EXPLORING THE VALUE OF BUSINESS INTELLIGENCE USING A SECOND GENERATION BALANCED SCORECARD APPROACH

by

SUSANNA S A EYBERS

submitted in accordance with the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in the subject

INFORMATION SYSTEMS

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF J H KROEZE

CO-SUPERVISOR: PROF I STRYDOM

FEBRUARY 2015

Abstract

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College: College of Science, Engineering and Technology

Department: School of Computing

Degree: Doctor of Philosophy in Information Systems

Keywords: Business Intelligence, business value, worth, performance evaluation, balanced scorecard, strategy map, key performance indicators, critical success factors

As with many new technology implementations before, Business Intelligence (BI) implementations have come under scrutiny in terms of the value added to organisations. The latest academic research uses various different 'traditional financial methods' such as the Return on Investment (ROI) calculations to determine the value of investments. In some instances customized measurement tools are proposed as a result of empirical studies conducted.

The main objective of this study is to perform qualitative investigation on the theoretical value of BI implementations in organisations. If it is assumed that BI does add value to organisations, the primary research question aims to investigate how this value is added. A balanced scorecard second generation approach is used as theoretical framework in order to address the question. This approach is also known as strategy mapping.

The research process starts with an extensive literature review on the topic of BI value evaluations and BI related balanced scorecards and strategy maps. As a result, various theoretical and practical research contributions are produced. One of the theoretical contributions includes an inventory of previous academic literature on the topic of BI value evaluations. This inventory is also presented diagrammatically.

A preliminary version of the BI balanced scorecard is developed and used as foundation for a semi-structured interview template to investigate the value of BI in organisations.

The semi-structured interview template was used as primary data generation instrument to gather data for this multiple-case study project. Four organisations participated in the study. The data obtained from the study was analysed and presented using an updated version of the theoretical framework of the study and was labelled as the intermediate version of the scorecard.

The intermediate version of the BI balanced scorecard provided valuable input towards investigating how value was achieved as a result of BI implementations. These results were verified as part of a final verification process through a consultation process with the same study participants. A final version of the BI balanced scorecard is presented and included in a complete BI value solution. This version of the balanced scorecard is also a valuable practical contribution of the study.

The verified results of the investigation indicated the following:- (1) BI adds value to organisations in all four perspectives of the organisation, namely the business value perspective, user orientation perspective, operational excellence perspective as well as the future orientation perspective. (2) Furthermore, the study confirmed that BI adds value to organisations through a number of benefits including an increase in sales and compliance to regulatory requirements (to name a few). (3) However, the study also indicated that value-related studies must adopt a holistic approach in an attempt to cater for the many facets of the topic. (4) Despite the challenge of implementing BI in organisations, the perceived value of BI implementations amongst senior management remained positive. This was supported by the continuous implementation of new BI projects in organisations. (5) There was a definite relationship between BI implementations and organisational performance. This is evident through the positive impact on sales figures, risk and compliance management and operational management.

The study contributes to the broader field of Information Systems (IS) in numerous ways. Firstly the research discovers gaps in existing research, then proposes a method to investigate the research question as a result of the gaps identified, and

uses this method as a tool to investigate the problem. The main contribution of the study is to contribute to the body of knowledge by investigating the value of business intelligence to organisations.

I declare that

"Exploring the value of Business Intelligence using a second generation balanced scorecard approach" is my own work and all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Acronyms

Acronym	Description
ACWP	Actual Cost of Work Performed
ASUG	Americas SAP User Group
BA	Business Analytics
BACMM	Business Analytics Capability Maturity Model
BAM	Business Activity Monitoring
BASM	Business-Analytics Success Model
BCWP	Budgeted Cost of Work Performed
BI	Business Intelligence
BI&A	Business Intelligence and Analytics
biMM / BIMM	BI Maturity Model
BPM	Business Process Management
CCP	Content Context and Process framework
CEO	Chief Executive Officer
CI	Competitive Intelligence
CIAT	Capital Investment Appraisal Techniques
COBIT	Control Objectives for Information and Related Technology
CPM	Corporate Performance Management
CPI	Cost Performance Index
CRM	Customer Relationship Management
CSF	Critical Success Factors
CTO	Chief Technology officer
CTQ	Critical To Quality
CV	Cost Variance
DSS	Decision Support Systems
DW	Data Warehouse
EBIM	Enterprise Business Intelligence Maturity
ECIS	European Conference on Information Systems
ETL	Extract Transform and Load
EIS	Executive Information Systems
ERP	Enterprise Resource Planning

Acronym	Description
FCMG	Fast Moving Consumer Goods
FD	Financial director
GDP	Gross Domestic Product
GIS	Geographical Information Systems
ICT	Information and Communication Technology
IS	Information Systems
ITOM	Information Technology Operations management
IRR	Internal Rate of Return
IT	Information Technology
itAIS	Italian Chapter for the Association of Information Systems
KM	Knowledge Management
KMS	Knowledge Management Systems
KPI	Key Performance Indicator
MIS	Management Information Systems
MSS	Management Support Systems
N/A	Not Applicable
NPV	Net Present Value
PMA	Performance Management Association
ODS	Operational Data Store
OLAP	Online Analytical Processing
ROI	Return on Investment
SAICSIT	South African Institute of Computer Scientists and Information Technology
SBIS	Strategic Business Intelligence System
SDI	Selective Dissemination Information technique
SDLC	Software Development Life Cycle
SOBIMM	Service-Oriented Business Intelligence Maturity Model
VoIP	Voice-over-Internet Protocol

Key definitions

Concept	Definition
Business Intelligence	Shollo & Kautz (2010) describe Business Intelligence as: *"… a product, process and technology or a combination of the three concepts in support of organisational decision making".*
Business value / value	Business value (also referred to as value), in this instance is perceived as the (positive) contribution of BI technologies, products and processes to the overall positive status of the organisation. Synonyms used in text also include worth, outcome and business benefits.
Critical Success Factor(s)	In a BI context, Olszak & Ziemba (2012:136) refer to CSFs as a *"set of tasks and procedures that should be addressed in order to ensure BI systems accomplishment"*.
Key Performance Indicator(s)	KPIs are tightly linked to the concept of critical success factors (CSFs). KPIs are the measureable items directly linked to the CSFs and are often used to track the effect of the CSF
Impact	The meaning of impact in this study indicates that the BI implementation had a (positive) influence on the organisation. However, impact does not necessarily guarantee that value has been added as a result of the implementation.
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Section 1

Background and Introduction

Chapter 1

Introduction

Section 1: Background and introduction

- Chapter 1: Introduction

Section 2: Literature review

- Chapter 2: Existing BI value models and contributing factors
- Chapter 3: Theoretical framework

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- Chapter 4: Research design
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Content

1.1 Background

Information Technology (IT) and the financial value added to organisations as a result of its implementation have been an extensively debated and researched subject for a number of decades (Barua *et al.* 2010; Dinter, Schieder & Gluchowski 2011; Kohli & Devaraj 2004; Sircar, Turnobox & Bordoloi 2000). Two main schools of thought are evident when research pertaining to the subject is considered. Firstly, authors such as Solow (1987) and Sircar *et al.* (2000) argued that IT does not add value to organisations by positively impacting on productivity by means of the 'productivity paradox'. The controversial article published by Nicholas Carr in 2003, *"IT doesn't matter",* contributed further to this viewpoint and highlighted that IT should be perceived as a utility and not as valuable resources and assets. The article not only supported the viewpoint of Solow (1987) and Sircar *et al*. (2000) but introduced renewed attempts to prove this statement wrong. On the other hand, continued research by authors such as Brynjolfsson & Hitt (2003), Bannister & Remenyi (2005) who indicated that this is not true and proposed innovative methods to confirm the value (Banker & Kauffman 1991; Melville, Kraemer & Gurbaxani 2004; Mooney, Gurbaxani & Kraemer 1995).

Attempts to justify the financial value added to an organisation using IT implementations are not limited to IT[1] implementations in general. Studies focusing on sub-components (such as Enterprise Resource Planning systems) and even sub-disciplines of IT and Information Systems (IS), for example Business Intelligence (BI) implementations, also very often come under investigation. This is evident from the numerous research articles, dedicated to the investigation of either the success of BI implementations (Dinter *et al.* 2011; Schieder & Gluchowski 2011; Venter 2005) or the organisational value offered by BI implementations (Elbashir, Collier & Davern 2008). However, similar to the discipline of IT, it remains challenging to determine the value of BI (Côrte-Real, Oliveira & Ruivo 2014). Although it is generally accepted, it is difficult to prove (Lönnqvist & Pirttimäki 2006; Popovič, Turk & Jaklič 2010). This can be attributed to various reasons, including:

- the value of IT and IS related implementations to organisations is dependent on the system type (Yogev, Fink & Even 2012). This is due to the unique

[1] No unanimous accepted definition for IT, IS and BI exists amongst academic scholars, industry and society. Section 1.4.7 describes these concepts in more detail and explains the definition adopted for the purpose of this study.

contribution of each type of system to organisational performance. For example, BI can positively contribute a unique blend of both operational and strategic benefits to organisations. Due to the uniqueness of studies evaluating IT value in general, or any particular system type, it remains challenging to generalize results to a BI environment;

- scholars are often in disagreement as to the true meaning and definition of the concept of BI;
- BI contains many facets of the implementation, such as proprietary technological software tools (for example specialized analytical and statistical tools) or various type of BI artefacts (such as data warehouses or front-end data-display mechanisms such as data dashboards);
- the application of BI in an organisational environment is often embedded in other processes making it difficult to identify and grasp the impact of BI on organisational performance; and
- the lack of measurement tools often makes it challenging to establish business value.

Despite all these challenges it has become increasingly important to establish the value of huge capital investments to organisations due to the increased high priority of BI implementations in organisations (Luftman & Ben-Zvi 2010). Various reasons might exist for the higher priority given to BI implementations. These are similar to the motivation of implementing BI in organisations (as identified by Gray 2010), namely:

- the availability of enormous amounts of data available on enterprise level (the so-called 'pervasive approach') (Bijker & Hart 2013; Hostmann, Rayner & Friedman 2006) in line with the concept of 'big data' (Chen, Chiang & Storey 2012);
- a considerable amount of time is spent by decision makers to gather data and the subsequent tasks of analysis;
- managers are confronted with more complex decisions;
- quick responses are required to support decisions in an unpredictable environment;

- the need has arisen to develop tools necessary for analysing, predicting and managing success in BI organisations due to huge capital investments (Adamala & Cidrin 2011).

1.2 Problem statement

Despite the obvious need for BI implementations, value determination efforts are often required for various reasons, namely:

- to prove the worth of the investment to stakeholders (Akhavan & Salehi 2013; Sawka 2000);
- to track and monitor the investment to ensure that deliverables are aligned with the user expectations during the project (Akhavan & Salehi 2013; Herring 1996);
- if benefits are identified and quantified, critical success factors can be implemented to measure success and benefits (Anjariny & Zeki 2011);
- to justify the existence of BI capabilities and subsequent departments or competency centres to organisations (Davison 2001; Pirttimäki, Lönnqvist & Karjaluoto 2006);
- to address the gap in traditional value calculation methods (such as financial methods) used in an IT environment to cater for a specialized field such as BI (Grublješič & Jaklič 2013).

Unfortunately, it remains challenging to identify the value of BI implementations (Lönnqvist & Pirttimäki 2006; Popovič *et al.* 2010). The main objective of the research study is to take up this challenge by means of assisting in the process of value identification and exploring the value offered by BI implementations in organisations. Based on the assumption that BI implementations add economic and business value to organisations, the main problem identified is that this (assumed) value of BI implementations is largely unknown and often not measured.

1.2.1 Problem 1

In order to prove the worth of investments to stakeholders, it is important to understand in what way BI adds value to organisations. One of the main challenges remains to identify the value as a result of a BI implementation and the impact on organisational performance (Elbashir *et al.* 2008).

1.2.2 Problem 2

Although authors agree that BI adds value to organisations (directly or indirectly), it is not clearly identified, explored and described in more detail.

1.2.3 Problem 3

There is very limited academic research investigating where the most business value is achieved (i.e. the location of the value or the various organisational functional areas or departments).

1.3 Research questions

Given the above problem statements identified, the following research questions have been identified as basis for this study:

1.3.1 Primary research question

Primary research question (PRQ)

How does BI add value to organisations?

The question focuses on the measuring mechanism and metrics used to identify how the benefits and value as a result of a BI implementation is measured in an organisation.

1.3.2 Secondary research questions

The following secondary research questions were identified to explore what value is added to organisations:

Secondary research question 1 (SRQ1):

What is the perceived value of BI implementations amongst senior management in organisations?

This question focuses on the identification of the value items created as part of the BI implementation as well as how the value was created.

Secondary research question 2 (SRQ2):

What was the impact of BI on the organisation?

This question focuses on the identification of the areas in the organisations on which the BI implementation had an influence. It is assumed that if the BI implementation has positively influenced the various organisational areas, value items and benefits will be introduced as a result.

Secondary research question 3 (SRQ3):

What is the relationship between BI implementations and organisational performance?
The focus is on the causativeness between the various aspects of the BI implementation and organisational performance. A positive relationship between BI implementations and organisational performance will indicate that certain business benefits or value has been achieved.

Secondary research question 4 (SRQ4):

In which organisational functional areas was the perceived value the result of a BI implementation?
The four perspectives of the balanced scorecard approach (financial perspective, customer perspective, internal perspective, as well as learning and growth perspective) will be utilized to explore the impact and subsequent value offered in these areas. Areas of impact will give an indication of the extent to which value has been achieved.

The research questions are addressed in the following sections of the document:

Research question	**Section where answered**
PRQ: How does BI add value to organisations?	6.7 5.3 Annexure B and C contains a list of all the metrics used in the study
SRQ1: What is the perceived value of BI implementations	6.7

Research question	Section where answered
amongst senior management in organisations?	
SRQ2: What was the impact of BI on the organisation?	6.7
SRQ3: What is the relationship between BI implementations and organisational performance?	6.7 Chapter 7
SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?	Chapter 7

Table 1 - Research question map

1.4 Significance of the study

The study aims to make a contribution to the current academic knowledge. The importance and significance of the study is highlighted by the following points.

1.4.1 In-depth analysis

During a preliminary scan of the academic literature focusing on the value determination of BI it becomes evident that various approaches are used in studies, namely:

- A 'traditional' approach, for example Return On Investment (ROI) and process engineering (Williams & Williams 2003);
- A performance measurement approach, for example the Balanced Scorecard (Hawking 2011; Vinciguerra 2004) and Key Performance Indicators (KPIs) (De Voe & Neal 2005; Sawka 2000) and Critical Success Factors (Mungree, Rudra & Morien 2013; Sangar & Iahad 2013);
- Customized measurement tools as a result of empirical studies, for example a BI opportunity analysis and BI readiness assessment (Williams & Williams, 2003), and Gartner's BI and Performance Management Framework (Hostmann *et al.* 2006);
- Existing models to establish the success of IT systems such as the DeLone and McLean Information System Success Model (Kokin & Wang 2013; Kulkarni & Robles-Flores 2013; Tona, Carlsson & Eom 2012).

Some of these approaches are described in more detail in the literature review section of this document (chapter two).

The main objective of this study is to use an interpretive approach utilising a qualitative data generation model, therefore focusing on the *context* in which the value of BI is presented (Myers 2009, 2013). The researcher therefore has to explore the *conditions* for the value to be created. A qualitative study allows for an in-depth analysis of the environment fostering successful BI implementations.

1.4.2 Unique research methodology approach

An extensive, critical literature review reveals that the majority of research utilizes a positivist philosophical approach and focuses on the interpretation of quantitative data (Kokin & Wang 2013). An exception to this general trend is a study conducted by Williams & Williams (2003). In their study, they reflect on the value of BI implementations based on lessons learnt as a result of BI implementations. The approach used by Williams & Williams (2003) is therefore based on an interpretive philosophical approach using qualitative data generation methods. The study conducted as part of this research therefore contributes to the current body of knowledge in a unique way (similar to that of the study by Williams & Williams, 2003) using an interpretive philosophical approach.

1.4.3 Investigation of intangible benefits

A quantitative research approach (as in the majority of the research studies referred to above), focuses on measurable items. Unfortunately, due to the nature of BI implementations and the fact that BI supports decision-making (Venter & Tustin 2009), various intangible benefits are introduced (Oakley, Iyer & Salam 2014). A qualitative approach will allow for the investigation of such benefits.

1.4.4 Definition of value and timing of investigation

According to Davern & Kauffman (2000), the value of IT investments can be determined prior to the project (potential IT value) or after the project (realized IT value). The articles evaluated as part of the literature review section of this document do not disclose *when* the particular study was conducted. In this proposed study, the researcher will focus on realized value after a BI implementation. It is anticipated that

this dimension will make a difference to the outcome of the perceived value of BI implementations to organisations.

1.4.5 Practical contribution

In support of the problem statement of this study, it is envisaged that a BI balanced scorecard are constructed to assist organisations in the process of substantiating the value realisation of BI interventions. Also, if the value of these implementations can be determined, further investigation can explore how the value is created and what conditions are necessary for the creation of value. The contribution is therefore practical to organisations aiming to establish the value of their BI implementations.

As mentioned by Williams & Williams (2003:2) it has become a *"strategic necessity for organisations to assess how they can use BI to improve results and to use a structured approach to ensure that their investment in BI actually deliver business value".*

One example of a tool based on a structured approach is a balanced scorecard. A balanced scorecard for a BI environment can be used during various stages during Business Intelligence interventions, namely:

- Pre-implementation: to establish if the value derived from the planned intervention will be worth the initial capital investment;
- During implementation: to ensure that the value realization identified pre-implementation is monitored and kept in mind during the implementation;
- Post-implementation: to establish the true value realization after the implementation when compared to pre-implementation value items.
- Continuous monitoring: after the implementation of the BI intervention to ensure that value realization items are continuously met and to identify new value items adapting to the organisation's changing environment.

1.4.6 Research output

In addition to the anticipated practical organisational contribution of the study (as explained above), it is anticipated that this study will also make a substantial contribution on academic level. A number of outputs are presented as a result of the research conducted, namely:

- an inventory of existing peer reviewed academic research on the topic of BI and business value evaluation methods and techniques are presented in tabular format as well as diagrammatically (chapter three). This list is used to critically analyse the state of BI value research, categorize and synthesize the various focus areas of the research and identify gaps for future research opportunities;
- an instrument, in the form of a semi-structured interview template, is developed to gather the primary data for this study. This interview template can be adopted, reused and improved by other academics for similar investigations. The interview template also contains detail about the various measurements used to investigate the research problem;
- a verified balanced scorecard for a BI environment is presented as a key deliverable. This balanced scorecard can either be used as a starting point for future academic research or utilized by organisations to determine the value of their BI implementations. Also, to ensure adequate ROI, the model can be used to identify and monitor the items that will positively impact the organisation's performance (Williams & Williams 2007).
- the data gathered as part of the study will depict the current value determination methods pertaining to BI utilized in a developing country (South Africa). It might be possible to compare the results obtained from this study with data obtained from developed countries in future research studies.

1.4.7 Motivation of the study as part of IS

The discipline of Information Systems (IS) is often perceived as a multi-disciplinary subject with no clear definition adopted by academics, industry and society (Avison & Elliot 2006). Schryen (2010) argued that the utilisation of terminology such as Information Systems (IS), Information Technology (IT) and Information and Communication Technology (ICT) are not clearly defined and are used interchangeably depending on research context. Due to the fact that there is no academically recognised taxonomy for the Information Technology discipline, Information Systems, Information Technology and Information and Communication Technology is perceived as the same discipline (Schryen 2010). However, for the purpose of this study, the view of Avison & Elliot (2006) is accepted whereby the main difference (from a technological perspective) between computer and related IS

disciplines lies in the focus of these disciplines. As a result, a clear distinction between IS and IT can be made, whereby IS *"focuses more on interactions between people and organisations (the 'soft' issues) and technology rather than on technologies (the 'hard' issues) themselves"* (Avison & Elliot 2006:7). IT, on the other hand, focuses on technological aspects or 'hard issues'.

When the meaning of BI is evaluated one discovers that BI, as sub-discipline, has a closer relationship to IS than IT[2]. This is due to the focus of BI on the interaction between information products (such as data, information and knowledge and decisions), the utilisation of these products for the purpose of gathering, storing, analysing, using and acting on these products with the support of technological components (such as data warehouses, OLAP, Knowledge Management Systems, Decision Support Systems) (Shollo & Kautz 2010). The focus is therefore not solely on technological components or 'hard' issues like Information Technology. Therefore, the practical and academic contribution made in this study not only contributes to the BI body of knowledge, but also contributes to the overall discipline of IS.

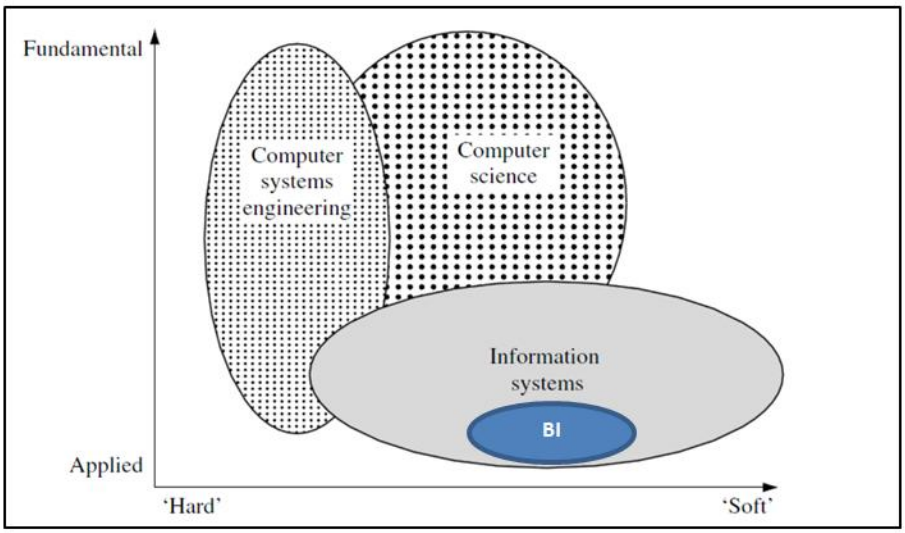


Figure 1 - Differentiating IS from other IT-related disciplines (adapted from Avison & Elliot 2006)

[2] This is implied by authors such as Kulkarni *et al*. (2013) and Tona *et al.* (2012) through the adoption of an IS specific model for the purpose of their BI focused research.

1.4.8 Unique theoretical framework

Based on the literature review chapter of this document (see chapter two), the author could not find, to the best of her knowledge, any particular study using a *second or third generation* balanced scorecard approach when investigating the value contribution of BI to organisations. This study will therefore be an innovative approach to the value exploration of BI. The second generation balanced scorecard approach is discussed in more detail in chapter three.

1.5 Research design

The research design and methodology is discussed in detail in chapter four.

1.6 Research tasks

A pragmatic approach was followed in the research process. The following tasks were included in the research:

1. An extensive, critical literature review focuses on previously published BI value models (chapter two) as well as existing balanced scorecard strategy maps (chapter three);
2. The primary research instrument for data generation is designed, namely semi-structured interview templates based on the second generation balanced scorecard approach (chapter five);
3. An internal pilot study is conducted to identify unambiguous questions and to check for completeness (chapter five) whereafter adjustments are made based on the findings;
4. Key participants are identified (i.e. organisations) to participate in the study;
5. Semi-structured interviews are conducted to gather the necessary data (chapter six);
6. Data is transcribed (summary of transcribed data Annexure F);
7. Data is analysed (using a conceptual data analysis approach, chapter six);
8. An intermediate BI balanced scorecard is developed based on the results of step five to seven above (chapter seven);

The verification process is started:

9. A short document is compiled containing the proposed BI balanced scorecard with a short description of the various components (based on the contents of chapter seven). This document was distributed to all research participants for input. The main purpose of this task was to verify the intermediate version of the BI balanced scorecard (chapter eight);
10. The input from the verification process is consolidated and interpreted. Where applicable, adjustments are made to the proposed BI balanced scorecard. The final version of the scorecard is presented in chapter eight.
11. The study is concluded and further recommendations are proposed (chapter nine).

Each of these steps is addressed as stated in the various chapters in the document.

The table below (table 2) contains a summary of the research outcomes with the corresponding chapter in which the component is addressed.

Research outcome / contribution	**Chapter**
Extensive, critical academic literature review focusing on BI value models	Two
Extensive, critical academic literature review focusing on balanced scorecards and the approach of strategy mapping	Three
Preliminary BI balanced scorecard	Five
Primary research instrument (semi-structured interview template)	Five
Intermediate (unverified) BI balanced scorecard	Seven
Verified BI balanced scorecard	Eight

Table 2 - Summary of research outcomes / contribution

The research approach and research methodology are covered in more detail in chapter four of the thesis.

1.7 Thesis outline

The outline of this document corresponds with the research process followed. The thesis is subdivided into six distinct sections, each focusing on a particular aspect of the research conducted. Figure 2 below depicts the outline of the thesis diagrammatically. This diagram is used at the beginning of each chapter to indicate the context of the chapter under discussion by means of a red border and tick mark.

