, R. H., Blakely, G., & Fuller, J. (2001). The Influence of Empowerment and Job Enrichment on Employee Loyalty in a Downsizing Environment. *Group & Organization Management, 26*(1), 93-113. doi: 10.1177/1059601101261006

Oliviera, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *Electronic Journal Information Systems Evaluation, 14*(1).

Parker, C. M., & Castleman, T. (2009). Small firm eBusiness adoption: a critical analysis of theory. *Journal of Enterprise Information Management, 22*(1), 167-182.

Pearlson, K. E., Saunders, Carol. S. (2010). *Managing and Using Information Systems* (Fourth ed.). United States: John Wiley & Sons. Inc.

Pipino, L. L., Lee, Y. W. (2002). Data quality assessment. *Communications of the ACM, 45*(4), 211-222.

Pita-Castelo, J., & González-Loureiro, M. (2012). A model for assessing the contribution of innovative SMEs to economic growth: The intangible approach. *Economics letters, 116*(3), 312-315. doi: 10.1016/j.econlet.2012.03.028

Podsakoff, P. M., MacKenzie, S. B., Moorman, R. H., & Fetter, R. (1990). Transformational leader behaviors and their effects on followers' trust in leader satisfaction and organizational citizenship behaviors. *Leadership Quarterly, 1*(2), 107-142.

Porter, E., & Millar, V. E. (1985). How information gives you competitive advantage *Harvard Business Review* (July - August), 1-13.

Powell, T. C., & Dent-Micallef, A. (1997). Information technology as competitive advantage: The role of human, business, and technology resources. *Strategic Management Journal (1986-1998), 18*(5), 375.

Ramdani, B., Kawalek, P., & Lorenzo, O. (2009). Predicting SMEs' adoption of enterprise systems. *Journal of Enterprise Information Management, 22*(1-2), 10-24. doi: 10.1108/17410390910922796

Ranjan, J. (2008). Business justification with business intelligence. *The journal of information and knowledge management systems, 38*(4), 461-475. doi: 10.1108/03055720810917714

Ratam, D. A., & Mazzarol, T. (2004). *A model of leadership, strategy and company structure in innovative Indonesian SME*. Paper presented at the Paper presented at Australia and New Zealand Academy of Management (ANZAM) Annual Conference, Dunedin, New Zealand.

Rubio, A., Aragón, A. (2009). SMEs Competitive Behavior. *Management Research, 7*(3), 171-190. doi: 10.2753/jmr1536-5433070301

Sackmann, D. (1990). Managing organisational culture: The juggle between possibilities and dreams. In A. Anderson (Ed.), *Communication yearbook* (Vol. 13, pp. 114-148). Los Angeles, CA: Sage.

Sadok, M., & Lesca, H. (2009). A Business Intelligence Model for SMEs Based on Tacit Knowledge. *Communications of the IBIMA, 7*(Journal Article), 177-184.

Salavou, H., Baltas, G., & Lioukas, S. (2004). Organisational innovation in SMEs: The importance of strategic orientation and competitive structure. *European Journal of Marketing, 38*(9/10), 1091-1112. doi: 10.1108/03090560410548889

Sangar, A. B., & Iahad, N. B. A. (2013). Critical factors that affect the success of business intelligence systems (BIS) implementation in an organization. *Journal of Scientific & Technology Research, 2*(3).

Sarros, J. C., Cooper, B. K., & Santora, J. C. (2008). Building a climate for innovation through transformational leadership and organizational culture. Journal of Leadership & Organizational Studies, 15(2), 145-158. doi:10.1177/1548051808324100

Sarros, J. C., Gray, J., Densten, I. L., & Cooper, B. (2005). The organizational culture profile revisited and revised: An Australian perspective. *Australian Journal of Management, 30*(1), 159-182. doi: 10.1177/031289620503000109

Scholz, P., Schieder, C., Kurze, C., Gluchowski, P., & Boehringer, M. (2010). *Benefits and challenges of business intelligence adoption in small and medium-sized enterprises.* Paper presented at the 18th European Conference on Information Systems, Pretoria, South-Africa. Retrieved from http://web.up.ac.za/ecis/ECIS2010PR/ECIS2010/Content/Papers/0252.R1.pdf

Scott, S. G., & Bruce, R. A. (1994). Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal, 37*(3), 580