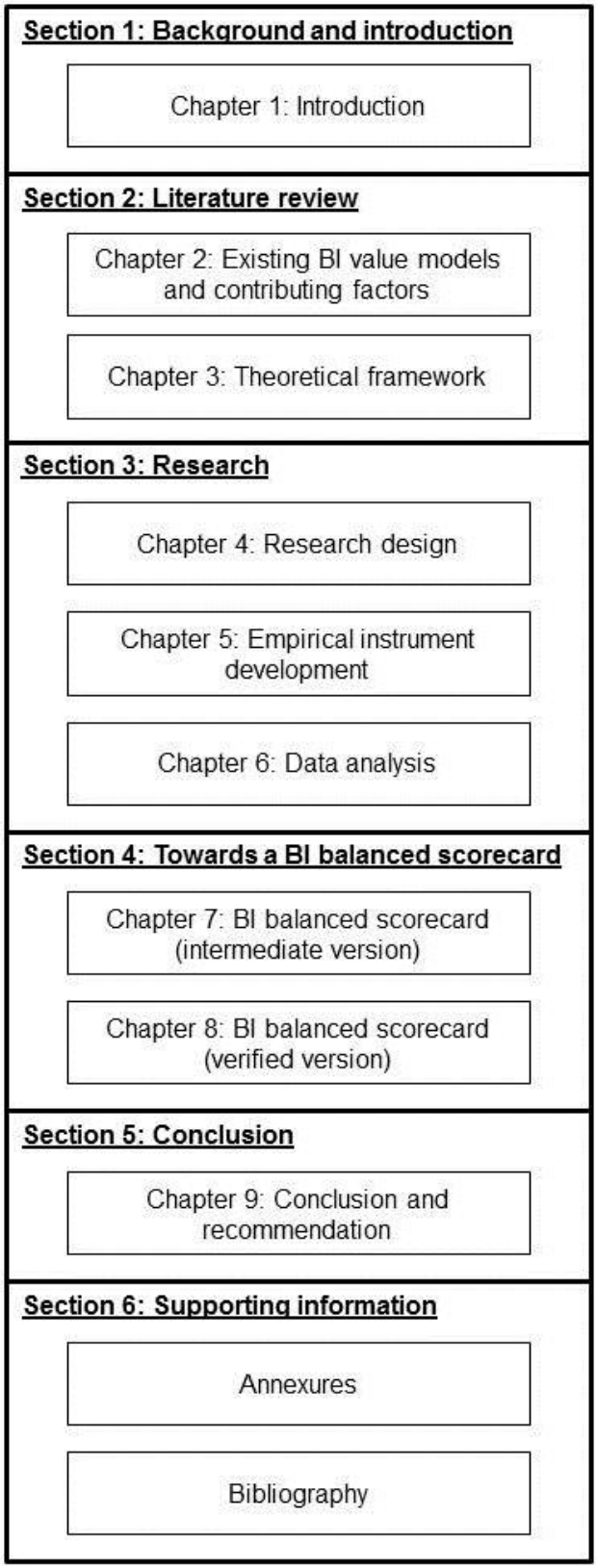


Figure 2 - Document outline

Section one provides the background and motivation for the study and comprises one chapter. Chapter one starts with an introduction to the study, followed by a

section on the justification and motivation of the research problem. Other focus areas include the problem statement, research question, purpose of the study, research objectives, as well as the importance and benefits of the study. The chapter is concluded with an outline of the chapters in the remainder of the thesis.

Section two focuses on the identification of existing academic models focusing on achieving business value of Business Intelligence in organisations. It considers all the contributing factors towards the achievement of BI value contained as part of various BI value models. Various academic literatures pertaining to the value offered by BI implementations are assessed. An inventory of the findings is presented. The last chapter in this section focuses on the theoretical framework for the study, namely the balanced scorecard strategy map approach. The approach is evaluated by considering the suitability towards the study, advantages as well as disadvantages.

Section three focuses on the empirical work conducted as part of the study. The section commences with detailed information about the research methodology adopted namely a multiple-case study approach. The other sources of evidence in support of the case study approach are described whereafter the data analysis approach is disclosed. The subsequent chapter in section three (chapter five) discusses the development approach used to construct a preliminary version of a BI balanced scorecard strategy map on which the semi-structured interview template is based. The BI balanced scorecard in this study was therefore used as a foundation for gathering data. The last section focuses on the instrument verification and procedures, including data validity and reliability. The last chapter in this section, chapter six, discusses the data gathered as part of the semi-structured interviews as well as the various sources of information identified in chapter four. The data obtained from all these sources are presented using four individual case studies as well as a cross-case discussion of the similarities and differences between the various individual case studies. A summary of the data obtained from the interviews are contained in Appendix F in the thesis.

Section four proposes an intermediate, unverified version of the BI balanced scorecard and discusses the various items (such as proposed perspective and objectives) in more detail. The preliminary version of the BI balanced scorecard (in

chapter five) is compared to the intermediate version of the BI balanced scorecard presented in this chapter. All the versions of the BI balanced scorecard were used as main toolset to investigate the value of BI in organisations.

The subsequent chapter (chapter eight) covers the actual verification process of the intermediate version of the BI balanced scorecard. Finally, the final version of the balanced scorecard for a BI environment is presented after feedback from the verification process was obtained. This version of the BI balanced scorecard was used to structure and interpret the findings of the study. It was also included in the final solution that can be used by organisations to establish the value of BI in their organisation.

Section five contains the assumptions, limitations, challenges and future research opportunities identified on conclusion of the study. Assumptions, limitations and challenges were included in the final chapter of the thesis due to the fact that these transpired in the course of the study and were therefore not evident at the onset of the study.

Section six lists all the supporting documentation for the study. All the critical success factors identified in literature are summarized in table form and compared to the list of proposed critical success factors for the interview template (Annexure A). The first version of the BI balanced scorecard strategy map used to construct the semi-structured interview template is presented both in tabular format (Annexure B) as well as graphical format (Annexure C). Supporting documentation of the interview process is enclosed, namely a copy of the participant permission form (Annexure D), interview template (Annexure E), as well as summary of interview responses (Annexure F). A copy of the institutional ethical clearance documentation is attached in Annexure G. Annexure H contains a copy of the certificate of language editing, confirming that the text contained in the thesis was verified by a registered language practitioner. Finally, a list of references consulted is contained in the ‘Bibliography’ section.

1.8 Chapter conclusion

Although consensus exists amongst academic scholars and industry practitioners that BI implementations add an enormous amount of value to organisations, no

consensus could be reached in terms of how this perceived value should be measured. This might be attributed to the challenges faced when dealing with BI implementations such as a lack of clear, unambiguous definition for BI as well as the fact that BI is often intertwined with organisational processes and difficult to isolate. The main problem statement was therefore identified as what value BI adds to organisations and how this can be measured.

Despite the growing number of academically published material focusing on the topic of Business Intelligence, there were seemingly limited qualitative research attempts using an interpretive approach to investigate the problem. This study therefore proposed an interpretative, qualitative approach to facilitate the in-depth investigation into the problem identified. Semi-structured interviews were selected as the data generation method of choice.

A number of research contributions were identified namely an inventory of existing peer reviewed academic research on the topic of BI and business value evaluation methods and techniques (presented in tabular format), a semi-structured interview template for future adoption and utilisation by other academics and a verified balanced scorecard for a BI environment. The scorecard can be used autonomously or as part of the proposed BI value solution to assist organisations with the identification of the value BI add to their organisations.

Section two will focus on the literature review phase and contains two chapters. Chapter two provides the reader with an overview of existing academically published BI value models, whilst chapter three describes and substantiates the selected theoretical framework – the balanced scorecard strategy map. This framework was also used as a main tool to be used during the data gathering process.

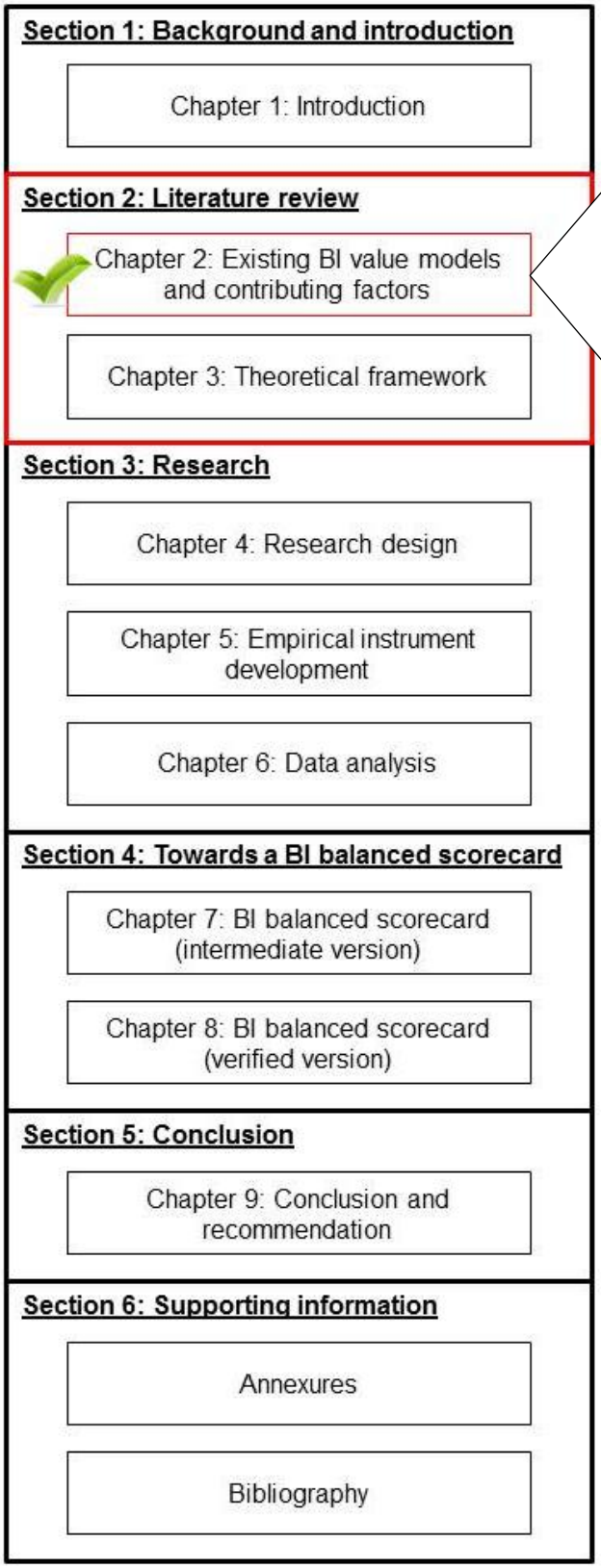
Section 2

Literature Review

Chapter 2

Existing BI value models and contributing factors

A sub-section of this chapter was presented at the 2013 itAIS conference, Milan, Italy, December 2013. *"Towards a classification framework of Business Intelligence (BI) value research", Eybers, S., Kroeze, J.H. and Strydom, I.* The feedback received during this session was considered and implemented (where appropriate) in this chapter.



Content

2.1 Introduction

Chapter two evaluates the current published academic literature focusing on the topic of BI value evaluations. As a starting point, the scientific search process is discussed in detail. The reason for the discussion is threefold. First, it allows future researchers to assess the findings of the literature review based on the process followed. Second, the legitimacy of the findings presented can be repeated using the same search criteria (content validity). Third, it also contributes to the reliability of the study. The findings of this research effort can subsequently become the foundation for future research efforts.

The meaning of the concept of BI and business value is a well debated topic amongst scholars (Arnott & Pervan 2005; Schryen 2010; 2013; Shollo & Kautz 2010; Watson 2009). Due to the ambiguous nature and lack of cohesion when defining both concepts, the second section of the chapter focuses on the clarification of the term Business Intelligence and business value.

Finally, a list of academic literature focusing on the key focus of the research (the value of Business Intelligence in organisations) are considered and presented. BI studies focus on various aspects of the implementation process. For example, some studies focus on preconditions to achieve business value such as organisational maturity and organisational readiness. Understandably, the existence of certain preconditions as well as the level of organisational maturity and readiness influences the implementation success of BI interventions. Another focus point of studies focusing on BI value is the level on which benefits or success factors are identified. For example whilst some studies focus on identifying success factors or benefits on process level some studies focus on organisational level and on both process and organisational level. All these approaches were considered and classified in a sensible concept-centric approach.

The chapter outline is diagrammatically depicted in the figure 3.

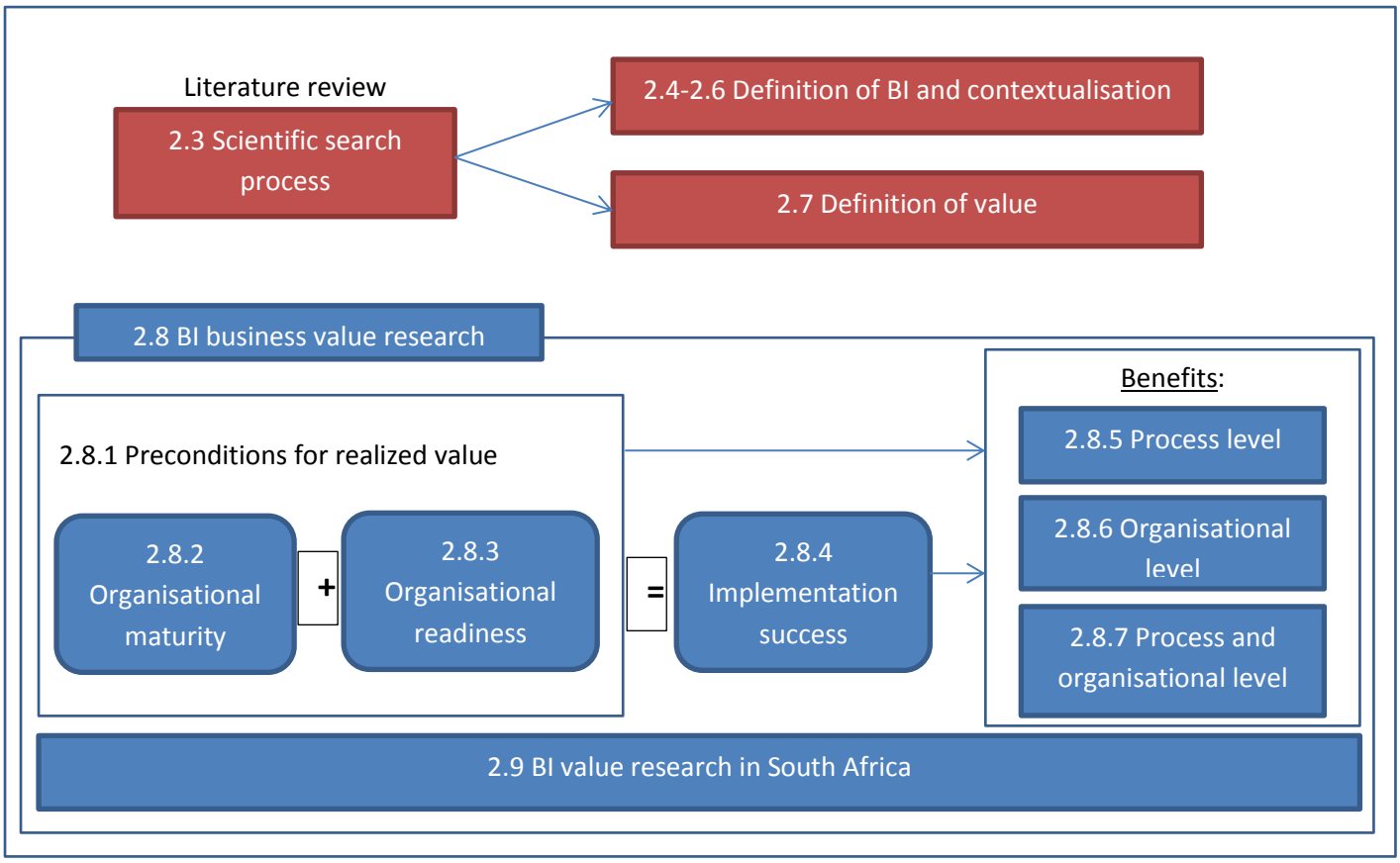


Figure 3 - Chapter two outline

2.2 Background

In general, authors are in agreement that BI implementations do add value to organisations (Elbashir *et al.* 2008; Yogev *et al.* 2012). Despite the consensus amongst scholars, and the obvious benefits of BI implementations in particular the interpretation of enormous amounts of data since the introduction of the concept of big data, the challenge still lies in identifying and measuring more than just the obvious benefits (Lönnqvist & Pirttimäki 2006; Popovič *et al.* 2010; Smith & Crossland 2008).

Numerous factors have been identified as contributing to the challenge, namely: a lack of measurement tools, knowledgeable resources to assist in the measurement process as well as hidden benefits as a result of implementations. Despite the challenges, the measurement of these benefits and subsequent business value remains important to organisations (Schryen 2010, 2013; Solomon 1996; Viva Business Intelligence Inc. 2000). This perspective is supported by the increase in the number of academic publications over the past decade (Jourdan, Rainer & Marshall 2008; Schryen 2013) and the priority allocated to BI projects despite financially challenging times (Farrokhi & Pokorádi 2012).

During an extensive academic literature review, it became evident that a number of academic materials were published in the last decade contemplating: (a) the meaning of BI; and (b) the nature of the perceived value of Business Intelligence (direct or indirect). Subsequently, research obtained while focused on a vast field including the multidimensional definition of BI (Shollo & Kautz 2010; Pirttimäki 2007) as well as the value of BI using various methodologies (Dinter *et al.* 2011), existing IT models (Gibson & Arnott 2005), techniques (Elbashir *et al.* 2008) and dimensions (Farrokhi & Pokorádi 2012). For this reason, it has become important to categorize and synthesize related literature in an attempt to make sense of the current BI value research.

Although the focus of the research aims to investigate the value reaped by South African based organisations as a result of BI implementations, the original literature review scope was not limited to this particular environment.

2.3 Scientific search process

A structured taxonomy is adopted in this study before the actual search process commenced. The adopted taxonomy is described in more detail before the search process is defined.

2.3.1 Cooper's taxonomy

Cooper's taxonomy of literature reviews (1988) is used as a structured guideline during the literature review process. The taxonomy provides a classification framework for conducting literature reviews. It provides guidance to the researcher conducting the review to guide the review process using five characteristics namely focus of attention, goals of synthesis, perspective of the literature, what is covered in the literature, the organisation of the perspective and intended audience. Each of the characteristics is sub-divided into lower level categories. These categories include research methods, research outcomes, theories and practices or applications for the focus of attention characteristic. When the researcher conducts the literature review process the main focus of the research will be on one of these selected categories. Other categories include integration (generalization, conflict resolution, and linguistic bridge-building), criticism and identification of central issues when the goals of the synthesis characteristic are considered. The remainder of the characteristics and categories are displayed in the table below (table 3) together with the focus categories selected for the purpose of this study (described in more detail after the table).

Characteristic	**Category**	**Focus of the study**
Focus of attention	Research methods Research outcomes Theories Practices or applications	Research outcomes
Goal of the synthesis	Integration: • Generalization • Conflict resolution • Linguistic bridge-building Criticism	Integration, generalization

Characteristic	Category	Focus of the study
	Identification of central issues	
Perspective on the literature	Neutral representation Espousal of position	Neutral representation
Coverage of the literature	Exhaustive Exhaustive with selective citation Representative Central or pivotal	Exhaustive with selective citation
Organization of the perspective	Historical Conceptual Methodological	Conceptual
Intended audience	Specialized scholars General scholars Practitioners or policy-makers General public	Specialized scholars Practitioners or policy-makers

Table 3 - Cooper's taxonomy (adopted from Organizing Knowledge Synthesis: A Taxonomy of Literature Reviews, Cooper 1988)

A research outcomes oriented review approach is followed in this study, evaluating existing academic material (Randolph 2009). This approach focuses on the identification of the outcome or main contribution of the research topic under evaluation. The main objective is to critically analyse the literature to integrate and generalize findings in order to clarify concepts. The clarification process is imperative due to the vast number of definitions and subsequent practical implementation thereof. Also, it is necessary to integrate concepts for the purpose of this study. A neutral representation is adopted in order to objectively integrate the concepts. Key concepts are identified to contribute to the conceptual identification and visualisation of the key research outputs.

Dinter (2012) differentiates between BI related information sources introduced by vendors, consultancies, research institutions and academic scholars. The main challenge with some of these sources is the lack of a recognised rigorous scientific approach or the lack of disclosure. For this reason, only material from respectable

peer-reviewed academic publications are considered (therefore an exhaustive literature review focus with selective citation).

The intended audience of this thesis is primarily academic reviewers, evaluators and moderators. Secondarily both practitioners and policy-makers should benefit from the research.

2.3.2 The search process

The search process adapted is similar to that of Webster & Watson (2002). An electronic search was conducted by topic (Business Intelligence) across established peer reviewed academic journals and databases of conference proceedings. The search included keywords such as 'Business Intelligence', 'business' + 'intelligence', 'value', 'success', 'performance management' and 'worth'. All aspects of the BI concept was considered, including BI as technology (such as data warehousing, OLAP, decision support systems), product (data, information, knowledge, decisions) as well as process (extract, transform and load process) (Shollo & Kautz 2010). In addition, a purposive sample approach was followed whereby no literature from vendors or consultancies was considered where the research method was not disclosed or suspicion of product bias existed. The search was further restricted to include results from the past two decades, 1990 to 2013 in the English language only. The main reason for the date filter restriction is the fact that the concept of BI was only introduced in 1989 by Howard Dresner (Watson 2009; Shollo & Kautz 2010). The assumption was therefore made that BI, as discipline, did not receive sufficient academic focus prior to 1990. This is evident when a general search is conducted using the keyword "Business Intelligence" using a renowned academic search engine. For example, the PROQUEST (ABI/INFORM Global) search engine was used to perform a complete search (with no date restrictions). The search returned 41 records for the period 1990 to 1999; 522 records for the period 2000 to 2009 and a total of 491 records for 2010 to 2013 (search conducted on 1 September 2013). The inclusion of the period prior to 2000 did not make a huge impact on the number of relevant article retrievals.

The end result was a preliminary set of relevant articles. Articles were further evaluated for relevancy using the article abstract. Furthermore, the reference list of

each article in the pool was used to conduct a backward search. The results were considered based on the citation index from Web of Science. The knowledge pool was finalized.

Articles were classified according to the main investigation unit. For example, studies investigating success factors of BI implementations can investigate either process or organisational level success factors. These studies were then classified as process level or organisational level contributions. In instances where both units were investigated, the contribution was classified as part of the organisational level. Other classification categories included the interrelationship between process and organisational level items as well as preconditions for the realisation of BI benefits.

2.4 Clarification of terminology

The clarification of terminology is imperative in this study for two main reasons. Firstly Business Intelligence, business value and the meaning thereof are a much debated subject. Clarification is therefore imperative to prevent ambiguous understanding of the concepts. Secondly, by clarifying terminology, the scope of the study is delineated and confirmed. As mentioned by (Schryen 2010:235) *"for each academic discipline, a consistent terminology is essential to name relevant constructs, to define its semantics and to resolve potential ambiguities".*

Before a survey of literature relevant to the topic of Business Intelligence value is presented, the meaning of the concept of business value and Business Intelligence is critically examined.

2.4.1 The meaning of Business Intelligence

According to Pirttimäki (2007:23) a *"precise analysis and definition are required before a phenomenon can be quantified or measured"*. One of the objectives of this study is to perform a qualitative investigation and identify measurements to determine the value of BI. For this reason, it is imperative to clarify the term BI by means of a brief synopsis. Also, when conducting research investigations, it is important to establish clear research boundaries prior to the research. This will eliminate the inclusion of sub concepts often generalized to the field of BI. For example, technologies used in a BI system, such as a data warehouse, are

sometimes perceived as the BI system. However, this is only one component of a BI system.

The definition of the concept of Business Intelligence varies for many reasons, including:

- In comparison to established disciplines (such as computing), BI is perceived as a young discipline (less than 25 years old, Negash & Gray 2003), and therefore still evolving. However, not all authors agree with this point of view (Arnott & Gibson 2005; Gray 2003). According to these authors, BI has already been introduced by authors (Luhn 1958) by means of a Selective Dissemination Information technique (SDI). This technique allowed the distribution of particular information sets to individuals according to their individual needs specified by a predefined profile.
- BI is a flexible concept used in various environments. For this reason, the meaning of BI depends on the background of the person constructing the definition (Gibson, Arnott & Jagielska 2004; Lönnqvist & Pirttimäki 2006; Pirttimäki 2007). For example, practitioners representing a particular product might include the characteristics of their particular product in the definition. As a result, many definitions exist amongst scholars and academics referring to various elements of BI implementations.
- BI is a heterogeneous field influenced by other external research areas such as Decision Support Systems (DSS) (Arnott & Pervan 2008; Gray 2003). Business Intelligence might therefore 'overlap' with these systems making it difficult to establish clear boundaries for the concept.
- The concept is also defined as a technologically broad term and often labelled as an 'umbrella' term (Shariat & Hightower 2007; Sidorova & Torres 2014) for systems supporting decision-making (Popovič *et al.* 2010).

2.4.2 BI as a diverse term

The concept of BI is often used to refer to various diverse concepts, often influenced by the environment in which it is used. Unfortunately, these diverse opinions caused confusion amongst scholars and industry practitioners and a challenge was introduced to identify what is included and excluded in the scope of BI. Some of these variations include:

- BI is a diverse term (Bucher, Gericke & Sigg 2009; Pirttimäki 2007; Watson 2009) used in many instances. Some of the examples include:
  - BI has replaced DSS, MIS and EIS (Thomsen 2003);
  - BI systems has replaced Executive Information Systems (EIS) (O'Brien & Kok 2006);
  - BI systems are simply a consumer of data obtained from DSS (Negash 2004);
  - BI includes concepts such as Corporate Performance Management (CPM)[3], Business Activity Monitoring (BAM) and Customer Relationship Management (CRM) (Zaman 2005);
  - The concept of Corporate Performance Management (CPM) is used interchangeably with BI (Cokins 2009; Frolick & Ariyachandra 2006).

  Adding to the challenge of theorizing and classifying BI, authors are not even in agreement on the scope (what is included and excluded) of DSS and MIS. Clark, Jones & Armstrong (2007), for example, argue that DSS is part of a MIS, whilst Olszak and Ziemba (2006) argue that *"MIS have a much wider subject range, multi-variant analysis of semi-structured data that come from different sources and their multi-dimensional presentation".*

- BI is an 'umbrella' or collective term (Alter 2004; Bucher *et al.* 2009; Clark *et al.* 2007; Dinter *et al.* 2011; Kinsinger 2007; Mohamadina & Harbawi 2012; Power 2004, 2009; Shariat & Hightower 2007; Sidorova & Torres 2014; Venter & Tustin 2009; Watson 2009). It describes various Information Technology components in support of decision-making, such as Decision Support Systems (DSS), Management Information Systems (MIS) and Executive Information Systems (EIS).

Figure 4 graphically displays the relationships between these diverse and collective concepts often used to refer to BI.

[3] Business Performance Management and Corporate Performance Management (CPM) are perceived as the same concept in this context.

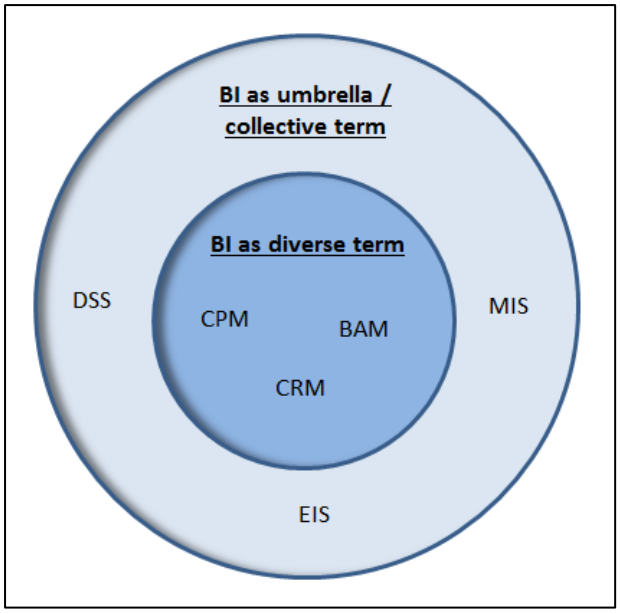


Figure 4 - BI as a diverse term

For the purpose of this study, the following demarcation has been accepted:

- BI has not replaced DSS and MIS but is merely part of the natural evolution from DSS systems (Power 2008) and can be seen as a sub-discipline of DSS (Arnott & Pervan 2008) supporting the task of organisational decision-making. Also, BI can be part of a bigger MIS system.
- Executive Information Systems (EIS) has not replaced BI systems. However, some components of a BI system can cater for a particular end-user group such as executives. This is discussed in more detail in the following section.
- BI is often part of bigger Business Corporate Performance Management (CPM) systems. BI can provide the infrastructure or foundation to CPM (Aho 2010) as well as Business Activity Monitoring (BAM) systems.
- Business Activity Monitoring (BAM) systems and specialised systems such as Customer Relationship Management (CRM) systems are often a consumer of data provided by BI systems. However, both BAM and CRM systems can also be an important data provider to the BI system.

Table 4 contains a summary of the meaning of BI in the context of this study.

Meaning of BI in the context of this study
BI has not replaced DSS, MIS or EIS.

BI is part of natural evolution from DSS systems and therefore perceived as sub-discipline.
BI part of bigger MIS system.
BI often part of bigger CPM system.
BI provide infrastructure to CPM and BAM.
Various specialized systems such as BAM and CRM can be both a provider to and consumer of data to BI systems.

Table 4 - Summary of BI terminology for study demarcation purposes

2.4.3 Technological broad term

BI originated from Decision Support Systems (DSS) (Power 2008). Subsequently, Power (2008) argues that the scope of BI depends on the 'purpose' or type of DSS implemented. For example, if the purpose of the implementation is to statistically evaluate and investigate the relationship and correlation between various data elements, implementations are often referred to as data mining. When metrics are used to display data in relation to various benchmarks or targets, the term 'dashboard' is used. In addition, Watson (2009) argues that different terms are used to label BI items depending on the *focus* of the implementation. For example, in instances where data is plotted on maps, the label Geographical Information Systems (GIS) is used.

Some DSS systems cater exclusively for executives. These systems are typically labelled as Executive Information Systems (EIS). According to Shariat & Hightower (2007) both EIS and DSS support the same objectives, tools and techniques. O'Brien & Kok (2006) agree with this and further argue that BI is a type of DSS. However, senior business executives (as the main system user) do not necessarily differentiate between BI, EIS or DSS (Shariat & Hightower 2007). This might be due to the fact that the technical complexity of BI, EIS or DSS is concealed. However, the scope of BI is much wider than that of EIS. Whilst EIS focuses on providing a specific user group, namely executives, with the necessary information for decision-

making BI also includes the process, technologies and products in the information delivery process (Shollo & Kautz 2010).

On the other hand, a Strategic Business Intelligence System (SBIS) supports various processes (Martinsons 1994). SBIS is not different from traditional BI except for the strategic focus of SBIS (whilst BI focuses on all organisational levels).

BI is often used as a technological broad term (Popovič *et al.* 2010; Mohamadina & Harbawi 2012) and can also refer to disciplines such as Competitive Intelligence (CI), Knowledge Management (KM) and Business Performance Management or Corporate Performance Management (CPM). Unfortunately, these items are often confused with BI. Each of the items is discussed in more detail below.

2.4.3.1 Competitive Intelligence (CI)

There are a number of arguments amongst scholars on the meaning of CI in relation to BI. These include:

- CI and BI refer to the same concept (McGonagle & Vella 1996; Pirttimäki 2007);
- BI is an extension of a CI system (O'Brien & Kok 2006);
- CI is a specialized sub-section of BI (Kinsinger 2007; Negash 2004; Ranjan 2009);
- CI and BI are two vastly different concepts (Combs & Moorhead 1992; Gilad 1996).

A definition of CI, introduced by Rouach & Santi (2001:553), describes CI as the *"art of collecting, processing and storing information to be made available to people at all levels of the firm to help shape its future and protect it against current competitive threats".* In addition, Drucker (1998) also identifies the existence of a strong knowledge based component as the heart of CI. Without the necessary knowledge to interpret the stored information, CI is worthless to the user. Information is only relevant if the data serves a particular purpose. One example of such a purpose is to use the data to determine future threats and expand market share based on information from competitors. From this perspective, CI is a specialized sub-section of BI (Kinsinger 2007; Negash 2004; Ranjan 2009) utilising the same infrastructure but focusing mainly on unstructured data (Kemper & Baars 2006).

The focus of CI is outwards (or external) with the objective of scanning the competitive landscape for information for the sole purpose of survival and competitive advantage (Ranjan 2009). BI, on the other hand, has a strong internal focus, focusing on supporting decision-making during all aspects of the business, not limited to competitor related challenges. The scope of BI is therefore much broader than that of CI (Choo 2002; Mintzberg 1994; Weiss 2003). This view is accepted for the purposes of this thesis and is also accepted by Popovič *et al.* (2010).

Finally, it is important to note that the concept of CI and BI has evolved independently. Whilst CI originated from Porter's concept of competitor intelligence (Porter 1980, 1985, 1990), BI evolved from DSS. In essence, the reason for their existence is related yet vastly different. It is anticipated that the two concepts will continue to exist separately.

2.4.3.2 Knowledge Management (KM)

Knowledge management can be described as the utilisation of information in a particular situation, combined with wisdom, with the end result of new knowledge. In an organisational context, KM refers to the ability of an organisation *"to manage, store, value, and distribute knowledge"* (Liebowitz & Wilcox 1997). For this reason, BI, DSS and data mining tools are perceived as components of knowledge management assisting in the harvesting of knowledge (Nyalungu 2011).

In a study conducted by Herschel & Jones (2005) it became evident that 60 % of consultancy level respondents did not understand the difference between KM and BI. However, when both definitions of KM and BI were examined the confusion became evident. Both disciplines share the same objective of improved organisational performance by means of supported decision-making. It is therefore not surprising that these disciplines are often confused.

The major difference between BI and KM as identified by Herschel & Jones (2005) lies in the focus of the knowledge type. Whilst BI focuses on explicit knowledge, KM involves both tacit[4] and explicit[5] knowledge. Although different, both KM and BI should be integrated to achieve organisational goals (Herschel & Jones 2005).

[4] Tacit knowledge refers to knowledge that is difficult to transfer, contained in the minds of human beings.
[5] Explicit knowledge refers to articulated knowledge transferred amongst resources.

When evaluating Knowledge Management in the context of the BI definition proposed by Shollo & Kautz (2010) (postulating that BI is a process, technology and product), knowledge is a product. Knowledge as a product of BI refers to the knowledge obtained as a result of gathering and analysing information (the BI process) through the utilisation of technology (BI as a technology). The knowledge obtained during this process is stored in either a Knowledge Management System (KMS) or a BI system (Negash 2004). Once new knowledge is obtained based on information contained in the BI system the KMS can be updated. The artefacts stored in the KMS can serve as additional input to the BI system. A Knowledge Management System is therefore both a consumer of data as well as a data storage facility providing input to BI systems (data provider). A symbiotic relationship between KMS and BI therefore seems applicable.

2.4.3.3 Business Performance Management or Corporate Performance Management

According to Frolick & Ariyachandra (2006:41), Business Performance Management or Corporate Performance Management (CPM) *"offers organisations an IT-enabled approach to formulate, modify and execute strategy effectively".*

CPM, like BI, had its origins in Decision Support Systems (DSS) (Frolick & Ariyachandra 2006). Similar to BI and CI, CPM and BI are often perceived as the same concept (Popovič *et al.* 2010). However, BI and BI tools support the decision-making process, whilst CPM *"provides a means of combining business strategy and technological structure to direct the entire organization toward accomplishing common organizational objectives"* (Frolick & Ariyachandra 2006:42).

BI and CPM, although related, are two distinctly different concepts. CPM focuses on the processes for tracking organisational performance, whilst BI might assist the CPM process in support of better decision-making during performance tracking. In addition, BI also focuses on technological aspects like technologies (such as applications) and processes for gathering and storing information (using a process of extract, transform and load) to be used by systems such as CPM. In the context of BI, an empirical study conducted by Richards *et al.* (2014) investigates the impact of BI on CPM. The quantitative study highlighted the often symbiotic relationship

between these concepts, i.e. the successful adoption of BI technology contributes to successful CPM interventions.

In conclusion BI, CI, KM, and CPM are different concepts although slightly related. CI focuses outwards towards competitors and is therefore perceived as a subset of BI. KM, on the other hand, focuses on tacit and explicit knowledge created as part of BI and CI interventions. BI is often the enabler for KM and CI interventions. In contrast, CPM focuses on strategy execution by means of performance tracking with the end result often reflected in by BI presentation tools. Figure 5 diagrammatically displays the various concepts in relation to business intelligence.

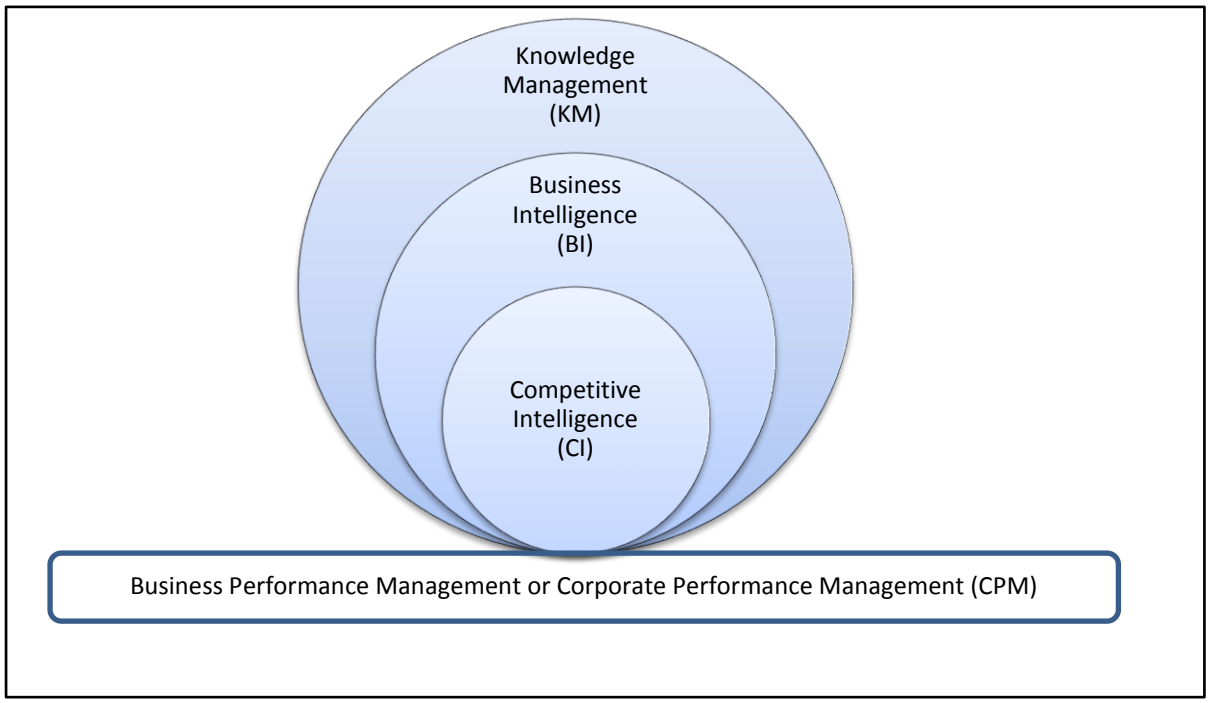


Figure 5 - The relationship between CPM, CI, BI and KM

2.4.4 Context

BI is used in various environments, referring to either the BI processes, products, technologies or a combination of these items (Shollo & Kautz 2010). BI products include data, information, knowledge and decisions. BI processes include the gathering and storing of data, analysis of information, utilisation of knowledge and acting in the decision-making process. Technologies such as data warehouses, OLAP, knowledge management systems and DSS are utilised in the BI environment. According to this definition BI is a *"three dimensional concept"* (Shariat & Hightower 2007; Shollo & Kautz 2010). These three concepts (products, process and

technology) are also referred to as *"the three pillars of the BI concept" (*Shollo & Kautz 2010).

The meaning of BI is influenced by the introduction and implementation of the BI dimension introduced in different parts of the organisation (Gangadharan & Swami 2004; Pirttimäki 2007). For example, departments in which a particular technology (for example a data warehouse) was introduced might perceive a data warehouse as synonymous with BI. In these instances, departments might fail to see the bigger scope of BI and result in various narrow definitions for BI.

An example of how the definition of BI is influenced by the context or scope of the research study is evident in a research paper presented by Tamm, Seddon & Shanks (2013). In their study investigating the various ways (referred to as *"pathways"* in the study) through which business analytics (BA) contribute to business value, they define BI as an extension of BA. BI is perceived as *"IT-based BA tools"* with the ability to perform analytical tasks containing a strong visualisation component (Tamm, Seddon & Shanks 2013:2).

2.4.5 BI as an evolving discipline

Since ancient times, warriors required intelligence regarding enemy lines in order to formalize war strategies (Tzu 1988). Even in war situations today, military intelligence is crucial to surviving conflict situations (Martinsons 1994). Although not known as Business Intelligence *per se*, not much difference exist between Business Intelligence as we know it today and the former formal or informal systems supporting important decision-making (Gilad & Gilad 1986; Kinsinger 2007). Similar to the organisational requirement of intelligence regarding both internal and external organisational strengths, weaknesses, threats and opportunities, the military require exactly the same information from enemies (Martinsons 1994). However, Business Intelligence was informally introduced in 1958, due to the need of scientist and engineers to deal with the growing amount of scientific literature (Luhn 1958; Shollo & Kautz 2010; Tutunea & Rus 2012). Much later, in 1989 / 1990 a Gartner analyst, Dressner, formally introduced the term (Negash & Gray 2003; Tutunea & Rus 2012; Watson & Wixom 2007) in an organisational context due to the perceived link between business information and the potential benefits if exploited by organisations

in the decision-making process (Dekkers, Versendaal & Batenburg 2007; Nylund 1999; Power 2004; Watson 2009). Therefore, some authors believe that the concept of Business Intelligence had its origins in Decision Support Systems (DSS) (Power 2008; Watson 2009) and can be perceived as a sub-discipline of DSS (Arnott & Pervan 2008).

Although some literature indicates the first real construction of a decision support system by Procter & Gamble in 1985 (Nylund 1999), evidence also exists of a doctoral research dissertation by Scott Morton conducted in 1967 (Watson 2009). His research entailed the construction, implementation and testing of a planning support system for laundry equipment.

BI is therefore a young, underdeveloped discipline still in an evolution phase (Negash & Gray 2003; Shollo & Kautz 2010), although not all authors are in agreement (Arnott & Gibson 2005; Gray 2003). Furthermore, because of the evolutionary status of the concept, the implementation and components are influenced by business (Pirttimäki 2007).

2.4.6 Coverage of BI as a discipline

Well-known concepts such as data warehousing and dimension modelling as introduced by Inmon (1996) and Kimball *et al.* (1998) became popular before the concept of BI was extensively published. These concepts made headlines and became synonymous with BI. Software vendors soon followed with the introduction of tools and technologies in support of data warehousing. These were widely advertised and the public associated these tools and technologies with BI (Power 2008). Unfortunately, academics lagged behind and academic material on the topic of BI was limited until almost a decade ago (Shollo & Kautz 2010).

Also, BI consumes information from other sources, such as data warehouses, CRM applications, DSS, EIS, knowledge management and GIS (Negash 2004). The focus is therefore often on these applications supplying data to a secondary system such as BI.

Table 5 provides a summary of the various viewpoints adopted by various authors as discussed above.

Definition	**Author**
BI is a diverse term	Thomsen (2003)
	Negash (2004)
	Zaman (2005)
	Frolick & Ariyachandra (2006)
	O'Brien & Kok (2006)
	Olszak & Ziemba (2006)
	Pirttimäki (2007)
	Bucher *et al.* (2009)
	Cokins (2009)
	Watson (2009)
BI as umbrella or collect term	Alter (2004)
	Power (2004)
	Clark *et al.* (2007)
	Kinsinger (2007)
	Shariat & Hightower (2007)
	Bucher *et al.* (2009)
	Power (2009)
	Venter & Tustin (2009)
	Watson (2009)
	Dinter *et al.* (2011)
	Mohamadina & Harbawi (2012)
Technological broad term	Gangadharan & Swami (2004)
	Popovič *et al.* (2010)
	Kulkarni & Robles-Flores (2013)
Applicable in various contexts	Pirttimäki (2007)
	Shollo & Kautz (2010)
	Tamm, Seddon & Shanks (2013)
BI is a young, evolving discipline	Gray (2003)
	Negash & Gray (2003)
	Arnott & Gibson (2005)
	Dekkers, Versendaal & Batenburg (2007)

Definition	Author
	Shollo & Kautz (2010)
	Tutunea & Rus (2012)
Coverage of BI as a discipline	Shollo & Kautz (2010)

Table 5 - Authors contributing to the BI definition debate (in chronological order)

2.5 BI definition

Various definitions have been published during the past decade either by academic scholars or industry practitioners attempting to describe BI. Some of these definitions are listed below:

Watson (2009:5) defines BI as follows:

"… a broad category of applications, technologies, and process(es) for gathering, storing, accessing, and analysing data to help business users make better decisions".

Similar to the definition adopted by Watson (2009), Power (2004) defines BI as:

"… a set of concepts and methods to improve business decision making using fact-based support systems".

In addition, Williams and Williams (2007:2) state that one should:

"… think of BI as business information and business analyses within the context of key business processes that lead to decisions and actions and that result in improved business performance."

Unfortunately little consensus exists amongst IS academics (Arnott & Pervan 2005; Gibson *et al.* 2004; Popovič *et al.* 2010; Watson 2009) with regard to a general accepted BI definition (the reasons are listed in section 2.4 above). However, when the variations of definitions are evaluated, a number of key elements could be identified. These definitions describe BI as a(n):

a) Application
b) Technology
c) Process

d) Analytical tool

e) Product

f) Decision support

Table 6 provides a summary of the research evaluated.

Author/s	Year	a) Application	b) Technology	c) Process	d) Analytical tool	e) Product	f) Decision support
Ortiz	2002		x			x	
Chamoni & Gluchowski	2004	x	x	x			x
Gangadharan & Swami	2004	x	x		x		x
Negash	2004		x		x		x
Arnott & Gibson	2005			x			x
Chung, Chen & Nunamaker	2005						x
De Voe & Neal	2005						x
English	2005				x		x
Lönnqvist & Pirttimaki	2006			x			x
O'Brien & Kok*	2006	x	x	x	x		x
Olszak & Ziemba	2006		x		x	x	x
Watson *et al.*	2006	x	x	x			x
Williams & Williams	2006				x		x
Zeng *et al.*	2006			x			x
Clark *et al.*	2007		x		x		x
Ko & Abdullaev	2007		x				x
Shariat & Hightower	2007	x	x	x	x		x
Sidahmed	2007		x		x		
Wu, Barash & Bartolini	2007	x	x				x
Abbasi & Chen	2008						x
Lutu & Meyer*	2008	x	x	x	x		x
Power	2008						x
Smith & Crossland*	2008	x					x

Author/s	Year	a) Application	b) Technology	c) Process	d) Analytical tool	e) Product	f) Decision support
Aho	2010			x	x		x
Shollo & Kautz	2010	x	x	x	x		x
Hartley & Seymour*	2011		x			x	
Olbrich *et al.*	2011	x	x	x			x
Ponelis*	2011		x	x	x		x
Al-Eisawi & Lycett	2012		x	x	x	x	x
Cosic, Shanks & Maynard	2012		x	x	x		x
Seddon, Constantinidis & Dod	2012				x		x
Yogev *et al.*	2012						x
Bijker & Hart*	2013			x	x		x
Dawson & Van Belle*	2013		x	x	x		x
Kulkarni & Robles-Flores	2013	x	x	x	x		x
Tamm, Seddon & Shanks[6]	2013				x		
Naderinejad, Tarokh & Poorebrahimi	2014	x	x				x
Oakley *et al.*	2014		x		x		x
Stone & Woodcock	2014		x	x			x
Sidorova & Torres	2014		x	x		x	x

Table 6 - Summary of BI definition (in chronological order)

*Literature published focusing on the South African context are indicated with an asterisk (*)

Each of the concepts is disseminated in the subsequent sections.

[6] The definition presented here by the authors of the paper was influenced by the context of the investigation, i.e. Business Intelligence in relation to Business Analytics.

BI as an application (referred to as (a)) and technology (referred to as (b) in table 6)

Various BI tools and techniques exist in the form of software applications and technologies. Advanced software applications, such as Oracle, Microsoft and Hyperion Intelligence (to mention a few) allow for the movement of data from various source systems, the creation of advanced data warehouse structures or data marts for the storing of data, and the presentation of data by means of operational reports, operational dashboards as well as advanced data mining and analytical capabilities. Williams & Williams (2007) as well as English (2005) explicitly state that BI is not just a single application or technology. Instead, various software applications and technologies should be considered as enablers in BI implementations.

BI as process (gather, store, access) (referred to as (c) in table 6)

The concept of BI often refers to the process of obtaining data from source systems, cleaning and moving it from the source system to a structure for easy retrieval and published for access to consumers (Zeng *et al*. 2006). Once available, end users can then access the data by means of query, reporting or analytical tools. The entire process is often referred to as a process of extract, transform and load (ETL). The extract part refers to the identification and obtaining of information from various systems such as ERP systems. The source data is then evaluated, cleaned and reorganised (or transformed) where necessary and loaded into a data store environment. One example of a data store is a data warehouse. A Data Warehouse is *"… a copy of transaction data specifically structured for query and analysis"* (Kimball *et al.* 1998). The data is accessible from the data warehouse (or the data store) using end user reporting software tools.

BI as analytical tool (referred to as (d) in table 6)

Once the data is available in a database structure, sophisticated tools allow the user to analyse the data in order to explore patterns, trends or relationships. Advanced data mining techniques allow for sophisticated statistical analysis performed by skilled users (Shim *et al.* 2002). The analytical capability is dependent on the underlying structure developed to support complex analysis.

The introduction of the big data analytics concept has created renewed interest in the capability of analytical tools. According to Chen, Chiang & Storey (2012:1166) *"big data and big data analytics have been used to describe the data sets and analytical techniques in applications that are so large (from terabyte to exabyte) and complex (from sensor to social media data) that they require advanced and unique data storage, management, analysis and visualization technologies".* A classification framework has been introduced whereby BI&A (Business Intelligence and Analytics) 1.0 focus on the traditional method of data gathering, extraction and loading into fairly static structures such as data warehouses. The traditional analytical tools are applicable and usable in this structured data environment. BI&A 2.0 focuses on unstructured data obtained from the web due to advancement in web technologies (such as web 2.0). Lastly BI&A 3.0 is the current hype and refers to huge amounts of structured and unstructured data introduced by for example mobile devices and RFID technologies (Chen *et al.* 2012). The traditional analytical tools and technologies may have to deal with enormous real time, unstructured data capacity.

BI as product (referred to as (e) in table 6)

BI as a product is often used in the context of a technical or business environment (Olszak & Ziemba 2006). From a technical perspective, it is often used to refer to software products or technologies with the objective of performing a particular task in the BI technical process. An example is the technical software product used to extract data from various source systems. From a business perspective BI as product refers to the output of the BI process (Shollo & Kautz 2010, Olszak & Ziemba 2006). For example, once data is gathered and stored in a central repository, users can access and analyse the data produce information on which decisions are based to create new knowledge. Both information and knowledge is the product of the BI implementation in this instance.

BI used in the decision support process (referred to as (f) in table 6)

Data can be presented in various formats, for example end user reports, dashboards or three dimensional cube structures. The main objective of these output objects is to supply the right people with the right information at the right time (De Voe & Neal 2005). This will enable decision makers with the correct information in order to make decisions based on historical events or predicting future trends (English 2005).

Human intervention is therefore imperative to the application of BI (English 2005; Hannula & Pirttimäki 2003), as well as the context in which the information is presented (English 2005). Oakley *et al.* (2014) furthermore include the analytical capability of BI solutions enabling insight into making good decisions (often to rectify the current state of affairs).

In summary

Given the vast range of definitions available describing BI as discipline and the increased academic coverage of Business Intelligence as discipline (as described in the section above), formulating a generally accepted definition for BI seems challenging. However, in a study conducted by Shollo & Kautz (2010) the authors present a BI definition containing traces of almost all aspects of the various items identified and discussed above. The definition depicts the multidimensional nature of the concept and seemed applicable for the purpose of this study. According to Shollo & Kautz (2010) BI can be described as:

"… a product, process and technology or a combination of the three concepts in support of organisational decision making".

The concept of BI is diagrammatically displayed in Figure 6. BI products refer to artefacts produced as a result of the process and technology area. For example, data is gathered and stored (process) and analysed to produce information whereafter the user applies knowledge to take a particular action such as making a decision. Technologies supporting both the product and process area include data warehousing, OLAP, knowledge management systems as well as decision support systems (Shollo & Kautz 2010). BI tools will typically be classified as part of the technology section. Although some authors focus on any one or all of the concepts, traces of all three concepts are in a symbiotic relationship. BI as multidimensional construct is depicted in Figure 6.