Seah, M., Hsieh, M. H., & Weng, P. (2010). A case analysis of Savecom: The role of indigenous leadership in implementing a business intelligence system. *International Journal of Information Management, 30*(4), 368-373. doi: 10.1016/j.ijinfomgt.2010.04.002

Shim, S., & Kotsiopulos, A. (1994). Technology Innovativeness and Adopter Categories of Apparel/Gift Retailers: From the Diffusion of Innovations Perspective. *Clothing and Textiles Research Journal, 12*(2), 46-57. doi: 10.1177/0887302x9401200207

Sigalas, C., Economou, V. P., & Georgopoulos, N. B. (2013). Developing a measure of competitive advantage. *Journal of Strategy and Management, 6*(4), 320. doi: 10.1108/jsma-03-2013-0015

Statistics New Zealand. (2013). *Business demography statistics.* Retrieved from http://nzdotstat.stats.govt.nz.

Tavakol, M., & Denmick, Reg. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2*(53-55). doi: 10.5116/ijme.4dfb.8dfd

Taylor, M., & Murphy, A. (2004). SMEs and e-business. *Journal of Small Business and Enterprise Development, 11*(3), 280-289. doi: 10.1108/14626000410551546

The European Commission. (2008). *The new SME definition: User guide and model declaration*. Retrieved from http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf

Thomas, J. H. (2001). Business intelligence: Why. *eAI* (July), 47-49.

Tucker, R. B. (2002). Innovation: the new core competency. *IEEE Engineering Management Review, 30*(4), 112-112. doi: 10.1109/emr.2002.1167290

Tutunea, M. F., & Rus, R. V. (2012). Business intelligence solutions for SME's. *Procedia Economics and Finance, 3*, 865-870. doi: http://dx.doi.org/10.1016/S2212-5671(12)00242-0

Tvrdíková, M. (2013). *Increase in the competitiveness of SMEs using Business Intelligence in the Czech-Polish border areas.* Paper presented at the Federated Conference on Computer Science and Information Systems Krakow.

Venter, P., & Tustin, D. (2009). The availability and use of competitive and business intelligence in South African business organisations. *Southern African Business Review, 13*(2), 88-117.

Wang, C. L., & Ahmed, P. K. (2004). The development and validation of the organisational innovativeness construct using confirmatory factor analysis. *European Journal of Innovation Management, 7*(4), 303-313. doi: 10.1108/14601060410565056

Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems, 12*(4), 5.

Weber, K., Otto, B., & Osterle, H. (2009). One size does not fit all: A contingency approach to data governance. *J. Data and Information Quality, 1*(1), 1-27. doi: 10.1145/1515693.1515696

Weill, P., & Broadbent, M. (1998). *Leveraging the new infrastructure: how market leaders capitalize on information technology*. Boston, Mass: Harvard Business School Press.

Wende, K., & Boris, O. (2009). A contingency approach to data governance. Retrieved from https://www.alexandria.unisg.ch/export/DL/213309.pdf

Williams, S. (2004). Assessing BI readiness: A key to BI ROI. *Business Intelligence Journal, 9*(3).

Williams, S., & Williams, N. (2007). *The profit impact of Business Intelligence*. San Francisco, CA: Morgan Kaufmann

Wong, K. Y., & Aspinwall, E. (2004). Characterizing knowledge management in the small business environment. *Journal of Knowledge Management, 8*(3), 44-61. doi: 10.1108/13673270410541033

Yu, A., & Humphreys, P. (2008). Intellectual Capital and Support for Collaborative Decision Making in Small and Medium Enterprises. *Journal of Decision Systems, 17*(1), 41-61. doi: 10.3166/jds.17.41-61

Zhu, H., Madnick, S. E., Lee, Y. W., & Richard, Y. W. (2012). Data and information quality research: Its evolution and future. In A. Tucker (Ed.), *Computing Handbook: Information systems and information technology* (3 ed., pp. 16-1). Boca Raton, FL: CRC Press.

# 9 Appendixes

## 9.1 Appendix 1: BI Definitions

| Author | Definition or description of BI |
|---|---|
| Sadok & Lesca (2009) | Sadok & Lesca (2009) applied Ansoff's (1975) view and define BI as a "collective process through which the enterprise is actively seeking relevant and timely environmental information referred to as weak signals." |
| Blanco & Lesca (1998) | Describe BI as uncertainty reduction process which consists in increasing information-processing capabilities. |
| Maholtra (2000) as sited in Ranjan (2008) | Describes BI that facilitates the connections in the new-form organization, bringing real-time information to centralized repositories and support analytics that can be exploited at every horizontal and vertical level within and outside the firm. |
| Lesca (1994) as sited in Blanco & Lesca (1998) | Define BI "as the information process through which companies prospectively monitor their environment by gathering weak signals in order to create opportunities and reduce their uncertainty." |
| Gangadharan and Swamy (2004) as sited in Ranjan (2008) | "BI describes the result of in-depth analysis of detailed business data, including database and application technologies, as well as analysis practices. BI is technically much broader, potentially encompassing knowledge management, enterprise resource planning, decision-support systems and data mining" |
| Davenport & Harris (2007) | Describe BI from applying analytics, where organisations will base strategies on the application of extensive quantitative analysis and fact base decision making. |
| Williams & Williams (2007) | BI seen as "business information and business analysis within the context of key business processes that lead to decisions and actions. |
| Negash & Gey (2008) | Define BI as "systems that combine:<br>• Data gathering<br>• Data storage |

| | |
|---|---|
| | • Knowledge management<br>BI systems provide actionable information and knowledge at the right time, in the right location and in the right form." |
| Canes (2009) | BI can be defined as "the ability to extract actionable insight from data available to the organization, both internal and external, for the purposes of supporting decision-making and improving corporate performance." |
| Sadok & Lesca (2009) | Describe BI's core as a collective sense-making process. Where sense-making refers to the interpretative process where meaning is assigned to ongoing events. This is a creative and collective method and the result can provide efficient supports to the decision making process by reducing information ambiguity and the uncertainty of the business environment. |
| Molensky, Ketter, Collins, Bloemhof & van de Koppel (2010) | Business intelligence consists of monitoring and analysis technologies that will enable business users to turn data into information and information into knowledge, in order to optimize decision making and manage business performance with the goal to improve profitability and competitiveness of the business." |
| Gardner (2013) | Describe BI also as an umbrella term but with a spectrum wider than Dresner's definition. Gardner refers to BI to "include applications, infrastructure, tools and best practices that enable to access to and analysis of information to improve and optimize decision and performance." |
| Isik, Jones & Sidorova (2013) | Isik utilised Hugh et al (2004) view of data warehousing and define BI as "a system comprised of both technical and organizational elements that presents its users with historical information for analysis to enable effective decision making and management support, with the overall purpose of increasing organizational performance" |

## 9.2 Appendix 2: Questionnaire

### Participant Information Sheet

**Research Project Title: The likeliness of Business Intelligence adoption by Small-to-Medium Enterprises in context of data management practices, organisation culture and organisational motivation**

**Researcher: Ria van den Berg, School of Information Management, Victoria University of Wellington**

SME's through day to day activities generate volumes of data in multiple formats. The question arises: does your organisation use this data intelligently to solve business problems, support decision making or create competitive advantage?

Extracting intelligence from data through the use of methods, processes and technology is referred to as *Business Intelligence (BI)*. Advances in technology enable organisations to analyse business data and present it in ways that can lead to insight to solve business problems, support decision making and create competitive advantage.

This study, as part of the completion of my Masters of Information Management, explores SME's data management practices; analytical activities; leadership style; information sensitivity; innovativeness; business motivation and view on the value of applying BI practices.

Research on SME's and BI are limited and the focus of existing studies is primarily on the challenges and benefits of BI for SME's. The research outcome will give an insight into how SME's capabilities position them for BI adoption. The insights gained will add to the limited body of knowledge available on the topic of SME's and BI.

Victoria University requires, and has granted, approval from the School's Human Ethics Committee.

I am inviting SME owners and management to participate in this research. Participation is voluntary and anonymous and the completion of the survey will take approximately 20 minutes. Through the survey tool you will be able to request a summary report of the findings of the study.

You and your organisation will not be identified personally in any written report produced as a result of this research, including possible publication in academic conferences and journals. All material collected will be kept confidential, and will be viewed only by myself and my supervisor Dr Tiong Goh (Senior Lecturer). The research report will be submitted for marking to the School of Information Management and subsequently deposited in the University Library. All data collected from participants will be destroyed 2 years after the completion of the project.

If you have any questions or would like to receive further information about the project, please contact me at vandecorn@myvuw.ac.nz or telephone 021 1832234, or you may contact my supervisor Dr Tiong Goh at Tiong.Goh@vuw.ac.nz or telephone 04 463-6860.