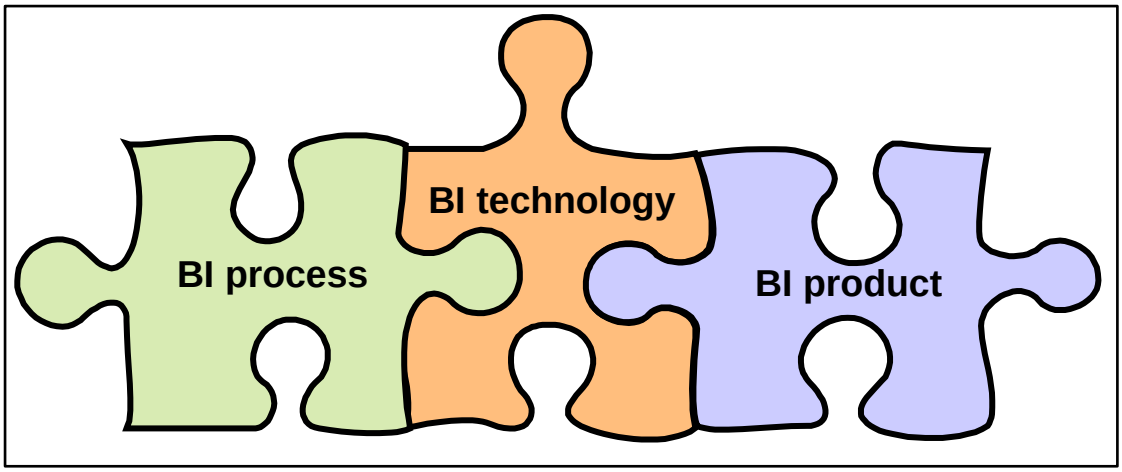


Figure 6 - BI as multidimensional construct

2.6 BI in South Africa

A number of academically peer-review literatures / studies could be found focusing on BI related success or value aspects in the context of South Africa. These include Bijker & Hart (2013), Hartley & Seymour (2011), Lutu & Meyer (2008), O'Brien & Kok (2006), Ponelis (2011), Smith & Crossland (2008), Venter (2005) and Venter & Tustin (2009). Similar to international trends, the authors agree that BI is perceived as a process, technology and product supporting decision making. This is in alignment with Shollo & Kautz's (2010) definition of BI adopted for the purpose of this study. Also, due to the small set of relevant academic contributions, international resources were consulted and the meaning of BI extrapolated from resources outside the South African context (as discussed in the above section).

The research conducted as part of studies focusing on the South African context is discussed as part of the BI business value research section of this document.

2.7 The meaning of business value

Academic scholars use a vast number of notations and semantics in their studies when evaluating business value (Schryen 2010, 2013). This might be due to business value being perceived as a multidimensional concept constituting both social and economic dimensions (Beck 2000). The social dimension involves characteristics which are intangible and sensory, therefore *subjective* in nature. The economic dimension, on the other hand, refers to tangible and economic value characteristics, often the main item measured within organisations (Beck 2000) and

often objective in nature. Both tangible and intangible items are considered as part of the study.

Schryen (2010, 2013) identified various notations and semantics used in academic material referring to the concept of business value. In addition, the meaning of business value depends on a variety of constructs, including the approach used (utilitarian approach or hedonic approach) (Petter, DeLone & McLean 2008); the level of the stakeholder performing the investigation (Schryen 2010, 2013); scope of the study conducted; object of investigation and time of the investigation (Schryen 2010). Also, the classification of benefits as an outcome of studies can be classified according to scope and granularity (Gustafsson *et al.* 2008); as well as the theory applied (Beck 2000). Each of these items therefore needs amplification.

2.7.1 Value in business context

Wiseman (1992) and Melville *et al.* (2004) use terminology such as "*value*", "*worth*", "*outcome*" or "*benefit*" in their investigative study of organisational performance. In addition, value is referred to as the "*economic impact*" or "*a set of impacts*" on organisational performance derived from IT investments (Kohli & Grover 2008; Prasad & Heales 2008). Melville *et al.* (2004:8) offer a more comprehensive definition of IT business value after a literature review of IT business value as: *"the organizational performance impacts of information technology at both the intermediate process level and the organizational-wide level, and compromising both efficiency impacts and competitive impacts".* Efficiency in this context refers to *"doing things right"*, i.e. therefore <u>internal</u> perspectives such as cost reduction metrics (Melville *et al.* 2004). Effectiveness on the other hand is *"doing the right things"* therefore facing outwards to an <u>external</u> environment such as actions taken to achieve competitive advantage (Melville *et al.* 2004). This is similar to the locus of business value (internal or external) as used by the study by Melville *et al.* (2004).

Economic impact is substantiated by means of performance improvement, which can be described as the positive or negative impact on either financial or non-financial business areas (Faupel, Strueker & Gille 2008). The impact is measured by means of an assessment on organisational performance (Melville *et al.* 2004).

2.7.2 Perception of value

The evaluator of business value is not a passive observer of business value but an active participant within the organisations with which they interact. The outcome and subsequent perceived performance improvement as well as the impact of information value are therefore dependent on the background of the evaluator (Brackett 1999). The background and experience of the evaluator constitutes the evaluator's frame of reference.

Perceived value is not static over time (Schryen 2010). As evidently indicated by Heraclitus postulating a realist philosophical view, one cannot step into the same river twice (Bakalis 2005). The implication is that the exact same conditions in organisations cannot be replicated when business value is evaluated. Also individuals' perceptions of the same situation might vary depending on the condition and time of the measurement. Business value results might therefore differ from the one measurement effort to the next.

Another challenge when defining value is to identify and describe what 'reality' or the state of 'things' are as they actually exist at a particular point in time (Barad 2007). The business value is often contained in the perception of reality. Only if the 'reality' can be identified and demarcated, can we determine what the value is.

The juxtaposition of the item measured with regard to the business value also influences the perception of value created. The implication is that the closer the measurement to the strategic objective of an organisation, the more difficult it becomes to measure and the bigger the impact of the measurement on organisational performance (Watson *et al.* 2006).

2.7.3 Scope of the study

The scope of the study influences the perceived business value of an IT investment. Gustafsson (2007) investigated the value derived from IT investments through the evaluation of the impact on the structure of organisations. According to the study, the value of IT investments are realized and therefore measured through the organisational impact. Thus, the bigger the scope of the project, the more business areas are impacted. Also, in some instances, studies distinguish between process-

level investigations and enterprise-wide studies (Barua *et al.* 2010; Meville *et al*. 2004).

2.7.4 Context of the study

Value, and in particular the value of information, is only visible in a particular environment or context (McNurlin, Sprague & Bui 2009). The value of this information is only fully visible when a particular price tag is attached to it. For example, data about consumer spending behaviour might only be valuable when another party is willing to invest money in order to obtain such a data set. Value, and the perception thereof, depends on the value of information to consumers and suppliers. Value is therefore a subjective concept. Clark *et al.* (2007) support this view and add that there is a gap between actual benefits and perceived benefits.

2.7.5 Level of analysis

The economic impact of Information Systems (IS) is often evaluated considering the impact on the individual, firm, industry or economy (Bakos 1987; Chau, Kuan & Liang 2007; Devaraj & Kohli 2000; Kauffman & Weill 1989), measured in terms of increased productivity (Brynjolfsson & Yang 1996). IS might contribute to increased individual productivity, whilst this might contribute to the overall firm, industry and economic performance. However, the investigation approach for each one of the levels might differ substantially. For the purpose of the study, the impact on firm (or organisational) level is considered.

Also the various levels within the organisation should be considered when performing value analysis studies, including operational, tactical or strategic levels. Benefits on an operational level are normally tangible, therefore measureable and often financial, whilst benefits on higher organisational levels are often intangible (Irani & Love 2001). Due to the approach used during this study (balanced scorecard strategy map), both tangible and intangible items will be identified across the various levels of the organisation.

2.7.6 Time of investigation

The time when the investigation is conducted is of vital performance to the outcome of the study. Investigations can be conducted before the occurrence (also known as

‘ex-ante’), during, or after (also known as ‘ex-post’) implementations (Kohli & Grover 2008). The results of value investigations might vary substantially depending on when the investigation is conducted. For example, planned value will be calculated before the occurrence of an event, whilst earned value will be calculated during or after an event.

The purpose of this study, an ex-post investigation will be conducted on completed BI projects.

2.7.7 Measurement tool

The measurement tool used to measure business value might have an influence on the outcome of the item measured. In instances where there is an in-depth focus placed on an item under investigation with increased precision, the precision of which we measure another item will be sacrificed. Therefore, when the foci of a study are placed on tangible benefits, intangible benefits might suffer as a result. Also, the apparatus or tool used will affect the outcome of the measurable. Measurement tools developed to identify and measure tangible outcomes might therefore miss intangible benefits. The outcome, therefore, might also be led by the apparatus used.

2.7.8 Value dimensions

Mooney *et al.* (1995) has identified three dimensions or effects in their study investigating how IT creates and delivers value. These include ‘automational’, informational and transformational effects. Through the investigation of these effects, value can be identified. For example, ‘automational’ effects are those impact items created as a result of automating or industrializing a particular task or process such as the introduction of a production line. Informational effects are those effects procured as a result of available information. For example, the availability of timely, correct information will lead to improved decision-making and decision-making quality. Transformational effects are those effects IT has on the *“process innovation and transformation”* (Mooney *et al.* 1995:21). As a result of these transformations, the organisation can, for example, restructure departments to be more effective.

This study considers all of the above value dimensions.

2.7.9 Theory used

According to numerous authors (Beck 2000; Markus & Robey 1988; Paré *et al.* 2008; Sircar, Turnobox & Bordoloi 1998; Soh & Markus 1995), two theories can be applied when investigating the value of IT. The variance approaches investigate what the relationship between IT investments and organisational performance is. The process approach investigates how this relationship works. The various authors normally favour one of the two approaches, of which the variance approach is the more popular one. This proposed study will focus on the variance approach.

2.7.10 Success versus value

Although success and value are not synonyms *per se*, success might indicate some degree of value achieved. However, value (although in small quantities) might be achieved without success. In the context of BI, Shollo & Kautz (2010) describes BI success as the positive benefits obtained as a result of the implementation. However, organisations' and stakeholders' definitions of success depend on the anticipated benefits.

The focus in terms of BI has been strong on the achievement of success and not necessarily value. This is evident when the vast number of academically published publications is evaluated postulating success models and critical success factors for BI implementations. These publications are described in more detail in the section focusing on BI success models (section 8.2.4).

2.7.11 Value taxonomy

Schryen (2010) developed a taxonomy for classifying IS business value research after an extensive literature review of academically published research. The proposed constructs were revised and published in 2013. The main objective of the taxonomy was to identify the key research areas in IS business value research attempts and to identify gaps, if applicable, for future research purposes. Also, one of the objectives included the investigation of *"what literature reviews have done to preserve knowledge"* (Schryen 2010:234). It is not clear, however, how the taxonomy caters for research studies investigating more than one dimension at a time. It is important to consider this taxonomy, as it underwrites the multidimensionality of value as a concept.

The proposed taxonomy is graphically depicted using a three dimensional-like structure classifying and categorizing IS related research pertaining to the business value in organisations. At the bottom end of the structure, performance measurements are identified depicting the various economic measurements investigated by researchers, including productivity, market performance, accounting performance and intangible benefits. The *productivity* category classified research evaluating the effect of IS investments on the productivity of organisations. The *market performance* category refers to studies investigating the degree to which Information Systems impact the market performance of organisations. The majority and most researched category depicted by the model refers to econometric *accounting performance* measurements such as financial ratios, including cost ratios, turnover ratios and profit ratios (such as Return on Investment or ROI). *Intangible benefits* refer to the investigation of increased decision-making, knowledge management and competitive advantage due to IS investments.

Various IS research endeavours investigating the economic impact or value of IT were pitched at a particular level, including the impact on firms, macro-economic and country level or the external enterprise environment analysing consumer surplus. The level of the focus on research is particularly important as the explanation of the productivity paradox can vary substantially (Brynjolfsson 1993; Dehning & Richardson 2002). Also the linkage between the various levels can explain how IS contributes to the value of the level (DeLone & McLean 1992; Kohli & Grover 2008).

One of the sections in the taxonomy refers to the type of IS asset under investigation. This section considers studies investigating the effect of the implementation of assets on the business performance and subsequent improved business value in organisations. For example, the effect of knowledge management systems on the decision-making process and the value created as a result is investigated.

Numerous performance measurement methods or appraisal techniques are used when value is evaluated. These methods refer to analysis of the value by means of calculations such as cost-benefit analysis, value analysis and critical success factors.

Various factors, not directly related to technology, can influence the benefits and subsequent business value of IS implementations. In his research, Schryen (2010) identified factors such as contextual factors also known as ‘economic structures’, lag effects and risks as major contributing factors.

There is a direct correlation between contextual factors such as firm, industry and economic factors and business value of implementations. On firm level, the organisation’s Information Systems should support organisational core capabilities and strategic planning; whilst the top management structure should also be involved in Information Systems investments.

Often, benefits derived from IS investments are ignored due to the inability of the methodology to account for ‘after the fact’ benefits.

IS implementations are risky due to futuristic uncertainties and possibly due to the huge financial investment requirements. Also, the implementations therefore contribute to the overall risk of the organisations (Dewan, Shi & Gurbaxani 2007).

Apart from the fact that the measurement of value related to IS implementations are often questioned, some researchers argue that the value is dependent on how the newly generated capabilities are utilised (Alshawi, Irani & Baldwin 2003), the benefits or values derived in relation to the achievements of competitors (Dehning & Richardson 2003) and influenced by the idiosyncratic inclinations of the evaluator (Sylla & Wen 2002).

Furthermore, Schryen (2010) acknowledges the influence of decision theory and utility theory on the concept of value. Decision theory refers to all aspects to be considered when making a relational decision, whilst utility theory refers to value perceived by means of the willingness of stakeholders to invest financial assets into a particular investment.

Table 7 contains a summary of the synonyms, characteristics and theory of value.

Synonyms	worth, outcome, benefit, economic impact
Characteristics	subjective
	tangible (measurable)
	intangible (not measurable)

	Influenced by:
	• individual perception of value • scope or context of the study • level of analysis • time of the business value investigation • the measurement tool • dimension
Theory	• variance • process

Table 7 - Characteristics of value

2.7.12 Philosophical view of value

Stark (2011) evaluates the concept of value and the worth of items from a different viewpoint. The worth of items, both on personal and organisational level, can lead to uncertainty if the method for discovering the worth is not disclosed. Despite the general trend to discourage or ignore this uncertainty, Stark (2011) argues that one should harness the benefits introduced as a result of this. Furthermore, this uncertainty might introduce new opportunities for inventive analysis.

2.7.13 Conclusion

In conclusion, despite all the various dimensions of value, the focus of this study is on BI value. Given the various definitions and interpretations of both value and Business Intelligence, value, in this instance is perceived as the (positive) contribution of BI technologies, products and processes to the overall positive status of the organisation.

Figure 7 graphically depicts the perspective (for the purpose of this thesis) that maximum business value can only be achieved where traces of all of the BI elements (technologies, products and processes) have been (correctly) implemented. This view is also supported by O'Brien & Kok (2006).

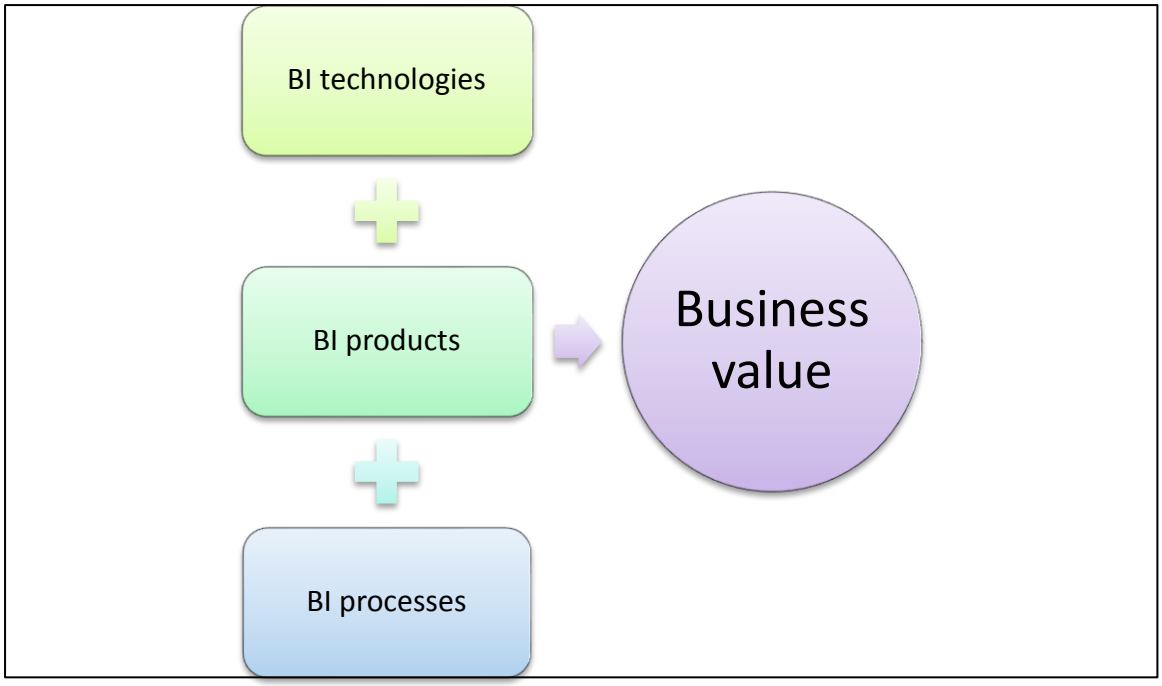


Figure 7 - BI value

2.8 BI business value research

Due to numerous researchers investigating the value of IT related implementations many models, frameworks and methodologies that prove the wealth of implementations have seen the light. Some of these results have been empirically verified through extensive testing, whilst some remain conceptual, based on theoretically founded theories without extensive testing. However, all these studies strive towards achieving the same objective – to prove the business value to organisations as a result of the appropriate investment. A similar scenario is evident in the BI research area.

BI value literature can be broadly classified into two categories. The first category reused existing IT value models, frameworks and methodologies applied to a BI environment (Schieder & Gluchowski 2011). The second category developed bespoke models specifically tailored for the BI environment (Wixom & Watson 2001; Yeoh & Koronos 2010). Both categories were considered as the focus of the studies that was used as the main classification method.

BI value research evaluated could be classified according to the focus area of the research. Whilst some research focuses on the preconditions necessary for the

achievement of maximum business value, others focus on process maturity and the organisational maturity, process or organisational readiness and success models. Only in instances where the identified conditions exist could BI business benefits be expected.

Another focus area evaluates BI value on organisational level, process level and the subsequent interrelationships. It is postulated that the value realized on process level will have a direct impact on the organisational level as well as the interrelationship between process and organisational level capabilities.

Critical success factors (CSFs) as well as project success failure is classified as the last focus area of BI value research. These critical success factors should be tracked in order to realize business value. Also, project success studies explore the reason for project success or failure and subsequent benefits. This section might also contain organisational or process level investigations. CSFs and the relationship to KPIs are discussed in more detail in chapter five).

Each of the above-mentioned focus areas are diagrammatically depicted in figure 8 and further described in the subsequent sections. These areas form the basis of a proposed framework for BI value research.

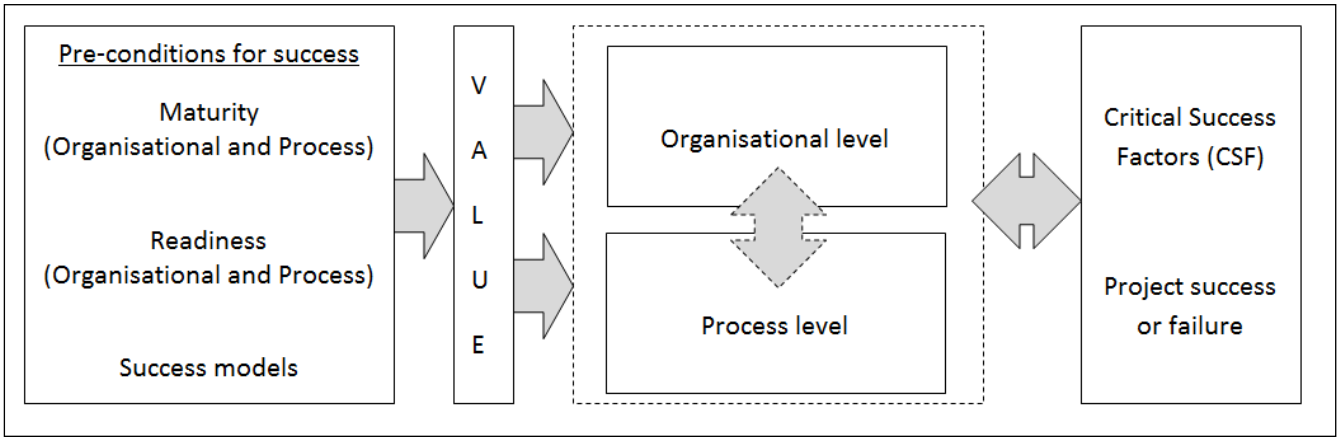


Figure 8 - A framework of BI value research

2.8.1 Preconditions for realized value

Numerous studies focus on the pre-conditions required to realize BI value as a result of implementations. Some studies focus on organisational and/or process level maturity, the readiness of an organisation and/or processes for a BI implementation

or contributing factors of project success. These studies postulate that for an organisation to maximize benefits of BI implementations, a particular maturity level, readiness level or conditions for success should be present.

Similar to the main challenge when defining BI, studies investigating the maturity and/or readiness for BI implementations focus on individual aspects of BI as a discipline, namely technology (Kimball *et al.* 2008; Watson, Ariyachandra & Matyska 2011), process or product (Dinter 2012) of which technology (data warehousing) is more prevalent. Although valuable to organisations a complete maturity or readiness model should focus on all aspects of BI.

2.8.2 BI maturity models

Maturity models assist organisations in identifying the maturity of the organisation on either process or organisational level. The approach proposes an analysis to identify the current maturity level of the organisation. The current level is then compared to a future desirable maturity level. Subsequent activities are identified to proceed to the next level within the maturity model to achieve the corresponding benefits of the succeeding level (Dinter 2012). The objective of a maturity model is twofold. Firstly, the focus is on the improvement of corporate data management (Hawking 2011). Secondly, gaps in the current implementation can be identified when benchmarked against the next desirable maturity level. A higher level in the maturity model implies more benefits (Eckerson 2007; Watson *et al.* 2011).

A number of maturity models were identified in the course of the literature review process. Whilst some models focused on the maturity of BI (Dinter 2012; Eckerson 2007; Hawking 2011; Lahrmann *et al.* 2010; Raber, Wortmann & Winter 2013; Shaban *et al.* 2011; Tan, Sim & Yeoh 2011), others focused on data warehouse maturity (Watson *et al.* 2011). On the other hand, some authors recently started focusing on maturity as one of the dimensions (along with information content and access quality, decision-making culture and utilisation of information in business processes) contributing to BI project implementation success (Popovič *et al.* 2012).

A more holistic approach specifically considering maturity for a Business Intelligence System (and not just the status of BI in general) suggested that small and medium-

sized organisations should use the proposed model to assess the BI project in order to make adjustments (Fedouaki, Okar & Alami 2013).

One of the recent trends is to use the term of ‘business analytics’ to include all the relevant technologies pertaining to business intelligence (such as ‘big data’ for example) in BI related research on general. In the particular instance of maturity models, Cosic, Shanks & Maynard (2012) postulate a maturity model for business analytics, namely Business Analytics Capability Maturity Model (BACMM).

There are many advantages of using BI maturity models in organisations. These models prescribe a structured approach to introducing or enhancing the current or new BI capability within organisations, contributing to the realization of maximum business value. Also, the existence of certain characteristics (pertaining to a particular maturity level), can contribute to the predictability of the success of a BI implementation.

Dinter (2012), on the contrary, identifies a number of disadvantages of maturity models. The vast number of maturity models available might pose a challenge to users in the selection of the appropriate model. Also, the research development methods of these models are not always disclosed, so that the validity and reliability of the instrument is questioned. As a result, these models are not always empirically tested. Maturity models focus on sub-sections of BI such as data warehousing or data quality, similar to perspectives of the proposed BI framework in this paper (namely readiness assessments). The applicability to BI of holistic implementation might be questionable. The various lower levels of maturity models are not always disclosed, making it challenging when implementing these models. Finally, maturity models include a subjective component containing an element of individual preference.

2.8.3 BI readiness assessments

Readiness assessments investigate the organisations’ inclination for achieving success prior to a BI implementation. It is a business centric assessment and includes investigations into certain organisational, process and technical level characteristics to establish readiness (Williams & Williams 2007). The main objective of a readiness assessment is to minimize risk when implementing a BI solution. One

such example is the assessment of the organisation's ability to provide BI systems with data. The lack of data will increase the risk of project failure.

Advantages of using readiness assessments focus on the period prior to BI implementations. If the susceptibility of the organisation towards the BI implementation can be established, corrective action can be implemented, therefore mitigating the risk of project failure. In addition, if the ideal incubation period is established prior to the BI implementation, the implementation should be uneventful. Unfortunately, these readiness assessments are often created focusing on the sub-components of BI such as data warehouses (Kimball *et al.* 2008; Williams & Williams 2007).

2.8.4 BI success models

In the context of BI, Shollo & Kautz (2010) as well as Isik (2010) describe BI success as positive benefits obtained as a result of implementation (Shollo & Kautz 2010). The organisation's and subsequent stakeholders' definitions of success depend on the anticipated benefits.

The application of success models in the context of BI varies substantially, depending on the objective of the method used. Some success models aim to understand the elements affecting or contributing to successful implementations including critical success factors (CSF) (Adamala & Cidrin 2011; Fedouaki, Okar & Alami 2013; Hawking & Sellitto 2010; Mungree *et al.* 2013; Naderinejad, Tarokh & Poorebrahimi 2014; Olbrich, Poeppelbuss & Niehaves 2011; Sangar & Iahad 2013).

On the other hand, some studies focus on understanding, assessing and scrutinizing the success of BI implementations either by using instruments (Schieder & Gluchowski 2011) or BI success models (Kulkarni & Robles-Flores 2013; Yeoh & Koronios 2010). Some studies include the influence of contextual factors on the success of BI implementations (Elbashir *et al.* 2008) such as BI capabilities (Isik 2009). Data warehouse success has also been a topic of investigation by authors such as Hwang & Xu (2008), Shin (2003) and Wixom & Watson (2001).

The majority of the studies utilised the adoption of the empirically tested DeLone and McLean success model or used this model as basis for proposing new models. This

model has been evaluated, tested and extended to include the evaluation of BI interventions. Authors following this approach include AlMabhouh & Ahmad (2010), Dinter *et al.* (2011), Hartono, Santhanam & Holsapple (2007), Kulkarni & Robles-Flores (2013), Nelson, Todd & Wixom (2005), Schieder & Gluchowski (2011), Shin (2003) and Tona *et al.* (2012).

The advantage of using success models is obvious. The early identification of characteristics necessary for the successful BI implementation can minimize project failure risk. Unfortunately, similar to maturity models, success models might be subjective, containing an element of individual preference. Also, some of the models proposed focus on sub-components of BI such as data warehousing (Kulkarni & Robles-Flores 2013; Shin 2003).

2.8.5 Value investigations at the organisational level of analysis

Studies focusing on the organisational level of analysis assess the organisational impact of IT on organisational performance (Gustafsson *et al.* 2008). The bigger the positive impact the more business value is realized. In the context of BI, Chasalow (2009) supported the same view, focusing on identifying both individual and organisational competencies necessary to realize benefits of BI implementations. These competencies should be embedded in Business Intelligence Systems (BIS) in order to maximize business value (Grublješič & Jacklič 2013).

In an attempt to ensure the realisation of BI benefits, Miller (2010) proposes a six sigma approach as part of the BI project management process. The six sigma approach is a methodology focusing on the quality of outputs. The approach is typically applied by organisations striving towards a zero defect deviation of products. In the application proposed by Miller (2010), the author proposes certain objectives (or so-called *"Critical to Quality"* (CTQ) goals) to be achieved, for example quality of data. These are similar to organisational wide critical success factors (CSFs). If these factors are positive, project benefits will be realized.

The stakeholder theory is applied by Simmons (2004) to their BI value investigation. The focus of the study is on the so-called new-form organisation with its unique characteristics. The approach includes a unique value creation objective identified

across all organisational boundaries. These objectives can be monitored and assessed in performance management investigations.

This approach has several advantages. Firstly, it might be easier for the evaluator to relate the benefits or value identified on this level to the overall organisational goals. Secondly, a broader view of benefits might be necessary to identify the impact on organisational decision-making and competitive advantage. This is supported by a study by Isik, Jones & Sidorova (2013) in a study investigating the influence of a decision-making environment on the capabilities that influence BI success.

2.8.6 Value investigations at the process level of analysis

Various studies pertaining to IT value investigations focus on the value of investments generated on process level, also known as the process approach (Byrd & Davidson 2006; Silvius 2006; Soh & Markus 1995). Process theory, in general, investigates 'how' the value occurs by means of inputs resulting in desirable outcomes and the interrelationships between these constructs (Soh & Markus 1995). This approach is also used by Yogev *et al*. (2012) to investigate the value of BI to organisations.

Subsequently in the context of BI, Smith & Crossland (2008) argue that an investigation on business process level is necessary to understand the business value created on organisational level. The study uses a customized model based on the process model by Soh & Markus (1995) as well as Marshall, McKay & Prananto (2004). The finding is that business benefits are realized on various activities across all the processes but that they are challenging to measure due to the indirect and delayed onset of benefits. On the contrary, the impact of BI implementations is usually more visible on process level. These individual process level benefits contribute directly to the overall organisational level performance.

Unfortunately, this approach requires that the evaluator have a thorough understanding of the various organisational processes.

2.8.7 Value at the organisational and process level of analysis interrelationships

Whilst some authors argue that an investigation on business process level is necessary to understand the IT business value realized on organizational level (Davern & Kauffman 2000; Melville *et al*. 2004), other authors focus on understanding the relationship between the two constructs (Elbashir *et al*. 2008). The focus of these studies is the mutual affiliation rather than the business value outcome.

There seems to be a (positive) correlation between business process performance and organizational performance. However, the strength of the correlation varies between various industries (Elbashir *et al.* 2008). Therefore, context should be considered when designing performance management measurement systems for the purpose of value realization.

In a study conducted by Arnott & Gibson (2005) the Content, Context, and Process (CCP) framework Symons (1991) is utilized to analyse the effectiveness of an existing evaluation process. The study finds that traditional financial measurements are too narrow and that the evaluation technique should include content, process and context.

Seddon & Constantinidis (2012) investigate the various factors impacting on organisational benefits as a result of business analytics and business intelligence usage. They use components of existing process and variance models[7] to investigate the perceived business value. Based on their findings they propose a new model to assist in the identification of value, namely "Business-Analytics Success Model" (BASM).

This approach allows for a holistic approach to the identification of the value of BI implementations both on strategic and operational level. Unfortunately, this approach can be complex to implement.

[7] As described in section 2.7.9 in this document: the variance approaches investigate what the relationship between IT investments and organisational performance is, whilst the process approach investigates how this relationship works.

A summary of the BI value models, frameworks, tools and techniques used as basis for the framework is given in Table 8 that is followed by a summary of the advantages and disadvantages of each of the focus areas (in Table 9).

Classification	Contribution	Author/s
Preconditions for value or success:		
Maturity models (BIMM)	Data warehouse process maturity	Sen, Sinha & Ramamurthy (2006)
	BI Maturity Model	Eckerson (2007)
	Theoretical BI maturity model	Lahrmann *et al.* (2010)
	Americas SAP User Group (ASUG) BI maturity model	Hawking (2011)
	Service-Oriented Business Intelligence Maturity Model (SOBIMM)	Shaban *et al.* (2011)
	Enterprise Business Intelligence Maturity (EBIM)	Tan *et al.* (2011)
	Data warehousing stages of growth	Watson *et al*. (2011)
	Business Analytics[8] Capability Maturity Model (BACMM)	Cosic, Shanks & Maynard (2012)
	BI Maturity Model (biMM)	Dinter (2012)
	Maturity as one of the dimensional attributes to BI success	Popovič *et al.* (2012)
	Maturity model for a Business Intelligence System project	Fedouaki, Okar & Alami (2013)
	Business Intelligence Maturity Model (BI MM)	Raber *et al.* (2013)
Readiness assessments	Method for BI readiness assessment	Williams & Williams (2007)
	Success factors indicating readiness	Kimball *et al.* (2008)
Success models	Instrument for understanding, evaluating and analysing success of BI solutions	Schieder & Gluchowski (2011)
	Data warehouse success model	Williams & Williams (2007)

[8] The authors define Business Analytics as an umbrella term that includes both Decision Support Systems and Business Intelligence.

Classification	Contribution	Author/s
	Critical success factors	Hawking & Sellitto (2010)
		Olbrich *et al.* (2011)
		Ponelis (2011)*
		Dawson & Van Belle (2013)*
		Fedouaki, Okar & Alami (2013)
		Mungree *et al.* (2013)
		Sangar & Iahad (2013)
		Naderinejad, Tarokh & Poorebrahimi (2014)
	BI success model	Kulkarni & Robles-flores (2013)
	Capability assessment framework	Isik (2009)
	Framework for CSF	Adamala & Cidrin (2011)
	Model for BI success	Yeoh & Koronios (2010)
	System success factors in DW	Shin (2003)
	Structural model of DW success	Hwang & Xu (2008)
	DeLone and McLean's success model tested in BI environment	Tona *et al.* (2012)
	New dimensions proposed to DeLone and McLean's success model (2003)	AlMabhouh & Ahmad (2010)
	Success predecessors for Management Support Systems (MSS) implementations	Hartono *et al.* (2007)
	Quality construct success predictions for data warehouses	Nelson *et al.* (2005)
	BI success model	Dinter *et al*. (2011)
Organisational level:		
Six sigma approach		Miller (2010)
Model of organizational competencies for BI success		Chasalow (2009)
Stakeholder model of BI		Simmons (2004)
Success in BI-based organisations		Olszak (2012)
Success factors in BI systems		Grublješič & Jaklič

Classification	Contribution	Author/s
		(2013)
Assessment framework		Sidahmed (2007)
Influence of decision-making environment on capabilities to influence BI success		Isik *et al.* (2013)
Factors promoting implementation of pervasive BI as a construct of maximizing value		Bijker & Hart (2013)*
Factors to successful adoption of BI		Lutu & Meyer (2008)*
Framework for identification of adoption rate factors		Hartley & Seymour (2011)
Qualitative and quantitative empirical study into the benefits of BI		O'Brien & Kok (2006)
Process level:		
Business value process model		Smith & Crossland (2008)
Process oriented research approach for investigating value		Yogev *et al.* (2012)
Process and variance model		Seddon *et al*. (2012)
Both process and organisational level and interrelationships:		
Theory of content, context and process (CCP) for BI (based on Smith and Crossland, 2008)		Arnott & Gibson (2005)
BI value measure instrument		Elbashir *et al.* (2008)
Business-Analytics Success Model (BASM)		Seddon & Constantinidis (2012)

Table 8 - Summary of BI value models, frameworks, tools and techniques

*Literature published focusing on the South African context indicated with an asterisk (*)

Preconditions for value or success:

Maturity models (BIMM)

Advantage(s)	Disadvantage(s)
Structured approach to introducing or enhancing the current or new BI capability can contribute to the creation of maximum business value.	There are many maturity models available and it might be challenging selecting the appropriate model.
The existence of certain characteristics	Some maturity models focus on sub-sections

Advantage(s)	Disadvantage(s)
(indicate a particular maturity level) can contribute to the predictability of the success of the BI implementation.	of BI such as data warehousing or data quality (Dinter 2012).
	The research development method of some of the models is not always disclosed (Dinter 2012).
	The various lower levels of maturity models are not always disclosed making it challenging to implement (Dinter 2012).
	Not all maturity models proposed are empirically tested (Dinter 2012).
	Maturity models include a subjective component containing an element of individual preference (Dinter 2012).

Readiness assessments:

The susceptibility of organisations towards the implementation of BI can minimize risk for failure.	Often focus on sub-components of BI such as data warehousing (Williams & Williams 2007).
If the correct incubation environment exists for BI implementations, the contributed value should be more (Williams & Williams 2007).	

Success models:

Early identification of characteristics necessary for successful implementation of BI can minimize project failure risk.	Similar to maturity models, success models might be subjective, containing an element of individual preference.
	Some success models focus on sub-components of BI such as data warehousing (Kulkarni & Robles-Flores 2013; Shin 2003).

Organisational level:

It might be easier to relate the benefits or value on this level to the overall strategic	

Advantage(s)	Disadvantage(s)
goals.	
A broader view of the benefits of BI implementations might be necessary to identify the impact on organisational decision-making and competitive advantage.	

Process level:

The impact of BI implementations is usually more visible on process level.	Business process improvement interventions should commence prior to a BI implementation to ensure maximum value.
The value experienced as a result of BI implementations on process level contributes directly to the overall organization level.	Individual processes should be well understood and documented for this approach to be successful.

Both process and organisational level and interrelationships:

This approach allows for a holistic approach to the identification of the value of BI implementations both on strategic and operational level.	This approach can be complex.

Table 9 - Advantages and disadvantages of BI framework focus areas

2.9 BI value research in South Africa

Business Intelligence studies in the context of a developing country such as South Africa seems to have been neglected. Although the number of articles increased post 2010 (five in comparison to three prior to 2010), the number of articles obtained is not nearly as many as in the developed or European counterparts.

The majority of authors evaluating BI in the South African context agree that BI is an enabler of decision-making (Bijker & Hart 2013; Dawson & Van Belle 2013; Lutu & Meyer 2008; O'Brien & Kok 2006; Ponelis 2011). Also, there seems to be agreement that BI is a multidimensional construct including BI as technology, process and analytical tool (Bijker & Hart 2013; Dawson & Van Belle 2013; Lutu & Meyer 2008;

O'Brien & Kok 2006; Ponelis 2011). Some authors, however, did not include BI as application in their understanding of BI (Bijker & Hart 2013; Dawson & Van Belle 2013; Hartley & Seymour 2011; Ponelis 2011).

Although the investigations obtained in a South African context focuses on BI, the studies are clearly demarcated, focusing on particular domains (Strategic Intelligence as opposed to BI), sectors and public or private enterprises. A summary of the research papers and demarcation filters are contained in the table below (Table 10). For example, Ponelis (2011) focuses on small, medium and micro-enterprises (SMMEs) where enterprises are knowledge-based. Pellissier & Kruger (2011) focus on a subset of BI namely Strategic Intelligence (SI). The former research is not included in the table containing a summary of the BI value models, frameworks, tools and techniques (Table 8) as there is a lack of general consensus amongst scholars on the generalizability of SI in the context of BI. For example, Dawson & Van Belle (2013) see competitor intelligence (CI), customer intelligence, product intelligence and others as included in the broader concept of BI. The question remains what the meaning of 'others' includes.

Reference	**Domain**	**Sector**	**Private / Public**	**Evaluation**
O'Brien & Kok (2006)	BI	Telecommunications	Private	Empirical
Lutu & Meyer (2008)	BI	Education	Public	Exploratory case study
Smith & Crossland (2008)	BI	Financial services	Private	Empirical case study
Bijker & Hart (2011)	BI	Various	Not disclosed	Exploratory
Hartley & Seymour (2011)	BI	Government	Public	Survey
Pellissier & Kruger (2011)	SI*	Long-term insurance	Private	Empirical
Ponelis (2011)	BI	Knowledge-based small, medium and micro-enterprises	Private	Exploratory

Reference	Domain	Sector	Private / Public	Evaluation
		(SMMEs)		
Dawson & Van Belle (2013)	BI	Financial services	Private	Delphi-technique

Table 10 - Summary of BI research focusing on the South African context (in chronological order)

*Strategic Intelligence

2.10 Challenges and limitations

The term BI is an encapsulating term that refers to many aspects of BI products, processes and technologies. This study focuses on all these aspects, contributing to an extremely wide scope. Perhaps the scope should be contained by focusing on only one aspect of BI, for example data warehousing.

On the other hand, various studies focus on a particular aspect of BI (for example processes) without considering all aspects. The question remains if the findings of research studies with such a narrow scope are generalizable to the entire scope of BI.

The objective of the chapter, as part of the bigger research agenda, presents a provisional framework of current research (completed or work-in-progress). The result was a broad classification method based on recent academic articles. Although it might appear as if the first version of this framework is merely a list of bibliographies, it serves as a starting point for a proper classification framework. The suggested framework is work-in-progress, and the various perspectives identified as part of this framework would have to be critically compared in future work in order to increase the usability and value of the proposed framework. This, together with the additional dimensionality of the various versions of BI&A (1.0 to 3.0) might be used to compare the various approaches used according to the focus areas identified. All these might be considered in subsequent research papers.

The number of BI academic published material is on the increase and the latest material would have to be considered to get a true indication of the status of BI value

research. Therefore, the challenge remains to obtain the latest, up to date academically published material and to agree to a particular cut-off point.

Future research opportunities identified after this chapter is that the current literature review scope can be enlarged to perhaps include other BI&A specific resources as identified in a paper by Chen *et al.* (2012).

2.11 Chapter conclusion

The chapter started with an investigation into the meaning of key terms such as Business Intelligence and business value. The ambiguous nature of both terms was highlighted and a general definition for the purpose of this study was proposed. For the purpose of this study, the BI definition as proposed by Shollo & Kautz (2010) was adopted. According to this definition, BI is a multidimensional construct consisting of products, processes and technologies (or a combination of the three concepts) in support of organisational decision-making. Business value, in this instance, is perceived as the (positive) contribution of BI technologies, products and processes to the overall positive status of the organisation.

The main objective of this chapter was to investigate the extent to which BI value has been researched in order to present a summarized consolidated view. After an extensive literature review focusing on existing academic research pertaining to BI value research, various research results were combined and presented in a framework format. Although similar work has been done by Schryen (2010) (with an updated version published in 2013) focusing on IT value research, little evidence could be found of a similar framework focusing on BI. Furthermore, the framework classified, categorized and synthesized academic literature focusing on the topic of BI value over the last decade. This was similar to an approach used by Boell *et al*. (2013) on the topic of telework. Therefore, this chapter makes a contribution by a diagrammatical presentation of an overview of BI value literature.

The framework identifies the extent to which BI value has been researched as well as gaps with a view to future research. Firstly, there seems to be a need to investigate mobile BI (also known as BI&A 3.0) as well as BI applicable to social media which is currently in its infancy. Secondly, the investigation highlights the lack of published academic material focusing on the evaluation of the organisational level

of analysis, followed by the process level of analysis and the interrelationships between these two levels. It seems as if the focus is on investigations of pre-conditions of success, such as maturity models, readiness assessments and success models.

A possible explanation for the lack of organisational level focus might be attributed to the assessment of the net value of both tangible and intangible benefits of BI implementations without considering lower level (process level) characteristics.

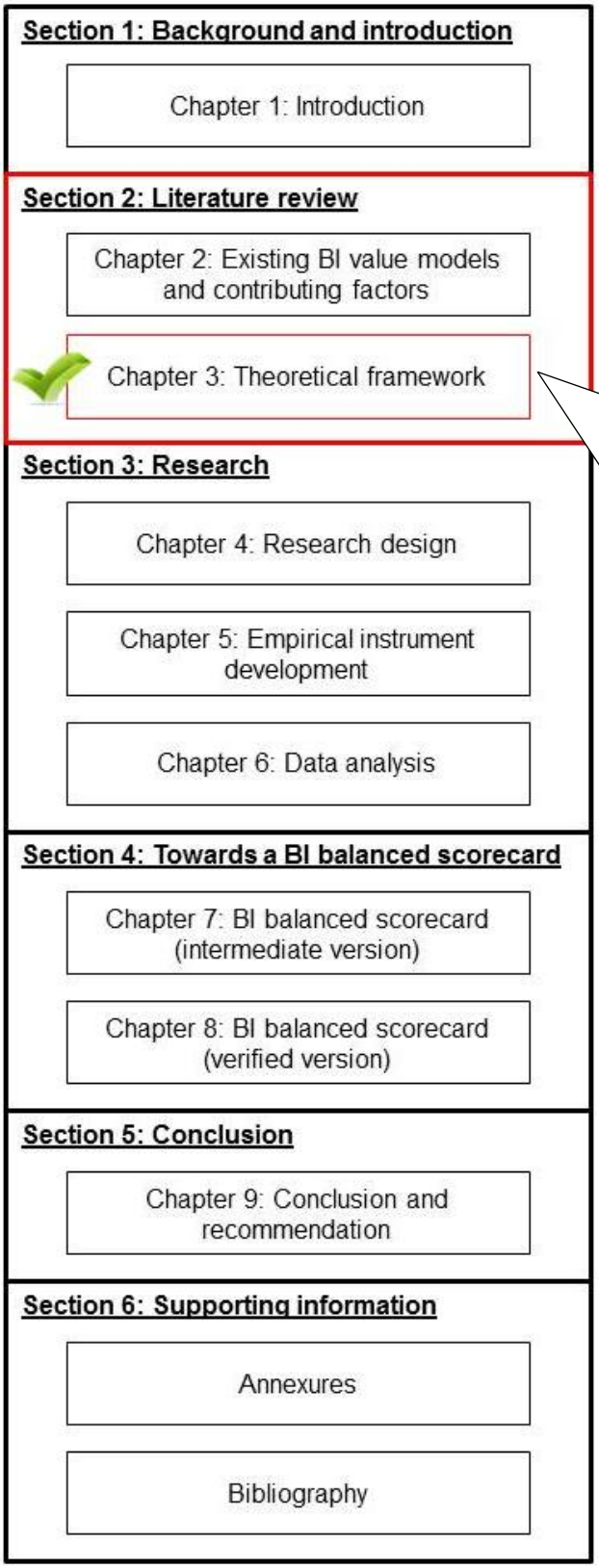
The research focus areas identified in the framework are in line with the level of the measurement research field as described by Schryen (2010, 2013) in his taxonomy of IS business value research. This refers to both the organisational and process level units of analysis. The importance of considering the level of analysis is stressed by Dehning & Richardson (2002) who postulates that the distinction between the levels contributes to the explanation of the productivity paradox. The separation of the different levels is useful to structure research and to resolve conflicting results. This is similar to the approach used by Sidahmed (2007). It is also argued that, beyond the distinction between the levels, the interrelationship between the levels can provide useful insights into how Information Systems (IS) generates value (DeLone & McLean 2003; Kohli & Grover 2008).

The framework contributes to the existing pool of academic literature as it provides the reader with a high level classification framework for current BI value literature; identifies gaps in the current research (as discussed above); identifies future research areas; and contains a bibliography of academic research according to the identified focus areas. Also, an overview of the various BI definitions and components thereof are presented.

The next chapter focuses on the theoretical framework of the study, namely the balanced scorecard strategy map approach. It substantiates the adoption of the approach, elaborates on specific focused balanced scorecards strategy maps for the IT industry and proposes a map tailored for a BI environment.

Chapter 3

Theoretical framework: balanced scorecard strategy map



Content

3.1 Introduction

There are many investigative studies focusing on the value of Information Technology (IT) in organisations (Banker & Kauffman 1991; Beck 2000; Kohli & Grover 2008). In fact, the topic of IT value assessments is one of the most studied topics in Information Systems (IS) (Bannister & Remenyi 2000). Various methodologies and approaches have been used, some of which are more widely adopted than others. According to research conducted by Berghout & Renkema (1994) and Renkema & Berghout (1997) approximately sixty evaluation techniques are identified, whilst Wilson (1988) identifies more than one hundred and sixty IT evaluation measurements grouped in seven assessment methods. These methods include techniques and measurement methods for the measuring of productivity, user utility, value chain; organisational performance, business alignment, investment targeting and management vision (Wilson 1988). Whilst some studies apply only one evaluation method, such as Porter's Value Chain (Porter 1985), others use mixed method approaches contained in a propriety method such as information economics (Parker & Benson 1987) and the balanced scorecard approach introduced by Kaplan & Norton (1992, 1996).

Whilst traditional financial calculation methods remain a popular method for IT evaluations, authors agree that these methods are not sufficient in IT value calculations (Elbashir *et al*. 2008; Kohli & Grover 2008). For this reason, many research attempts focus on mixed calculation methods.

In Business Intelligence (BI), investors are faced with similar challenges. For this reason, BI related research in general focuses on a single evaluation method consisting out of a combination of approaches. For example, Atre & Moss (2003) identifies the following components in an attempt to justify the benefits of BI investments, namely the business reasons for the investment, information about the requirements in support of the strategic objectives of the organisation, a cost and benefit analysis component as well as a risk factor (in other words, the technological risk and complexity of the project). Similar to IT value calculations, very little consensus exist amongst scholars about the applicability of a single evaluation method. For this reason, one of the objectives of this chapter is to identify and justify the evaluation approach used in this Business Intelligence evaluation study. Secondly, the selected evaluation method is adopted and customized to fit the

Business Intelligence domain. The newly proposed version of the method is used as basis for creating of a semi-structured interview template. Lastly, the validity and reliability of the instrument are tested.

3.2 IT evaluation methods

As stated above, there are many IT evaluation methods available for consideration. It is therefore impossible to discuss all of the available methods, although there is a need to discuss at least some of the more popular methods. This is necessary in order to identify the various options for calculating value; to justify the technique used in this study; and to confirm the applicability of the selected method.

3.2.1 Financial calculation methods

Capital Investment Appraisal Techniques (CIAT), as labelled by Milis & Mercken (2004), refers to utilising traditional, financial evaluation methods. Examples of commonly used methods include Return On Investment (ROI), Net Present Value (NPV) and Internal Return Rate (IRR). These are typically used in financial calculations and therefore focus on tangible aspects of investments. However, these techniques do not apply when intangible benefits are implied in investments.

3.2.2 Proprietary evaluation methods

Proprietary evaluation methods refer to customized evaluation methods introduced after numerous research efforts by the authors. In some instances, some aspects of the method include aspects of subjective evaluation efforts. A good example is the evaluation of intangible benefits from perspectives of the balanced scorecard introduced by Kaplan & Norton (1996). Other well-known proprietary evaluation methods include Porter's value chain (1985) and the information economics approach by Parker & Benson (1987).

The balanced scorecard does not only focus on intangible benefits but also include the assessment of tangible benefits. The method focuses on four distinct perspectives or focus areas in support of the organisational strategy. The four perspectives include a financial perspective, customer perspective, internal process as well as an organisational learning perspective. The strength of the method is attributed to the inclusion of both tangible and intangible benefits, hence the term

‘balanced’. An example of a tangible outcome is the financial calculations catered for in the financial perspective whilst intangible benefits such as a learning culture (part of the organisational learning perspective) influence other perspectives such as customer satisfaction. A learning culture will foster knowledge sharing attributing to more knowledgeable employees who deliver better customer service. Due to this ‘balanced’ view, this method is selected as the theoretical framework for the proposed study and discussed in more detail in the subsequent sections.

3.3 Theoretical framework

A theoretical framework is used in studies to guide a structured approach to research. In the instance of this study, the framework used will ensure that a structured approach to the research is followed, and all areas of the organisation are investigated for possible BI value drivers. For this purpose, a balanced scorecard strategy map approach is proposed. This well-known concept is one of the most widely adopted and successful approaches to strategy formulation (De Waal 2003) and has been widely published and applied successfully across various industries. It remains one of the most cited works at the 1998, 2000 and 2002 Performance Management Association (PMA) conferences (De Waal 2003). In addition, studies pertaining to balanced scorecard related issues, and the adoption thereof, are conducted in numerous countries, including Finland (Malmi 2001), North America (Lawson, Stratton & Hatch 2005), and Sweden (Christian & Trond 2005).

In order to perform a complete assessment of the value realisation of BI, an assessment must be performed from managerial level down to operational (or process) level. The balanced scorecard strategy map approach therefore seems appropriate as it uses a top down approach (Herring 1996; Lönnqvist & Pirttimäki 2006).

Furthermore, the selection of the balanced scorecard, strategy map approach for performance assessment purposes can be attributed to the following reasons:

- the need for an integrated evaluation method has been recognised by various authors (Elbashir *et al*. 2008; Kohli & Grover 2008) and the balanced scorecard approach caters for both tangible and intangible benefits;

- the balanced scorecard is a well-researched methodology for investigating lagging results that are often a result of an investment;
- the method, through the utilisation of strategy maps, allows for linking various measurements, identifying the ‘cause-and-effect’ result of items;
- in an investigative study into success factors of BI implementations, Adamala & Cidrin (2011) postulate that a substantial number of success factors are contained in the management domain rather than in the technological domain. Therefore, neither a pure technologically-focused evaluation nor a management-focused evaluation will give a thorough indication of the true benefits. A broader evaluation focus is therefore considered to be appropriate;
- the balanced scorecard approach is a well-known, widely published and implemented evaluation method. The majority of organisations have either implemented a similar performance management method or are familiar with the method. The outcome of the research should therefore contribute to a body of knowledge with which organisations are familiar.