Ria van den Berg

| **1.Data Management** | | | | | | | **Source** |
|---|---|---|---|---|---|---|---|
| | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | |
| **Tell me about your organisation's data management practices by responding to the following statements** | | 1 | 2 | 3 | 4 | 5 | |
| Structure | Our organisation's data originates from a variety structured sources i.e. transaction applications, databases. | | | | | | |
| | Our organisation's data originates from a variety of unstructured sources i.e. social medial, emails. | | | | | | |
| Uniqueness | Our organisation's data is unique and can give us a competitive edge. | | | | | | Wang & Strong (1996) |
| | Our organisation's data adds value to our operation | | | | | | |
| Integration | Our organisation's data can easily be joined with other data. | | | | | | |
| | Our organisation's data **c**an easily be compared with past data. | | | | | | |
| Quality | Our organisation's data is accurate, flawless, reliable and errors can be easily identified. | | | | | | |
| | Our organisation's data **is** believable, which implies the data is true and credible. | | | | | | |
| Access | Our organisation's data can easily be accessed. | | | | | | |
| | Our organisation's data can easily be downloaded / uploaded. | | | | | | |
| Privacy | Our organisation's data is secure and access is restricted. | | | | | | |
| Governance | Our organisation's data have a person assigned that has clear responsibility for the data. | | | | | | |

| 2 | **Business analysis activities** | |
|---|---|---|
| | Business analytics involves reporting, modeling, analysis, and decision support. This is enabled by technologies that provide access to data and analytical tools that support operational reporting, institutional decision-making, and regulatory compliance. Tell me about your analytical environment. | Educause (2009) |
| 2.1 | Which of the following is part of your institution's reporting, modeling, analysis, and decision support tools? | Malladi (2013) |

| | In use | May implement | Not under consideration | Don't Know |
|---|---|---|---|---|
| Spreadsheets / Microsoft Excel | | | | |
| Dashboards (drillable / interactive data visualization interfaces) | | | | |
| Embedded BI (Charts/ data visualization within business apps and portals | | | | |
| Mobile (smartphones- or tablet based) dashboards / data visualization | | | | |
| Query and analysis software (e.g. in memory what-if planning, OLAP cubes etc.) | | | | |
| Reports (formatted PDF / HTML sent by email or accessed online) | | | | |
| Scorecards (comparing performance to pre-defined goals) | | | | |
| Alerts (e-mail, SMS etc. for exceptions / thresholds) | | | | |

| | | |
|---|---|---|
| 2.2 | What is the primary use of reporting, modeling, analysis, and decision support tools in your organisation today? | Educause (2009) |

- ☐ Extraction and reporting of transaction-level data
- ☐ Analysis and monitoring of operational performance (e.g., dashboard)
- ☐ "What if…" decision support (e.g., scenario building)
- ☐ Predictive modeling and simulations
- ☐ To use information to automatically trigger a business process
- ☐ We are not active users of reporting, modeling, analysis, and decision support.

| | | | |
|---|---|---|---|
| 2.3 | My organisations BI maturity level can be described as: | | Davenport, Harris & Morison (2010) |
| | | Analytical impaired | My organisation lacks data, analytical skills or management support or serious analytical work. |
| | | Localised analytics | My organisation has pockets of analytical activity, but they are not coordinated or linked to focused strategic targets. |
| | | Analytical aspirations | My organisation envisages a more analytical future, has established analytical capabilities and has a few initiatives underway, but progress is slow. |
| | | Analytical organisation | My organisation has the necessary human and technological resources and applies analytics on a regular basis and realises benefits across the organisation. Lacks grounding in analytics to achieve strategic focus and hasn't turned it into competitive advantage. |
| | | Analytical Competitor | My organisation routinely uses analytics as a distinctive business capability. Follows an enterprise wide approach, has committed and involved leadership. Portrays itself as an analytical competitor. |