However, the balanced scorecard strategy map approach has also been widely criticised by various authors. Some of the arguments include:

- The evaluation of intangible assets is influenced by the context in which the asset is consumed as well as the evaluation method used. This includes the organisation itself, the organisational strategy as well as supporting assets (Kaplan & Norton 2001). For example, it is important for highly competitive, innovation-focused organisations to measure the number of new innovative products successfully introduced to customers. In order to achieve this, innovative products (tangible asset) can only be successfully introduced to customers if the sellers of the product are familiar with the product and if the appropriate training was provided in promoting these products.
- It is often challenging to identify quantifiable measurements. For example, the number of products sold might be influenced by the training provided to customer agents in charge of the selling. In this instance, there is a direct relationship between training agents and the number of products sold. The relationship is neither always easily identifiable nor measurable.

- When identifying measurements for the balanced scorecard, both formal and informal processes are scanned, of which informal processes might not be clearly defined or implemented. Also, according to Mooraj, Oyon & Hostettler (1999) unwritten rules will have to be considered when scrutinizing a process (Mooraj *et al.* 1999).
- According to Mooraj *et al.* (1999) the cost benefit ratio is not always clearly defined in the balanced scorecard and users should consider additional applied case studies to assess business value.
- Although generic scorecards and strategy maps exist, measurements are unique depending on the organisation and type of industry in which the balanced scorecard is implemented. This requires involvement from all stakeholders (Milis & Mercken 2004).

Despite criticism against the use of the balanced scorecard, it is believed that it remains a useful performance measurement methodology. As long as the user is cognisant of possible challenges, it is believed that the methodology can be successfully utilised.

Subsequent sections describe the original balanced scorecard, including the strategy map approach proposed as well as other important variations of the balanced scorecard applicable to the study, namely the IT balanced scorecard. Finally, the influences of these are used to construct a BI balanced scorecard strategy map on which the measurement instrument (interview template) for the data gathering stage of the research is based. Although a preliminary version of the BI balanced scorecard is constructed, cognisance should be taken that the main objective was to *use* the BI balanced scorecard as a structured guideline or tool for the purpose of investigating the value BI adds to organisations. The main objective was not to produce a balanced scorecard for business intelligence.

3.4 The original balanced scorecard

The original balanced scorecard concept was introduced by Kaplan and Norton in 1992 and refers to the identification of key performance indicators (KPI) across four functional areas also known as ‘perspectives’ (Tonchia & Quagini 2010). These include a financial, customer, internal business process as well as learning and

growth perspectives[9] (Kaplan & Norton 1996; Kaplan 2010). In the first literature study published by Kaplan & Norton in 1992, the internal business process perspective was also known as the internal process perspective, whilst the learning and growth perspective was known as the innovation and learning perspective (Lawrie & Cobbold 2004). However, this was revised in the second publication of the balanced scorecard. This, however, can sometimes be confusing to readers.

The main objective of the balanced scorecard approach is to align the identified measurements of all four perspectives with the organisation's strategy in order to meet organisational objectives. These measurements can be tracked and monitored to ensure alignment. Two types of measurements are imperative to the successful implementation of the scorecard, namely performance-driver measures and outcome measures (Kaplan & Norton 1996). An example of an outcome measure is the number of successful calls closed by a call centre operator. The number of calls successfully closed is directly related to extensive training efforts to equip agents with the necessary knowledge and skills in handling queries. Therefore, the outcome measurements appeared after or as a result of the performance driver measure. Therefore, outcome measures are also referred to as lag measures whilst performance driver measures are the lead measurements.

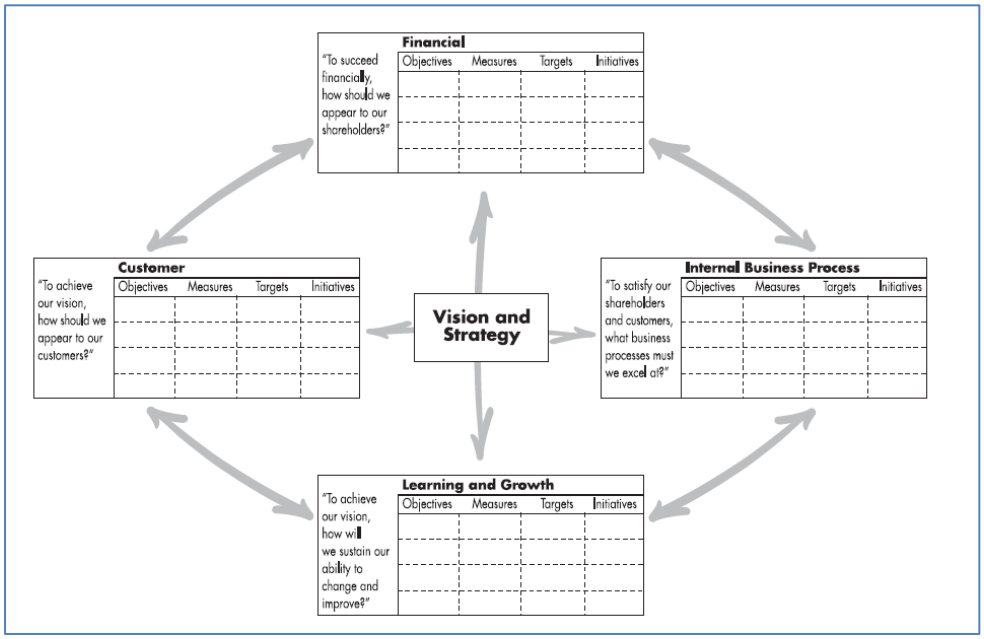


Figure 9 - The four perspectives of the balanced scorecard (Kaplan & Norton 1996, 2010)

[9] The learning and growth perspective is introduced as one perspective.

Figure 9 diagrammatically depicts the four perspectives of the balanced scorecard. The financial perspective is concerned with economic measurements usually dictated by the needs of the various stakeholders. For example, organisational stakeholders would typically be interested in how well the organisation is performing in terms of financial indicators such as return on capital and cash flow related measurements.

The customer perspective refers to the core value proposition for attracting, retaining and strengthening customers (Kaplan & Norton 2000). The perspective is typically sub-divided into three main objectives, namely operational excellence, customer intimacy and product leadership. Operational excellence refers to competitive pricing, product quality and selection, the speed at which orders are fulfilled and on-time delivery of products and services. The customer intimacy objective refers to measurable items in support of quality customer relationships such as exceptional service and completeness of the solution offered. Product leadership refers to the functionality, features and overall performance of the product or service. Customer perspective objectives should support the main goal of achieving financial objectives.

The internal business process perspective refers to the internal processes necessary to support the achievement of both customer and financial perspective objectives. For example, an adequate customer management process should support the overall goal for selecting and acquiring new customers, as well as retention of existing customers in order to develop the existing customer base.

Finally, the learning and growth perspective focuses on the requirement of human capability development in support of organisational strategy. Focus areas include training and development of staff, as well as the implementation of knowledge management systems. The main objective is to sustain, innovate and adapt to new requirements in order to remain competitive.

3.5 The strategy map

Since the first introduction of the balanced scorecard in 1992, various iterations or improvements have been introduced to the approach. These iterations are an extension of the original balanced scorecard and are known as strategy maps.

A strategy map, also known as a 'strategic linkage model' (Lawrie & Cobbold 2004; Tonchia & Quagini 2010), is a *"visual framework for the corporate objectives within the four balanced scorecard objectives"* (Kaplan & Norton 2000). An example of a generic strategy map is contained in Figure 10 below.

Strategy maps have evolved over time and have subsequently been labelled as second or third generation strategy maps (Lawrie & Cobbold 2004). The latest balanced scorecard approach is referred to as a third generation approach (Tonchia & Quagini 2010). The main difference between the second and third generation approaches is that the latter contains a destination statement, as well as the need to set clear targets for measurements. The destination statement describes the ideal futuristic end state of the business, i.e. what the business would like to achieve within the next three to five years (Tonchia & Quagini 2010).

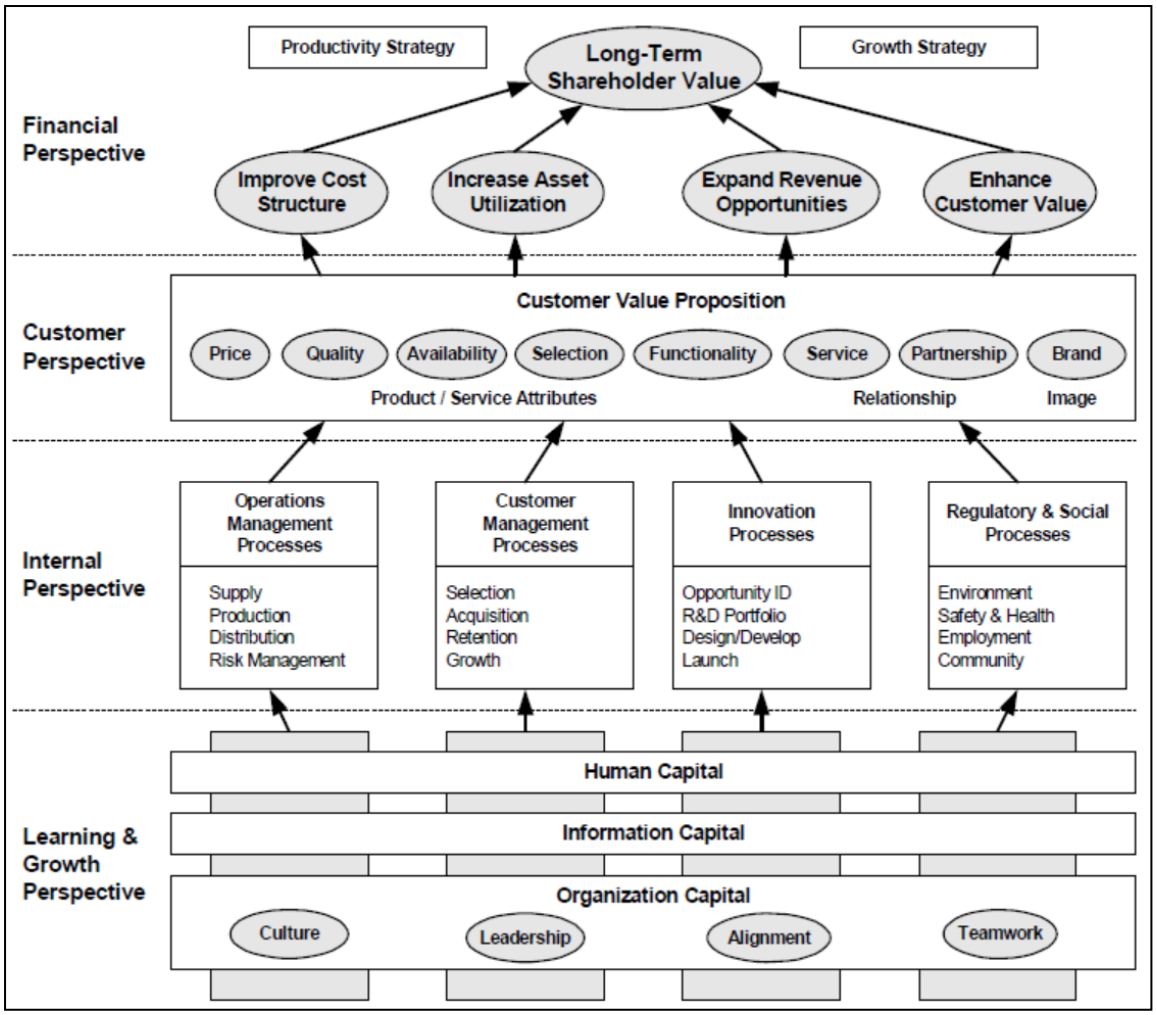


Figure 10 - A generic strategy map (adopted from Kaplan & Norton 2004a; Kaplan 2010)

A strategy map depicts the essential ‘cause and effect’ relationships amongst the four perspectives of the balanced scorecard as well as their respective objectives for driving organisational performance. The four traditional balanced scorecard perspectives are arranged in a hierarchy with the financial perspective at the top, driven by measurements from the customer perspective. The internal perspective supports the customer perspective, while the learning and growth perspective supports the internal perspective (Kaplan & Norton 2004a). In addition, strategic objectives are identified for the four perspectives. The replacements of goals with strategic objectives were one of the improvements from the first generation scorecard to the subsequent iterations (Lawrie & Cobbold 2004). For each of the four objectives, various measurements are identified (Tonchia & Quagini 2010). Strategic objectives make it easier to justify the inclusion of one measure over another (Lawrie & Cobbold 2004).

The overall foundation of a strategy map is the formalisation of an organisational mission, value statement, strategic vision or overall goal and how these goals will be achieved (Kaplan & Norton 1997, 2000). For this reason, strategy maps are relatively unique to an organisation. However, in profit organisations, similarities amongst organisations exist in terms of the overall mission, vision and goal. For example, the main objective of a profit organisation is to maximize profit and minimize cost. For this reason, it was possible to create a generic strategy map for profit organisations. The generic strategy map was introduced by Kaplan and Norton in 2004 (Kaplan & Norton 2004a, 2004b; Kaplan 2010) and depicted in Figure 12. This generic strategy map can be utilised as a starting point in performance management efforts for profit organisations.

After the formalisation of the organisational mission, value statement, strategic vision or overall goals, the starting point for creating a strategy map is the learning and growth perspective, “w*hich defines the core competencies and skills, the technologies, and the corporate culture needed to support an organization’s strategy”* (Kaplan & Norton 2000:70). Given the identified financial, customer and internal perspective objectives, the organisation should identify and implement development paths for employees as well as training and development on technologies in order to achieve the set objectives.

For the purpose of this study, a second generation approach will be followed. A second generation approach seems applicable as the tool will be utilized to explore the realized current value of BI implementations. There is therefore no need to include destination statements, a typical characteristic of the third generation approach. Also, strategy maps visually communicate the strategy, vision and organisational goals as well as the linkage with individual measurements in achieving organisational objectives. It exposes gaps in the strategy and identifies the current position of the organisation as well as the future vision of the organisation (Kaplan & Norton 2000). Also, strategy maps evaluate the impact of IT in organisations (Kaplan & Norton 2004a, 2010). In their study, Gustafsson *et al*. (2008) propose the relationship between IT and business value through organisational impact using extended influence diagrams. Similar to the concept of strategy maps, extended influence diagrams can 'calculate' the value of related, linked elements due to their causality. Extended influence diagrams are normally used in enterprise architecture analysis as a formal language to graphically depict the enterprise architecture of various items within the organisation, for example enterprise information security (Johnson *et al.* 2007). These diagrams graphically depict a particular state or value also referred to as nodes. A secondary node connected to the first node is referred to as a utility node and indicates the desirable state as well as causality amongst nodes (Johnson *et al.* 2007).

One of the challenges identified when implementing strategy maps is the linkage of measurements as these are often visible or completed after the fact (Lawrie & Cobbold 2004; Buytendijk, Hatch & Micheli 2010). However, a prior understanding of the linkage is required in support of the strategy (Epstein & Manzoni 1997). This is also supported by the cause and effect theory introduced by Hedberg (1981).

3.6 The IT balanced scorecard

As mentioned before, the original balanced scorecard approach ensures that the individual items measured (as part of the four perspectives) are aligned with the organisation's strategy (Kaplan & Norton 1996). An organisation can implement more than one scorecard, focusing on various aspects or functional areas within the business. For example, an IT balanced scorecard can be implemented focusing on the IT competency in support of the overall business strategy. Due to the fact that

Business Intelligence is perceived as part of the IT function, a separate scorecard can be implemented in support of the IT strategy and subsequent organisational strategy. Hence, the fulfilment of the BI scorecard will therefore contribute to the overall business balanced scorecard. This view is supported by various studies postulating that BI should support the business strategy in order to be successful (McMurchy 2008; Hobek, Ariyachandra & Frolick 2009). The relationship between the various versions of the balanced scorecard is graphically displayed in figure 11.

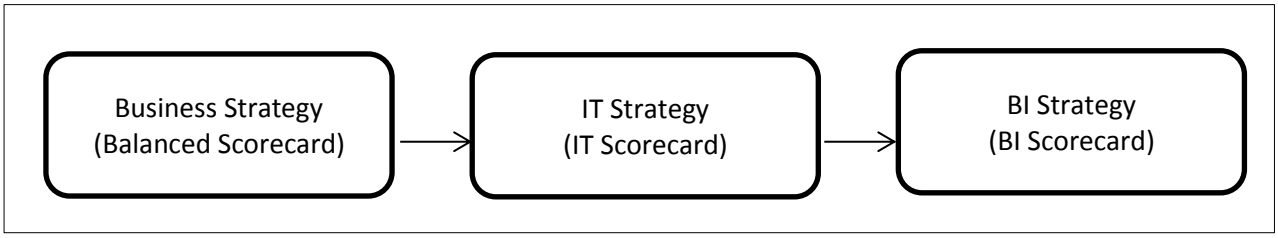


Figure 11 - Relationship between various balanced scorecard versions

The concept of an IT balanced scorecard was based on the original Kaplan and Norton balanced scorecard concept and introduced by Van Grembergen and Van Bruggen (1997), Van Grembergen and Timmerman (1998), Martinsons, Davison & Tse (1999) and Van Grembergen (2000). Whilst the traditional balanced scorecard focuses on measurements at the organisational level across various departments and business units (therefore horizontal), the IT balanced scorecard focuses on a vertical level, i.e. on a particular business unit or department.

The original concept of four perspectives have been adopted and slightly modified for an IT environment. The main reason for the modification can be attributed to the main objective of the IT department, that of service delivery in support of business activities (Martinsons *et al*. 1999). The customers and stakeholders are therefore internal to the organisation, facing 'inwards' (Martinsons *et al.* 1999). As a result, the following deviations from the original concept were proposed:

- The financial perspective has been expanded and relabelled as the **business value perspective.** This perspective has a much broader focus than that of the original financial benefits focus. Although financial analysis methods such as revenue obtained from IT related products and services are included, the perspective allows for risk analysis as well as measurements to establish the

business value of IT to the organisation. An example of measurements includes the *"perceived relationship between the IT department, management and top management"* (Martinsons *et al*. 1999). Although Van Grembergen, Saull & De Haes (2003) defines the same type of perspective the authors refer to the perspective as the 'business contribution' perspective to include the calculation of the business value of IT projects to the organisation.

- The customer perspective of the traditional balanced scorecard refers to customer experience and the objective of customer retention, customer service and satisfaction (to name a few) (Martinsons *et al.* 1999). Because the IT department mainly provides a service to internal organisational users, the original perspective has been relabelled as the **user orientation perspective**. The perspective is therefore not just limited to external customers, although it is also important to measure and strive towards achieving external customer satisfaction. The satisfaction of external customers using inter-organizational systems is typically included in this perspective (Martinsons *et al.* 1999). The objective of the traditional customer perspective has therefore been expanded to provide for the goal of becoming the provider of choice relating to IT service delivery tasks. These include the provisioning and supplying of technology- and operational related support, as well as creating and fostering relationships with the end-users, thereby fulfilling the needs of end-users (Martinsons *et al.* 1999). This perspective is supported by the study by Van Grembergen *et al.* (2003).

- The **internal business process** refers to the process of planning, development and operations of the IT department. This perspective is similar to the operational excellence perspective as labelled by Van Grembergen *et al.* (2003). Planning refers to project management related activities including the prioritization of IS projects. Development focuses on the manufacturing and introduction of new IT applications as well as operational related activities and maintenance of current IT applications (Martinsons *et al.* 1999).

- The learning and growth perspective has been replaced by **'evaluating the future readiness'** perspective (Martinsons *et al.* 1999) or the **'future**

orientation' perspective (Van Grembergen *et al.* 2003). It entails the planning and reskilling of resources to keep competencies current and in line with the latest technologies; identify future applications; modify and implement technologies; as well as research future technologies. The objective of the perspective is to establish a vision pertaining to new technologies (Martinsons *et al.* 1999).

It is imperative that both the user-orientation perspective and internal process perspective are monitored to ensure that the demand for services and service efficiency is achieved (Martinsons *et al.* 1999). The optimal functioning of both the internal business processes together with customer and user satisfaction ensures that the demand for service is successfully met.

The preconditions for developing a useful IT balanced scorecard and subsequent strategy map are in line with conditions specified for the original balanced scorecard, and include the following (Kaplan & Norton 1996; Martinsons *et al.* 1999):

- The relationships between various measurements should be properly identified and defined. The strategy map approach allows for this level of linkage between measurements in the various perspectives;
- The scorecard should contain both outcome measurements (i.e. current generic items to be measured) as well as performance drivers (i.e. specific items indicating how the outcome measurements can be achieved);
- There is a strong correlation between performance drivers and the correlation should therefore be reflected in outcome measurements.
- All perspectives should ultimately support the main objective of business value (or financial perspective in the traditional balanced scorecard).

3.7 The BI balanced scorecard literature evaluation

There is little empirical evidence of the existence of a balanced scorecard for Business Intelligence or instances where this approach has been used to investigate the value of BI implementations to organisations (except for a study by Vinciguerra 2004 focusing on data warehousing). Although various BI tool suppliers (such as Microsoft and Oracle) introduced BI value scorecards as part of their product

promotional activities, only a few examples could be found in academic literature. This includes the utilisation of the balanced scorecard approach to evaluate the impact of BI as postulated by Vinciguerra (2004) as well a 'Business Intelligence Value Scorecard' introduced by Hawking (2011). Similarities between the studies included the utilisation of a traditional balanced scorecard approach (Kaplan & Norton 1992, 1996, 1997, 2001) and the consumption of case studies as primary data source. The case studies depicted a scenario of profit organisations and therefore share the same overall strategic objective of being financially sustainable and profitable. Both scorecards are discussed in more detail in the section below. A bottom-up approach is used as basis for the discussion, i.e. the lowest level of the scorecard is discussed first (the learning and growth) followed by the subsequent third, second and first perspectives.

3.7.1 Balanced scorecard approach for BI (Vinciguerra 2004)

The main objective of the study by Vinciguerra (2004) was to evaluate the impact of a data warehouse implementation on organisational performance in a financial services organisation. Although the original Kaplan and Norton balanced scorecard strategy framework (1992, 1996, 1997, 2001) was used to identify goals, objectives and subsequent measurements in support of achieving the financial goal of the organisation, i.e. to be profitable, a strategy map was further introduced to identify the linkage between the identified items.

The learning and growth perspective identified the objective of Information Systems development as well as the training and education of employees and system users. Some of the identified measurements include system related items such as response times and availability. The competency of employees was measured using skills assessments and satisfaction surveys. This is in contrast with the IT balanced scorecard introduced by Van Grembergen & Van Bruggen (1997) and Martinsons *et al*. (1999). Technical systems related measurements are measured as part of the operational excellence perspective (similar to the internal process perspective of Kaplan & Norton 1992, 1996). This is in support of the objective of the BI capabilities ability to support effective processes. Whilst system user training is similar to the IT balanced scorecard's future orientation (or learning and growth perspective as per

Kaplan & Norton 1992, 1996), the focus on employee satisfaction as a result of employee satisfaction surveys are contained in the user orientation perspective. This is due to the fact that internal users are perceived as 'clients' of the BI department, although internal to the organisation.

The internal perspective of the balanced scorecard used by Vinciguerra (2004) referred to the development of internal processes to assist employees in their understanding of the products and services offered to customers. These include product profitability analysis, market share and revenue as well as product related information such as time to market. In contrast, the internal processes perspective of the IT balanced scorecard refers to the objective of planning, development and operational support for delivering IT related services. This perspective, from an IT balanced scorecard perspective, therefore focuses on the IT service delivery objective for supporting the organisation in achieving financial goals, both internally and externally. According to Martinsons *et al*. (1999) and Van Grembergen *et al.* (2003) this perspective is also known as the operational excellence perspective.

The objective of the customer perspective according to the study by Vinciguerra (2004) is to supply customers with customized products and solution offerings. Measurements include the expansion of the current (external) customer base and the status of current (external) customer relationships. As mentioned above, the customer perspective of the IT balanced scorecard focuses on both internal users (and internal customers) and external customers.

The financial perspective aims to meet the objective of long-term financial profitability and sustainability. Again, this is similar to the main objective of the IT balanced scorecard, but on a smaller scale. For example, where the balanced scorecard by Vinciguerra (2004) measure revenue, profit and Return on investment (ROI), the IT balanced scorecard focuses on achieving business value, in support of the organisational financial objective. Business value calculations for the IT balanced scorecard include ROI evaluations, focusing on projects and implementation of tools in support of business. The focus is also on the relationship and perceived usefulness of IT to the business. Business surveys amongst management can therefore also be used as strategic measurement in this perspective.

The outcome of the study was the introduction of objectives and strategic measurements to evaluate the impact of a BI implementation on an organisation and not necessarily a 'new' BI balanced scorecard. Also, the IT balanced scorecard has a narrower focus on IT as a service delivery department than the study conducted by Vinciguerra (2004). In other words, the IT balanced scorecard has a vertical (or departmental) focus, whilst the Vinciguerra (2004) study has a horizontal (or enterprise) focus.

3.7.2 BI value scorecard (Hawking 2011)

Hawking (2011) conducted a study using the maturity level of an organisation as theoretical framework. As an outcome of the study, a 'Business Intelligence Value Scorecard' was introduced. The argument was that the business value achieved as a result of BI implementations is influenced by the maturity level of the organisation implementing the solution. The proposed scorecard focused on a high level scorecard based on facts obtained from the case study. No perspectives were identified although perspectives could have been derived from the proposed measurements. The measurements identified include:

- the organisational adoption rate of BI as a percentage of active BI users;
- the extent to which BI is utilised to support organisational processes within the organisation measured as the percentage coverage of departmental informational needs;
- response time when retrieving information including navigational speed;
- data characteristics such as reliability, consistency and quality;
- ease of use measured by the cost of training; and
- new customer related interventions introduced as a result of BI data.

The case study and subsequent BI value scorecard presented as part of the study indicate that the maturity level of the organisation adopting this performance management approach would have to be on higher maturity levels. One of the characteristics of this maturity level is the ability of an organisation to manage the entire value chain by means of KPIs (Hawking 2011). Therefore, organisations would have to achieve a high level of maturity before implementing a performance measuring systems such as a BI value scorecard.

The importance of maturity can be seen by the number of studies focusing on organisational maturity. These include maturity models or variations of maturity models (Dinter 2012; Eckerson 2007; Hawking 2011; Lahrmann *et al*. 2010; Sen *et al.* 2006; Shaban *et al*. 2011; Watson *et al*. 2011), as well as critical success factors or success models necessary for successful Business Intelligence implementations (Adamala & Cidrin 2011; Chasalow 2009; Hawking & Sellito 2010; Hwang & Xu 2008; Isik 2009; Schieder & Gluchowski 2011; Shin 2003; Wixom & Watson 2001; Yeoh & Koronios 2010). Also part of the focus on organisational maturity is the focus on the readiness of organisations to implement BI (Kimball *et al.* 2008; Williams & Williams 2007). These are perceived as predecessors for realizing value and are discussed in more detail in chapter two.