| **3.Leadership** | | | | | | | **Source** |
|---|---|---|---|---|---|---|---|
| Tell me about your organisation's leadership style by responding to the following statements. | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | |
| | | 1 | 2 | 3 | 4 | 5 | |
| Vision | Our organisation's management has a clear understanding of where we are going. | | | | | | Podsakoff, MacKenzie, Moorman & Fetter (1990) |
| | Our organisation's management is always seeking new opportunities for the organisation. | | | | | | |
| Providing individual support | Our organisation's management are willing to give their time when it is needed. | | | | | | Niehoff, Moorman, Blakely & Fuller (2001) |
| | Our organisation's management help remove roadblocks. | | | | | | |
| High performance expectations | Our organisation's management wants employees to get involved when they see a need and not wait to be told or given permission. | | | | | | |
| | Our organisation's management insists on only the best performance. | | | | | | Podsakoff, MacKenzie, Moorman & Fetter (1990) |
| Information sensibility | Our organisation's decision making style is based on information gathered from a variety of sources that might provide helpful input. | | | | | | Shim & Kotsiopulos (1994) |

| **4. Innovativeness** | | | | | | | **Source** |
|---|---|---|---|---|---|---|---|
| Tell me about your organisation's innovativeness by responding to the following statements. | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | |
| | | 1 | 2 | 3 | 4 | 5 | |
| Being innovative | Our organisation is willing to try new ways of doing things and seeks unusual, novel solutions. | | | | | | Wang & Ahmed (2004) |
| | Our organisation actively seek innovative ideas. | | | | | | Menguc & Auh (2006) |
| Take advantages of opportunities | Our organisation is last at adopting new ways of doing things. | | | | | | Wang & Ahmed, (2004) |
| | Our organisation's view is that technological changes provide bigger opportunities. | | | | | | Jaworski & Kohli, (1993) |
| Adaptability to changes | Our organisation can be described as flexible and continually adapting to change. | | | | | | Scott & Bruce (1994) |
| | Our organisation is open and responsive to change. | | | | | | |
| | Our organisation is constantly improving our business processes. | | | | | | Wang & Ahmed, (2004) |
| Risk taking | Our organisation is willing to take risks to seize and explore "chancy" growth opportunities. | | | | | | |

| **5.Competitiveness** | | | | | | **Source** |
|---|---|---|---|---|---|---|
| Tell me about your organisation's competiveness by responding to the following statements. | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | |
| | 1 | 2 | 3 | 4 | 5 | |
| Our organisation exploits all market opportunities that have been presented in our industry. | | | | | | Sigalas, Economou & Georgopoulos, (2013) |
| Our organisation neutralizes all competitive threats from rival firms in our industry. | | | | | | |
| Our organisation's objective is the reductions of total expenses at a higher rate than competitors. | | | | | | |
| Our organisation's objective is the reduction of operating expenses at a higher rate than competitors. | | | | | | |
| Our information technology planning is integrated with the overall business plan. | | | | | | Powell & Dent-Micallef (1997) |
| Our organisation actively research the best information technology practices. | | | | | | |

| 6. **BI Value** | | | | | | | **Source** |
|---|---|---|---|---|---|---|---|
| Tell me about your organisation's view on the business value that can be obtained from using BI (methods, processes and technology) to extract intelligence from data by responding to the following statements. | | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree | |
| | | 1 | 2 | 3 | 4 | 5 | |
| Strategic benefits | Our organisation believes that BI can improve customer relationships. | | | | | | Macada, Betrame, Dolci & Becker (2012) |
| | Our organisation believes that BI can provide better products and services to customers. | | | | | | |
| Information benefits | Our organisation believes that BI can enable faster access to information. | | | | | | |
| | Our organisation believes that BI can enable easier access to information. | | | | | | |
| | Our organisation believes that BI can improve information accuracy. | | | | | | |
| Transactional benefits | Our organisation believes that BI can reduce operation costs. | | | | | | |
| | Our organisation believes that BI can reduce communication costs. | | | | | | |
| Transformational benefits | Our organisation believes that BI can improve skill levels for employees. | | | | | | |
| | Our organisation believes that BI can enable the development of new business models. | | | | | | |
| | Our organisation believes that BI can improve existing business models. | | | | | | |

| 7 | **Organisation Demographics** | |
|---|---|---|
| | This section obtains information that describes your organisation | |
| 7.1 | Into which industry does your organisation best fit?<br><br>☐ Agriculture, forestry and fishing<br>☐ Mining<br>☐ Manufacturing<br>☐ Electricity, Gas, Water and Waste Services<br>☐ Construction<br>☐ Wholesale Trade<br>☐ Retail traded<br>☐ Accommodation and Food Services<br>☐ Transport, Postal and Warehousing<br>☐ Information Technology<br>☐ Information Media and Telecommunications<br>☐ Financial and Insurance Services<br>☐ Rental, Hiring and Real Estate Services<br>☐ Professional, Scientific and Technical Services<br>☐ Public administration and Safety<br>☐ Education and Training<br>☐ Health Care and Social Assistance<br>☐ Arts and Recreation Services<br>☐ Other Services | MBIE (2013) |
| 7.2 | For how many years has your organisation been in operation?<br><br>☐ < 1 year<br>☐ 1-3 Years<br>☐ 3-5 Years<br>☐ 5-7 Years<br>☐ 8-10 Years<br>☐ 10-15 Years<br>☐ 15+ Years | |

| | | |
|---|---|---|
| 7.3 | How many employees does your organisation have?<br><br>☐ 0 employees<br>☐ 1 to 5 employees<br>☐ 6 to 9 employees<br>☐ 10 to 19 employees<br>☐ 20 to 49 employees<br>☐ 50 to 99 employees<br>☐ 100 to 250 employees<br>☐ More than 250 | |
| 7.4 | Into which age group does the management of the organisation fall? (Select multiple options as applicable)<br><br>☐ 20-29 Years<br>☐ 30-39 Years<br>☐ 40-49 Years<br>☐ 50-59 Years<br>☐ 60-64 Years<br>☐ 65+ Years<br>☐ Decline to say | |
| 7.5 | My role in the organisation. (Select multiple options as applicable)<br><br>☐ Owner<br>☐ CEO<br>☐ Manager<br>☐ Employee | |
| | My gender is.<br><br>☐ Male<br>☐ Female | |

## 10 List of Figures

Figure 1: SME classification in proportion to the number of enterprises.....2-6
Figure 2: Likeliness of BI adoption research model.....3-45
Figure 3: Number of SME's per industry types.....4-53
Figure 4: Number of years SME's are in operation .....4-54
Figure 5: SME's per New Zealand size categorisation.....4-55
Figure 6: Distribution of SME's per respondent age.....4-56
Figure 7: SME per respondents role within the organisation.....4-56
Figure 8: Distribution of BI tools used and intention to use .....4-58
Figure 9: Primary use of BI tools.....4-58
Figure 10: SME's per analytical maturity level.....4-59
Figure 11: Maturity Level 1 BI tools in use and intention of use .....4-60
Figure 12: Maturity level 1 performance in context with research constructs .....4-60
Figure 13: Maturity level 2 BI tools in use and intention of use .....4-61
Figure 14: Maturity level 2 performance in context with research constructs .....4-61
Figure 15: Maturity level 3 BI tools in use and intention of use .....4-62
Figure 16: Maturity level 3 performance in context with research constructs .....4-62
Figure 17: Maturity level 4 BI tools in use and intention of use .....4-63
Figure 18: Maturity level 4 performance in context with research constructs .....4-63
Figure 19: Maturity level 5 BI tools in use and intention of use .....4-64
Figure 20: Maturity level 5 performance in context with research constructs .....4-64
Figure 21: SME data management practices .....4-65
Figure 22: SME data management practices per analytical maturity level .....4-66
Figure 23: SME transformational leadership .....4-67
Figure 24: SME transformational leadership per analytical maturity level .....4-67
Figure 25: SME innovativeness.....4-68
Figure 26: SME innovativeness per analytical maturity level.....4-68
Figure 27: SME competitiveness.....4-69
Figure 28: SME competitiveness per analytical maturity level.....4-69
Figure 29: SME BI value .....4-70
Figure 30: SME BI value perception per analytical maturity level.....4-70

Figure 31: Research Model ..... 4-71

## 11 List of Tables

Table 1: SME characteristics ..... 2-7
Table 2: Synthesise summarisation of various authors' definitions and descriptions of BI ..... 2-12
Table 3: Intelligence at work ..... 2-14
Table 4: Analytical maturity classification ..... 2-17
Table 5: Data attributes that support BI ..... 2-19
Table 6: Data quality dimensions ..... 2-21
Table 7: Responsibilities of data owner and stewards ..... 2-24
Table 8: Innovativeness types ..... 2-27
Table 9: Transformational leader characteristics and behaviour ..... 2-30
Table 10: Business-driven BI value creation opportunities ..... 2-36
Table 11: BI Benefits in context of business benefit dimensions ..... 2-38
Table 13: Factor analysis findings ..... 3-43
Table 14: Alpha Cronbach results ..... 4-52
Table 15: Multiple regression hypothesis testing results ..... 4-73