3.8 Chapter conclusion

This chapter offered a discussion of the theoretical framework adopted for this study, namely the balanced scorecard strategy map approach. The various iterations of the balanced scorecard strategy map approach were introduced as well as a generic version of the strategy map. A number of variations to the balanced scorecard were also included in the discussion focusing on the bigger context of this particular study, namely a balanced scorecard for IT. Lastly a literature review was conducted to investigate the existence of a balanced scorecard for BI and the results were discussed. This step was important in the literature review process to identify similar studies, i.e. studies where a BI balanced scorecard was used to investigate the value of Business Intelligence in organisations, as well as instances where a BI balanced scorecard was constructed for the purpose of considering and expanding on existing research studies.

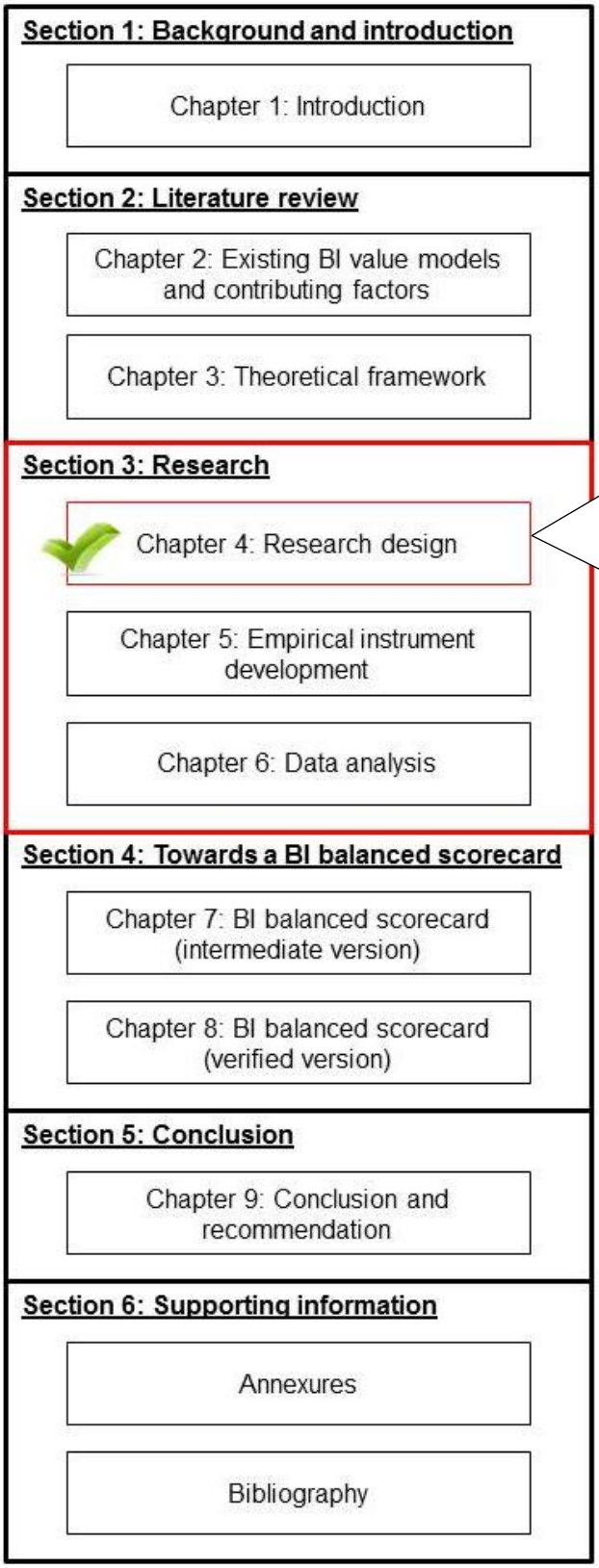
The following chapter is a discussion of the research methodology adopted and research approach for the empirical section of the research. The adoption of the multiple-case study research strategy is discussed and substantiated. The chapter is concluded with a description on the sources of evidence identified to gather the necessary primary and secondary data, whereafter the data analysis approach is disclosed.

Section 3

Research

Chapter 4

Research design: research methodology



Content

4.1 Introduction

Chapter four focuses on the research approach and methodology used in the study. It provides important background information about the interpretive research approach and the selection of the underlying constructivist paradigm. This discussion provides important background on the manner in which the research is conducted.

The first section focuses on the underlying epistemological assumptions. Interpretive studies create and associate their own subjective and intersubjective connotations to concepts in their interaction with the constructs around them. BI value is therefore investigated through the assessment of the meanings participants assign to them within the context of their organisational environments.

Two methods were used in the study. The first method, namely an extensive literature review, was used to develop a semi-structured interview template. This method as well as the development of the template is discussed in detail in chapter five (5). The second, and primary research method used in the study, was used to gather the main data set for the study. The multiple-case study approach is described in the second section of this chapter. The suitability of the method is evaluated using the strengths and weaknesses of the method. A mitigation plan is proposed to address the weaknesses. Each of the four case studies in this thesis is discussed briefly and lays the foundation for future discussions in subsequent chapters.

The sources of evidence used to construct the multiple-case studies are discussed in more detail. These include the utilisation of semi-structured interviews (based on the theoretical balanced scorecard framework), physical artefacts, and technical architecture documentation. Company websites provides valuable background information about the organisations and assists with finalizing the context for each of the case studies.

Thematic content analysis is selected as the data analysis method of choice. This method is used to perform data analysis within the individual case studies (within case analysis). The same method is applied to compare the outcome of the data analysis with other case studies (cross-case analysis).

The chapter is concluded with a summary of the proposed outcome of the study in the form of a written record.

The outline of the chapter is depicted in Figure 12. This figure contains elements of the qualitative research design as postulated by Myers (2009).

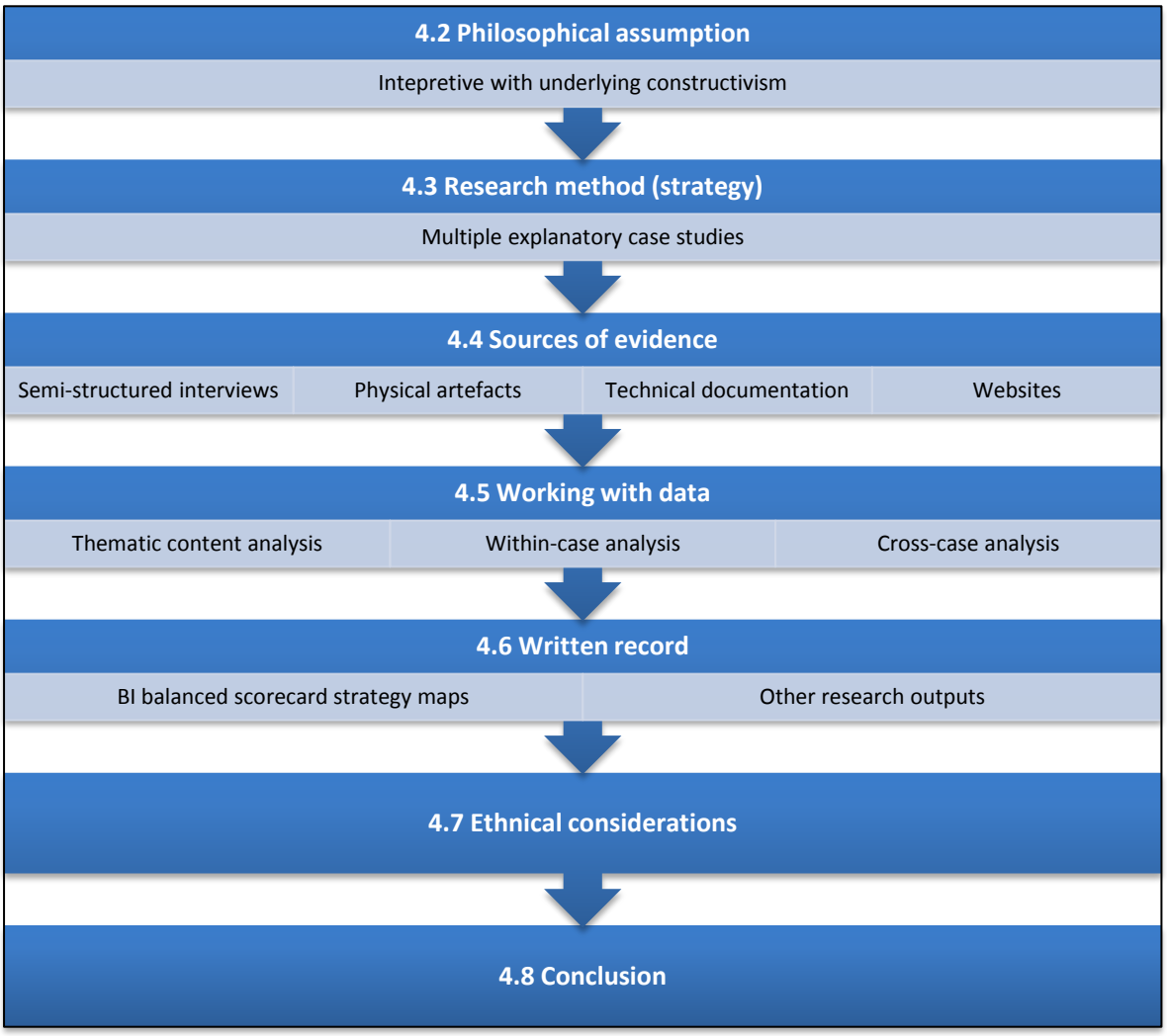


Figure 12 - Chapter outline: qualitative case study research design model

4.2 Philosophical assumption

The main objective of the research is to perform an in-depth analysis of the perceived value of Business Intelligence implementations across a limited number of pre-selected organisations; irrespective of the industry in which they are functioning. To facilitate the in-depth analysis, an interpretive philosophical approach was adopted based on a constructivist epistemology. As indicated by Orlikowski & Baroudi (1991:5): *"Interpretive studies assume that people create and associate their*

own subjective and intersubjective meanings as they interact with the work around them. Interpretive researchers thus attempt to understand phenomena through accessing the meanings participants assign to them". The objective is therefore to understand a particular research problem from the perspective of the individual experiencing it (Vaismoradi, Turunen & Bondas 2013). In this study the perceived business value and the meaning thereof are investigated in the context of organisational boundaries through the lens of managerial employees. However, despite the overall interpretive research approach followed, the research contains elements of positivism (as supported by Myers, 2009:36).

The nature of the study as well as the selected research problem similarly contributed to the adoption of an interpretive approach (Elliott & Timulak 2005). The type of investigation (in-depth analysis) in this instance prescribed exploratory type questions to investigate what the value of BI is, how it was achieved and what the organisational contribution was. A qualitative approach in support of the interpretive nature of the study therefore seemed applicable.

Although Schwandt (1994, 2000) postulates a difference between interpretivism and constructivism on the basis of epistemological assumptions, the author adopted the approach (along with many authors, Yuen 2005) that these two concepts refer to the same type of qualitative research approach. For the purpose of the study, although the constructivist epistemology adopted is described in more detail, it is assumed as the same interpretivism approach.

A constructivist epistemology is one of four underlying paradigms for qualitative research (Myers 2009, 2013). Other paradigms include positivism, post-positivism as well as critical theory (Guba & Lincoln 1994). Constructivism *"assumes that the meaning of experiences and events are constructed by individuals, and therefore people construct the realities in which they participate"* (Lauckner, Paterson & Krupa 2012:6). The meaning of the perceived business value is therefore subjective and depends on the position or role fulfilled by research participants within the research context (or organisation) as well as the meaning of value and BI to the individual. The research participant therefore gives an opinion, based on partial views of their perceived reality (Myers 2009, 2013). The result of the research, in this instance

multiple narrative case studies, are in itself a construction of a reality (Charmaz 2006) – a reality based on many views of independent experiences (or individual realities).

A qualitative case study approach (as proposed for the purpose of this study) is postulated to fall within the paradigm of constructivism (Stake 1995, 2000, 2005, 2006). This approach allows for the investigation into multiple perspectives (on the business value achieved) supporting the aim to gather mutually agreed upon and diverse notations of how and why it occurred (Lauckner *et al.* 2012).

Qualitative research interventions are often criticised by academic scholars and accepted with scepticism. This is evident in the number of academically published papers when compared to quantitative studies. Although there seems to be a steady increase in the number of papers over the past decade (Sarker, Xiao & Beaulieu 2012), it is important to address some of the criticisms against the approach.

The main criticism against qualitative research, and a much debated topic amongst scholars, is that of trustworthiness of empirical research. This issue of research validity and reliability is often challenged due to the misfit of validity and reliability criteria (such as internal validity, external validity or generalizability, reliability, objectivity), that ensure the trustworthiness of empirical work used in quantitative studies (Shenton 2004). However, many authors attempted to address this challenge through the implementation of alternative constructs to ensure trustworthiness (Silverman 2001; Pitts 1994; Guba 1981). In response, alternative terminology to trustworthy measurements was introduced and includes measurements of credibility (similar to internal validity measurements in quantitative studies), transferability (similar to external validity or generalizability in quantitative studies), dependability (similar to reliability in quantitative studies) and conformability (similar to objectivity in quantitative studies) (Guba 1981; Lincoln & Guba 1985). These measurements are included in the discussion of the empirical data generation process.

In addition, Myers (2009, 2013) contributes to the validity and reliability debate, postulating that the challenge is not to prove validity and reliability of qualitative studies, but plausibility. Plausibility, in this instance, refers to the confidence

evaluators and fellow academic scholars have in the research and how believable the research outcome or results are. He suggests that multiple sources of information are used in the instance of case study research. This should be combined with a clear description of what the researcher did and how the outcome was achieved. All these items were considered in this research process.

4.3 Research method (strategy): Multiple-case studies

A multiple-case study research strategy was adopted to gather empirical data for the study. This research strategy is applicable to situations where real life events are explored without the intervention from the researcher (Myers 2009, 2013). This description of case study research is similar to Yin (2003, 2009, 2013) arguing that case studies refer to an empirical method of enquiry *"that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident"* (Yin 2009:18). The phenomenon in this instance is the business value achieved as a result of BI implementations within an organisational context.

The selection of a multiple-case study strategy was confirmed after careful consideration of both strengths and weaknesses of this approach. Each of the strengths and weaknesses are discussed in more detail. A summary of the discussion is contained in Table 11 and 12:

- The reason for adopting a multiple-case study method was to contribute to the research objective of performing a detailed, in-depth and complex investigation into the research problem across diverse organisations (Anaf, Sheppard & Drummond 2007; Stake 1995, 2000, 2005, 2006). The method is ideal in instances where real-life, often chaotic, scenarios exist without the control of the researcher. In this research, the researcher was merely a facilitator guiding a semi-structured interview to obtain information.
- The objective of the research was to explore the perceived BI value in a real-life, organisational context (Myers 2009, 2013). As a result, boundaries between the construct being researched (the perceived value) and the organisational context in which it functions are not clearly evident. A case study method is therefore

suitable in research cases where the boundaries are not clearly definable (Yin 2003).

- Case studies are a suitable research method in instances where the researcher has little or no control over the events (Oates 2006). The research problem is investigated in a real life context without any intervention (apart from the role as facilitator) from the researcher.
- In general, the audience of the research output (organisations, researchers, scholars) can easily relate to real-life 'stories' described in case studies. The research output can therefore be more usable than traditional academic studies.
- The method is suitable for theory building and testing, especially in instances where a theoretical framework is used to guide the data collection and analysis (Oates 2006; Yin 2003). This research is based on elements of the balanced scorecard strategy map approach although modified for the context of this study (BI).
- Multiple-case studies, in particular cross-case analyses, allow for the ability to depict complexities and causality between research constructs which otherwise would have been difficult to identify (Oates 2006). For example, the causality between the days allocated to training might directly influence the number of products sold as a result of increased product knowledge and better customer service.
- This research method is ideal for answering 'how' research questions (Oates 2006). The primary research question is identified as 'how does BI add value to organisations'?
- Multiple-case studies furthermore allow for both in case and cross-case analysis, adding to the richness of the study (Oates 2006). It is an important strategy for investigating the research problem within context with the objective of exploring the business value of BI through a multidimensional lens (Baxter & Jack 2008).
- Multiple sources of evidence can confirm the plausibility of the research as suggested by Myers (2009). In this research, semi-structured interviews were used as a main source of evidence, whilst the evaluation of physical artefacts and technical BI architecture documentation is assessed (where available and accessible).

Strengths
The ability to deal with complex, often chaotic situations or real life events (Lauckner *et al.* 2012; Oates 2006).
This method allows the researcher to explore the problem in a real-life context (Myers 2009, 2013) in particular where the boundaries between the research constructs under investigation and the context in which these function are not clearly evident (Yin 2003).
Ideal research method in instances where the researcher have little or no control over the events (Oates 2006).
In general, organisations can relate to the real life scenarios described in case studies[10]. For this reason organisations can benefit from this type of research (Myers 2009, 2013; Oates 2006).
Suitable for theory building and testing (Oates 2006).
The ability to depict complexities and causality between research constructs which otherwise would have been difficult to identify (Oates 2006).
Ideal research method used to answer 'how' research questions (Oates 2006).
Case studies, in particular multiple-case studies, ensure richness and depth to understand the research problem (Anaf *et al.* 2007; Stake 1995, 2000, 2005, 2006)
Multiple sources of evidence can confirm the plausibility of the research and contribute to the richness and depth to understand the research problem (Myers 2009, 2013).

Table 11 - Strengths of multiple-case study research

Weaknesses
Challenging to identify and focus on key issues due to the vast numbers of facts (Myers 2009, 2013).
Challenging to find participants (Myers 2009, 2013).

[10] Myers (2009) refers to this concept as 'face validity'.

Weaknesses
No control over the situation (Myers 2009, 2013).
Time consuming (Myers 2009, 2013; Oates 2006).
Poor credibility due to lack of perceived reliability and validity (Oates 2006).
Presence of researcher might influence outcome (Oates 2006).
No rules (Oates 2006).
Seemingly poorly defined data analysis process (Yin 2003).

Table 12 - Weaknesses of multiple-case study research

Unfortunately, no method is without weakness and the discussion will not be complete without considering and evaluating the shortcomings. For each of the weaknesses identified, a risk mitigation response is included. A summary of the weaknesses is contained in Table 12, while the weaknesses and the corresponding risk mitigation response are summarized in Table 13:

- In multiple-case studies, researchers are often overwhelmed by the amount of factual feedback received from participants. Due to this vast amount of facts, the researcher should take cognisance of the risk of *"reducing complex cases to a few comparable variables, resulting in the loss of the idiosyncrasies of individual cases"* (Stoecker 1991; Myers 2009, 2013). Creswell (1998) suggested that the researcher should select no more than four cases as part of the study in order to mitigate this risk. This allows for thorough individual case investigations.
- It might be challenging to find participants for the research process. However, finding voluntary participants in academic studies are often challenging and not necessarily restricted to case study research (Myers 2009, 2013).
- The researcher often has no control over the situation under investigation (Myers 2009, 2013). However, the lack of control often results in the disclosure of additional dynamic variables influencing the research outcome. This can contribute to a better understanding of the research phenomenon.

- The research is often time consuming (Myers 2009, 2013; Oates 2006). Although time is always a significant challenge when conducting research, other data generation methods can also be equally time consuming, for example interviews.
- Although qualitative research has poor credibility due to a lack of perceived reliability and validity (Oates 2006), authors such as Guba (1981), Lincoln & Guba (1985), Silverman (2001) and Pitts (1994) suggest alternative constructs to ensure trustworthiness. Also, Myers (2009, 2013) proposed the concept of plausibility in favour of traditional trustworthiness constructs.
- Although the presence of the researcher might influence the outcome of the research results (Oates 2006), this challenge is not isolated in terms of case study research only. Other approaches such as ethnographic studies face similar challenges. In case study research, the researcher will have to take cognisance of this possible influence and conduct multiple observations or interviews to mitigate the risk. Furthermore, to mitigate the risk *in this study*, other (multiple) sources of information are considered and evaluated to support and supplement interview data.
- Oates (2006) indicates that there are no rules when conducting case study research. However, the researcher should either compile a protocol document describing how the research was conducted or disclose the research process in detail. Also, the absence of rules might contribute to understanding the research problem identified. Other dynamic variables might surface in the absence of strict rules, which might contribute to a better understanding of the phenomenon under investigation.
- There seems to be a lack of a clear data analysis process (Yin 2003). However, qualitative data analysis methods (such as thematic and content analysis) might assist with the process. Also, irrespective of the process selected, clear documentation should support the procedure.

Weakness	**Risk mitigation**
Challenging to identify and focus on key issues due to the vast amounts of facts (Myers 2009, 2013; Stoecker 1991).	Creswell (1998) suggests that the researcher should select no more than four cases as part of the study in order to

Weakness	Risk mitigation
	mitigate this risk.
Challenging to find participants (Myers 2009, 2013).	Finding voluntary participants in academic studies are often challenging and not necessarily restricted to case study research (Myers 2009, 2013).
No control over the situation (Myers 2009, 2013).	The lack of control often results in the disclosure of additional dynamic variables influencing the research outcome. This can contribute to a better understanding of the research phenomenon.
Time consuming (Myers 2009, 2013; Oates 2006).	Although time is always a significant challenge when conducting research, other data generation methods can also be time consuming, for example interviews.
Poor credibility due to lack of perceived reliability and validity (Oates 2006).	Authors such as Guba (1981), Lincoln & Guba (1985), Pitts (1994) and Silverman (2001) suggest alternative constructs to ensure trustworthiness.
Presence of the researcher might influence the outcome (Oates 2006).	This challenge does not apply to case study research only. Other approaches, such as ethnographic studies, face similar challenges. In case study research multiple sources of evidence (or information) should be used to support the outcome in instances where the presence of the researcher might have an influence.
No rules (Oates 2006).	The researcher should compile a protocol document describing how the research

Weakness	Risk mitigation
	was conducted. Also, the absence of rules might contribute to understanding the research problem identified.
Seemingly poorly defined data analysis process (Yin 2003).	Increased focus on qualitative data analysis methods such as thematic and content analysis. The process should be well documented.

Table 13 - Weaknesses of case study research and risk mitigation

4.3.1 Description of multiple-case studies

Yin (2003, 2013) identifies three types of case studies. These include exploratory cases, descriptive cases and explanatory cases. Whilst exploratory cases attempt to understand a research problem, descriptive case studies describe the details of the case or multiple-cases presented and typically tell a story about the research phenomenon. Explanatory cases try to explain why events occurred or why a particular outcome took place. In this instance, the research problem attempts are not limited to investigating how BI adds value to organisation but also extends to explaining why the value was achieved. An explanatory case study type is therefore applicable to this study.

Case studies can be conducted to investigate historical events, short term (contemporary studies) or longitudinal cases (Oates 2006). Historic events perform investigations on events happened in the past. Short term, contemporary studies investigate a current scenario, in other words, what is happening at the moment? Longitudinal studies perform an investigation over a specific time period. This study investigates the status quo of the value added to organisations as a result of BI implementations. A short term, contemporary study is applicable here.

Although no sampling technique was applicable in this instance of qualitative research, some type of selection criteria was considered. According to Oates (2006) case studies are selected, should the case be a typical instance comprising the phenomenon under investigation. Should a case then represent an extreme instance

of the phenomenon such as a test bed for theory, such case must be selected because of the convenience of the opportunity presented; or if a unique opportunity exists to investigate the phenomenon within the context of the case. To be eligible for selection as participant in this research, organisations should have completed a BI project irrespective of the BI tool, technique or concept implemented. This criterion was one of the most important delineations of the study because the value and benefits of BI can only be ascertained if such implementation has been conducted. These cases have been selected since the case is a typical instance of BI implementations.

A further geographic restriction applied when participants were selected. All participants had to reside in Gauteng, South Africa. The geographical restriction can be ascribed to the nature of the research method, namely face-to-face interviews. Although it is possible to use telecommunication media to conduct interviews outside the borders of Gauteng, the interview requires quite a long process (at least one hour) which might make it challenging for both the interviewee and interviewer. The restriction was therefore applied not only for practical purposes but also for convenience and cost purposes.

Although organisations were randomly contacted for participation, two selection approaches were applied. Firstly only organisations with which the researcher had had previous interactions and subsequent business relationships were contacted. Unfortunately not enough organisations were willing to participate. As a result, a number of BI industry practitioners were contacted to obtain contact details of possible additional participants. The list was used to contact potential participants[11]. This ensured that suitable, experienced individuals with the required business acumen and knowledge were selected. This was in line with the approach proposed by Elliot and Timulak (2005) suggesting that participants should be selected for the purpose of in-depth interviewing whilst the characteristics of each participant should be considered and documented (in the demographic section of the interview template).

[11] In quantitative studies this is similar to a purposeful selection technique (Marton 2013).

The process of research saturation was challenging to achieve. The main reason was that the majority of the organisations had a flat organisational structure with one human resource official performing a middle management function (part of the research target population). In instances where more members of the target population were available, this was catered for (panel interview as described in Case Study 1 Organisation A). Also senior team members were consulted where applicable and available. The interviewer had to rely on additional documentation to accommodate the saturation requirement.

Four (4) organisations from various industries in Gauteng, South Africa were selected to participate in the study.

The characteristics of the multiple-case studies are summarised in Table 14.

Type of case study	Explanatory
Time focus of case study	Short term, contemporary
Selection criteria	Convenience and typical
Prerequisite	Organisations with completed or in progress BI implementations.
Geographical demarcation	Gauteng province, South Africa
Language	English
Number of participative organisations	4
Number of interviews[12] conducted	4
Level of participants	Middle, senior, top management
Total number of case studies	4

Table 14 - Characteristics of multiple-case studies

Although it was envisaged that this research would focus on a total of five organisations – and therefore generate five individual case studies – the end result only comprised four case studies. This decision was based on prescriptions from Creswell (1998) that the researcher should select not more than four cases as part of the study in order to mitigate a risk raised by Stoecker (1991). According to Creswell

[12] This includes panel interviews.

(1998) it is challenging to identify and focus on key issues in individual case studies due to the vast amount of facts.

Each of the four cases is described in more detail:

- The organisation described in case one is a BI consultancy and technology services establishment specialising in delivering BI solutions to organisations whilst hiding the complexity of technology. The organisation focuses on providing organisations with the insight necessary to make informed decisions therefore minimizing uncertainty and risk. The organisation currently trades in the public sector. A panel interview was conducted with the owner of the organisation (also fulfilling the role of Chief Executive Officer) as well as a number of senior BI consultants currently employed by the organisation. The role of these consultants ranged from pure consultancy services (assisting with advice and guidance with regard to BI related aspects) to technical implementations of BI solutions. Although the organisation is classified as a micro organisation (less than ten employees), this is a dynamic organisation currently servicing a large organisation (more than 250 employees). They currently advocate a particular software product.
- The organisation described in case two is a public medium size organisation (less than 250 employees) currently trading in the financial services (banking) industry. The interviewee fulfilled a dual role: Chief Technology Officer as well as head of operations (risk division). There were no other consultants available for interview purposes but the interviewee supplied the interviewer with secondary information such as a technical architecture outline of the current infrastructure in support of the information provided in the interview.
- In case three the organisation described trades in the Fast Moving Consumer Goods (FMCG) public industry specializing in the South African staple food market (staple food in this instance refers to bread, flour and maize), although they also manufacture some sweet brands. The organisation is classified as ‘large’ due to the fact that more than 250 employees are employed. The total number of employees is estimated to be approximately 7,000 across South Africa. These include 6 mills, 9 bakeries and a number of distribution outlets across South Africa. The majority of the BI competency is outsourced to external

consultants. The interview was conducted with the IT Technical Operations Manager. From a business perspective, no other managers were involved in any aspects of BI and therefore not adequately knowledgeable to be included in the interview process.

- The organisation described in case four operates in the government sector, in particular the public administration industry. The department fulfils the role of tax collecting authority across South Africa. It is estimated that more than 15,000 full time employees are employed in various provinces across South Africa. The interview was conducted with the data analytics manager. One of his tasks is to ensure the timely delivery of BI artefacts to support complex decision-making.

Participating organisations in the study therefore represent a diverse population in terms of size, industry and sector.

4.4 Sources of evidence

In case study terminology used by Yin (2003, 2009, 2013) data generation methods are referred to as 'sources of evidence'. These sources of evidence are the main source of information used as evidence to construct the either single- or multiple-case studies. In instances where the physical BI artefacts[13] were available, these were evaluated and considered in the research. Additional detail contained in technical architecture documentation is incorporated into the individual case study descriptions (chapter 6). This information has provided important contextual information about the implementation. It should be noted that the research participants are in general not keen on sharing technical architecture related documents[14].

Interviews were used in two instances during the study. Firstly, semi-structured interviews were used as primary data generation method. Secondly, open ended interviews were used to verify the consolidated information obtained during the study. These are discussed in more detail below.

[13] Physical BI artefacts in this instance refer to examples of BI products, process and technologies. For example, one client presented an operational dashboard with lower level reporting during the interview.
[14] Technical architecture related documents refer to documents or descriptions of the physical hardware and software installations of the various BI technologies along with an outline of the application and role sharing amongst hardware servers.

4.4.1 Interviews

Semi-structured interviews were identified as main source of evidence at the onset of the study (also referred to as phase one). A semi-structured interview refers to an interview guided by a pre-defined template containing both closed-ended as well as open-ended questions, allowing the participant to share opinions and views freely. The development of the template is discussed in detail in chapter five. As mentioned by Myers (2009:38) *"interpretive researchers assume that access to reality (given or socially constructed) is only through social constructions such as language, consciousness, shared meanings, and instruments".* The main reason for selecting a semi-structured interview method for this study can be attributed to the requirement to gather data across various organisations in a consistent manner. In addition, pre-defined interview questions allowed for a structured approach to the interview process and perhaps facilitated analysing the data for the researcher as this is easier than unstructured interviews. The approach also allowed for a higher response rate when compared to online questionnaires. Not only is data gathered in person by the interviewer, but the process and subsequent data gathered are controlled by the interviewer. Both the physical and social environment in which the interview is conducted can be closely monitored (although not controlled) and responses can be analysed taking cognisance of these possible interferences. The respondent's interpretation of questions and responses can be clarified and confirmed to gain a full understanding of responses.

Interviews had also been used before the final version of the BI balanced scorecard was confirmed (referred to as phase two). This mechanism was used to verify and confirm that the data had been gathered and presented using the BI balanced scorecard. Each of the four study participants were given the opportunity to comment on the intermediate version of the BI balanced scorecard. No interview template was used. This activity was also used to confirm that the interviewees' responses to questions had been captured and applied correctly.

Both phases are discussed in more detail below.

4.4.1.1 The interview process: Phase one

In order to ensure research plausibility (Myers 2009, 2013), it is imperative that the researcher should disclose as much information as possible about the research process. For this reason, the interview process is disclosed in more detail.

Prior to the scheduled interviews, the template was submitted for ethical approval to the relevant institutional body (see Annexure G). Once the approval had been obtained, a copy of the interview template was distributed to participants using e-mail before the actual scheduled interview. As part of the interview template, a 'Participant Permission Form' was distributed indicating the research background, purpose of the study, research benefits and risks as well as methods used. Participant's rights were also articulated in this form. This is discussed in more detail as part of the ethical consideration section of this chapter. A copy of the 'Participant Permission Form' is attached as an annexure to the study (see Annexure D).

The semi-structured interview template (as described in detail in chapter five) was used as a flexible guide in the interview process to gather data and subsequently categorise these for analysis purposes. In some instances, participants were given the opportunity to select particular categories whilst the remainder of the questions were flexible and open ended. Participants were never forced to make any selection. Interview participants, in this instance, were seen as co-researchers.

All the interviews were conducted by one researcher to ensure consistency with regard to the interview process and interpretation of feedback. The process was limited to approximately one to two hours, although this was quite challenging due to the number of questions contained in the interview template. Interviews were conducted on-site.

The researcher is currently employed as a Business Intelligence manager. Although care has been taken to limit the influence of the researchers' bias towards the value of Business Intelligence implementations the reader should be cognisant of possible inferences. As mentioned by Orlikowski and Baroudi (1991:15): *"The interpretive research approach towards the relationship between theory and practice is that the researcher can never assume a value-neutral stance, and is always implicated in the phenomena being studied".* However, the exploratory research could not have been conducted without a prior in-depth understanding of the various components and

dynamic interactions between these components. The background of the researcher was therefore invaluable to the construction of the semi-structured interview template, the interview process as well as the analysis and interpretation of data.

4.4.1.2 The interview process: Phase two

As mentioned above, an interview approach was also adopted to verify the final artefact produced as part of the study. Once the intermediate balanced scorecard had been constructed, it was distributed by e-mail to all the participants. All the participants were contacted telephonically or VoIP (Voice-over-Internet Protocol) tools were used to conduct interview sessions. An open ended interview process was adopted to obtain as much related feedback as possible. This was included in the research process for two main reasons. Firstly, the balanced scorecard strategy map was generated based on data received from interview respondents. Respondents should therefore verify that the interpretation of their input is correct and valid. Secondly, the model is tested for accuracy, ensuring that the constructed model indeed produces the intended results. This artefact was used as a tool to answer the research questions in the study.

Verification interviews were conducted with the same participants in the initial interviews over a period of a month. In addition, a number of BI business practitioners were also asked to provide their input on various aspects of the proposed BI balanced scorecard strategy map namely completeness, verification and usability. This contribution was considered due to their extensive practical knowledge with regard to BI. All these contributions will hopefully assist towards a validated toolset to investigate the value of BI in organisations.

4.4.2 Physical artefacts

Physical artefacts as a source of evidence (in the context of case studies) refer to physical evidence of an implementation. In the context of the study, physical artefacts refer to a demonstration of the BI solution developed and implemented in the organisation. This might include dashboards (executive, strategic or operational), reports as well as the analytical competency of data structures used in the organisation. In some instances, the extent to which the artefact was utilised was

influenced by the capability of the toolset as well as the ability of the demonstrator. The demonstration of the artefact also provided rich insight into utilisation of the BI products as described during the interview process.

4.4.3 Technical architecture documentation

Although the original technical architecture documentation was not formally disclosed to the interviewer, the interviewee disclosed enough detailed information about the back-end physical structures to construct a high level architecture diagram. The outline of the architectural components was evaluated in support of the questions contained in the semi-structured interview.

4.4.4 Company websites

The various company websites provided valuable information to understand the nature of the business of the various organisations participating in the studies. Value investigations can only be fully understood and explored if the nature of the business and the various role players involved in their immediate environment are understood.

4.5 Working with data

The same data analysis approach is adopted for both phase one and two of the interview process. Important considerations with regard to the data analysis approach are communicated in the first section whereafter the actual data provisioning is discussed in more detail.

4.5.1 Data analysis approach

The data analysis process is directly influenced by a number of independent variables inadvertently introduced by the researchers' background, experience, frame of reference and beliefs. It is important to disclose these independent variables as they influence the lens through which the data is analysed. Also, these preconditions should be disclosed for research transparency purposes. These variables include:

- The researcher is currently a private practitioner with practical working knowledge of a BI environment. This background contributes to an in-depth understanding of

the phenomenon within the boundaries of this research. Myers (2009, 2013) confirms this point of view and postulates that the researcher must have some high level knowledge of the topic under investigation. This was also an advantage as it offers the opportunity to perform data analysis without the help of qualitative software toolsets. However, researcher bias is often a problem in qualitative research where scenarios are observed and interpreted. The challenge, therefore, is to take cognisance of this challenge and ensure that the research, and particular the data analysis, are approached considering possible bias influences.

- The researcher offers a critical perspective to the research due to extensive involvement in previous BI project failures. Due to the combination of practical experience, the critical perspective is vastly different from the point of view of academic scholars.
- The extensive practical knowledge contributes to an appreciation for the complexities and challenges introduced by BI implementations. This experience, influenced by the epistemological viewpoint adopted, suggested the adoption of a theoretical (or an inductive approach) (Braun & Clarke 2006). This type of approach (theoretical or inductive) *"tend(s) to be driven by the researcher's theoretical or analytic interest in the area, and is thus more explicitly analyst-driven"* (Braun & Clarke 2006:84). The data coding is also performed with a particular research question in mind which is rooted in the theoretical framework or approach adopted for the study.
- The researcher has a general interest in the topic of BI and subsequent academic contribution. Due to the general interest, a theoretical approach to the study was adopted whereby literature was evaluated prior to any data analysis attempts.

A thematic data analysis approach is selected to analyse the data obtained from the primary source of evidence, namely interviews. *"Thematic analysis involves the searching across a data set – to that a number of interviews or focus groups, or a range of texts – to find repeated patterns of meaning"* (Braun & Clarke 2006:86). This method is used firstly to perform in-case analysis to identify individual themes. This is followed by cross-case analysis to compare the themes identified in the various individual case studies with each other.

When conducting thematic content analysis, both Braun & Clarke (2006) and Vaismoradi *et al*. (2013) outline a number of prescriptive phases to follow. These phases are considered during the actual data analysis process:

1) Familiarize yourself with the data. This includes transcribing, reading and taking notes.
2) Identify and generate an initial coding structure to code interesting features of the data across all the subsets of data.
3) Group initial codes together to generate common themes across the data. A thematic map is created.
4) The themes identified are defined in more detail and named accordingly.
5) Produce a report on the overall story based on the themes identified.

This process was repeated twice. Firstly, the current structure of the semi-structured interview template was not considered. All transcriptions were evaluated to identify possible codes and themes. This was done according to prescriptions to conduct thematic analysis according to Braun & Clarke (2006) and Vaismoradi *et al*. (2013). However, the semi-structured interview was constructed using a particular outline to assist with the data coding and identification of themes. For this reason, the analysis phase was repeated. The first version of the thematic map was used as basis to expand on. A final thematic map was constructed. The data analysis process is described below.

4.5.2 Data analysis process

The data obtained from the interviews were captured within eight hours on completion of the interviews. This was imperative as the interviews could not be recorded due to the sensitive nature of the data[15]. Although interview notes were made during the interview process, some of the information was captured using memory recall. The correctness of the captured data was verified as part of the verification process of the preliminary BI balanced scorecard (also referred to as 'the interview process phase two'). In one instance a research participant was not available for a face to face interview. For this reason the interview template was completed electronically. The researcher clarified and confirmed her understanding of the question responses using telephone communication.

[15] The competitive advantage of organisations is often contained in the implementation, application and utilisation of Business Intelligence tools, techniques and technologies.

In the remainder of the interviews, the data was captured directly after the interview on the interview template. Once all the interviews were concluded all the responses from all interviews were re-captured, per question, on a spreadsheet. For example, the response to question one was captured in corresponding cells on the same row. This method allowed for easy comparative analysis. A copy of the captured data is attached as an annexure to this document (Annexure F).

Phase one: The data was analysed without considering any theoretical framework adopted in the study. This was to identify all the possible themes not necessarily included by the framework. A preliminary thematic map was constructed.

Phase two: The data analysis process was repeated using the preliminary thematic map as starting point. During this phase, the structure of the semi-structured interview (based on the theoretical framework of the study) was considered. The following approach was used to expand on the preliminary thematic map:

Each interview question focused on the lowest individual item on the balanced scorecard strategy map. Therefore, each question is seen as a meaningful unit as it relates back to a particular KPI identified on the BI balanced scorecard and collectively contributes to each of the balanced scorecard strategy map objectives and subsequent perspectives. The same coding system (i.e. numbering approach) is used in both the proposed BI balanced scorecard (diagrammatical and tabular versions) and the interview template. This allows for easy feedback traceability relating to the appropriate balanced scorecard strategy map objective and organisation of data for analysis purposes.

The organising of data into these structures was formally referred to as domains in literature (Elliot & Timulak 2005). In this instance, each of the perspectives on the balanced scorecard strategy map was identified as a domain, therefore five in total. The first domain focused on demographic information depicting the characteristics of the study participants. The remainder of the domains included a domain for each of the perspectives, i.e. domain two was the business value domain, domain three was the user orientation objective, domain four was the operational excellence domain

and domain five was the future orientation domain. The domains were used for two main reasons. Firstly domains are important for the categorisation of data for analysis purposes. During the categorisation process the data, every bit of data including the open ended interactive type of dialogue questions were compared to each of the identified categories, classified and sorted accordingly. Secondly, the anticipated kind of relationship under investigation is the causal link between the various items in the balanced scorecard strategy map that contribute to the final identification of the true business value identified by respondents. The relationships between categories are identified and depicted graphically. As a final step, main findings could be abstracted using the balanced scorecard strategy map as taxonomy for describing and interpreting the findings and phenomena in the data. The data categorisation process is diagrammatically displayed in figure 13.

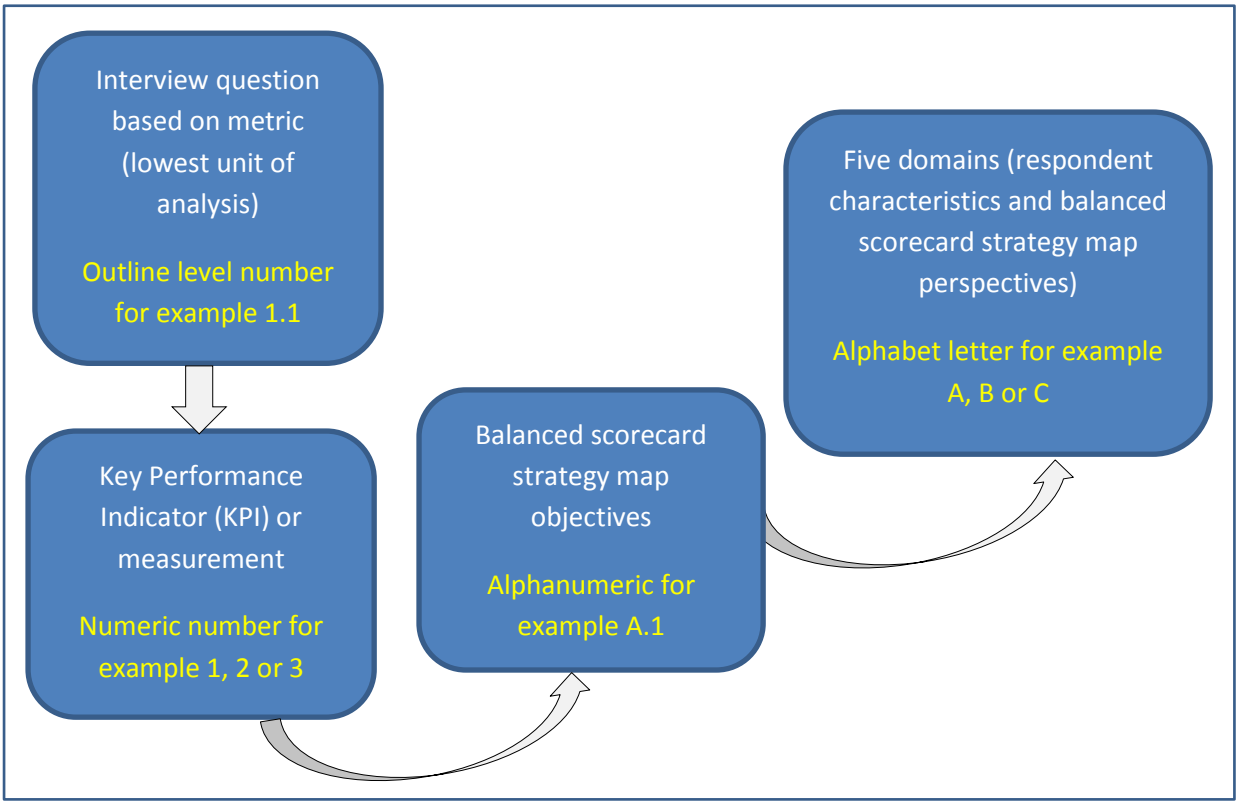


Figure 13 - Diagrammatical presentation of data categorisation for coding purposes based on the theoretical framework

4.6 Written record

The research process as well as the output of each research task was recorded in detail. Apart from the written record contained in the document, various visual aids were used to graphically depict data. These included:

- A framework of BI value research diagrammatically categorizing the existing research focusing on BI value research after an extensive literature review (chapter two);
- A BI balanced scorecard strategy map containing measurements, objectives and perspectives customized for the BI environment, also referred to as the preliminary version (chapter five);
- Graphs displaying demographical data gathered as part of the interview process (chapter six);
- Graphs graphically depicting the feedback received from interview respondents (chapter six);
- BI balanced scorecard used to interpret and visually summarize data gathered, also referred to as the intermediate version (chapter seven);
- Final version of the BI balanced scorecard after the verification process (chapter eight);
- A visual representation of the first preliminary version of the BI balanced scorecard strategy map is included as an annexure to the study (Annexure C). This strategy map was not verified by the study participants but used as basis for the construction of the semi-structured interview template.

Other written outputs, not using graphical representation included:

- A spreadsheet used to record the collected data (Annexure F);
- A matrix used to classify, categorize and synthesize the concept of BI in support of the definition of BI adopted for the purpose of this study (chapter two);
- A table summarizing the BI value models, frameworks, tools and techniques with the contribution, area of contribution as well as the corresponding author (in support of the BI value research framework) (chapter two).

4.7 Ethical considerations

The research was conducted considering the ethical aspects of the various participants in the study. As confirmed by Oates (2006), various research participants and their respective rights should be considered when embarking on any study. The participants included the researcher, the participants (or interviewees) as well as the tertiary institution which enforces its own set of institutional ethical codes.

The researcher considered the ethical principles in line with some of the aspects identified by Myers (2009, 2013):

- The researcher, when in doubt about potential ethical questions, considered the appropriate action acceptable should the researcher be the participant.
- The research process was conducted with honesty. Data was recorded and presented accurately and to the best of the researchers' ability to reflect the real state of the findings.
- The necessary informed consent was obtained from all research participants prior to the research. The rights of participants were clearly articulated and included the voluntary participation in the study; the right to withdraw from the study at any given time; measures to ensure that the privacy and dignity of participants are not violated with the utilisation of any device or voice recordings without the necessary permission; data gathered will be treated with the necessary confidentiality and will remain completely anonymous; the participant's identity will not be revealed and any conclusions derived from the study will be treated as anonymous; the content of both the participant permission form and interview template will be clearly explained before the start of the interview process; and the results of the study will be used for research purposes and may be published.

In addition to the above principles, the researcher has considered UNISA's policy on research ethics during the study. A copy of the successful ethics clearance confirmation is attached as an annexure to this document (Annexure G).

4.8 Chapter conclusion

An interpretive philosophical approach was adopted based on a constructivist epistemology to facilitate an in-depth investigation into the stated research problem.

A multiple-case study approach was selected after careful consideration of both strengths and weaknesses of the method. Various sources of evidence (or additional data sources) were used to obtain additional supportive data, namely physical artefacts, technical architecture documentation and company websites. All these items were considered as part of the first phase of the interview process. The second phase of the interview process focused on the verification of the intermediate version of the BI balanced scorecard. No interview template was used to obtain as much as possible information from participants.

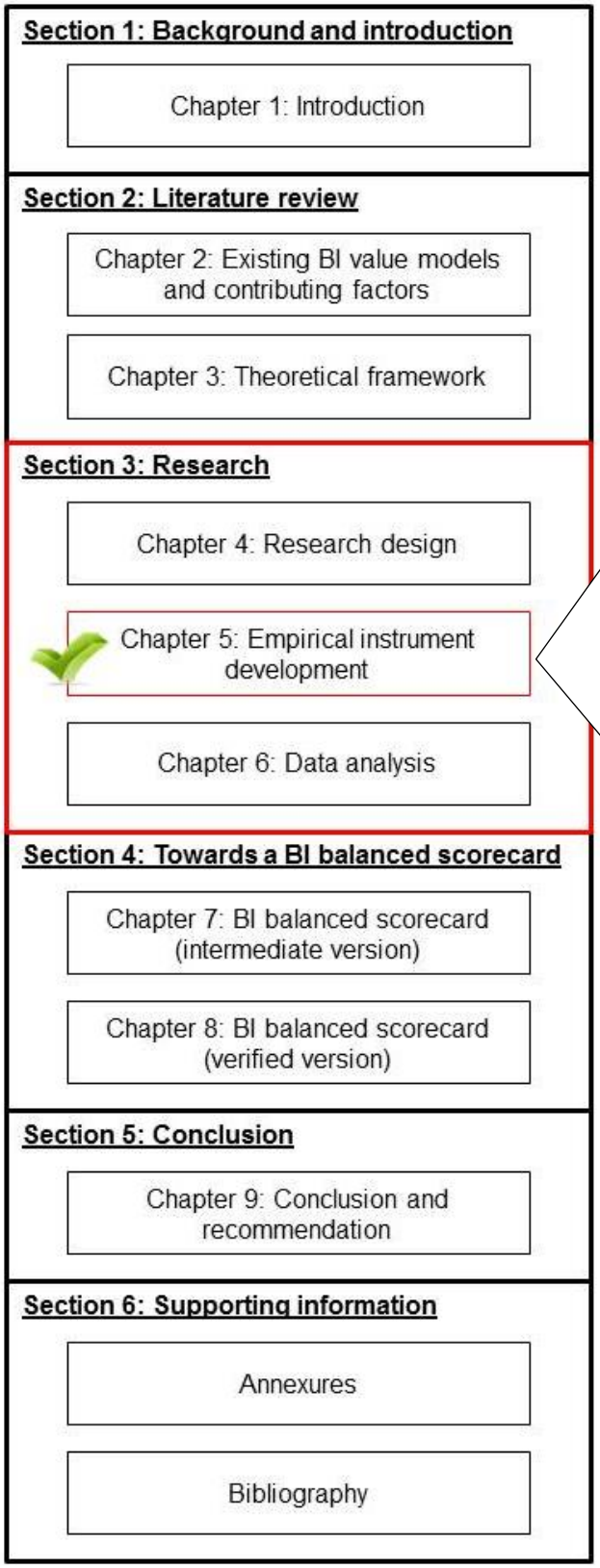
The thematic content analysis approach adopted for the purpose of data analysis was disclosed. The data analysis processes also contained two phases. As part of a first phase, the data was analysed without considering any theoretical framework. A preliminary thematic map was constructed and re-used in phase two of the analysis process.

The next chapter (chapter five) proposes a customized balanced scorecard strategy map for a BI environment based on the current traditional, generic balanced scorecard strategy map approach for IT. This balanced scorecard strategy map was used to develop questions for a semi-structured interview template used to investigate the value of BI in organisations. The questions were based on lower level metrics for each of the four identified perspectives and objectives. The final list of metrics was verified against literature focusing on the topic of critical success factors for Business Intelligence environments.

Chapter 5

Empirical instrument development

A sub-section of the Business Intelligence balanced scorecard strategy map presented as part of this chapter was presented at the 2014 ITOM Workshop, pre-ECIS conference, Tel Aviv, June 2014. *"Rethinking the value of Business Intelligence and Analytics (BI&A) – a balanced scorecard approach", Eybers, S., Kroeze, J.H. and Strydom, I.* The feedback received during this session was considered and implemented (where appropriate) in this chapter.



Content

5.1 Introduction

The main objective of this chapter was to develop and verify an empirical instrument to support the main objective of this study, namely to establish the value Business Intelligence adds to organisations. The instrument suitable for data gathering purposes was a semi-structured interview template. The proposed template was based on the theoretical framework, namely a BI balanced scorecard strategy map and focused on measurable items (or Key Performance Indicators) contained in the strategy map.

The first section of this chapter discusses the development approach followed in the construction of both the BI balanced scorecard strategy map as well as the semi-structured interview template. Subsequently, the proposed BI balanced scorecard is discussed, including elements such as the mission and vision, four scorecard perspectives and objectives as well as Key Performance Indicators (KPIs). The identified KPIs are linked between the various perspectives to generate the BI balanced scorecard strategy map. Finally, questions are based on the various KPIs within the strategy map and included in a semi-structured interview template. The template was used as primary data gathering instrument and, therefore, tested for completeness, reliability and validity. During the testing process, all questions were reviewed to ensure alignment with the main research objective (to establish the value of Business Intelligence to organisations).

5.2 Development approach

A pragmatic development approach was adopted to construct a BI balanced scorecard strategy map as foundation for the semi-structured interview template. This approach was in line with guidelines introduced by the originators of the balanced scorecard concept (Kaplan & Norton 1992) and diagrammatically presented in Figure 14 in line with the chapter outline. The following steps were identified:

- Step one was to research, identify and substantiate the appropriate theoretical framework for the study. This was concluded in the proposal stage of the research and selection was further substantiated in chapter two and three of this document.

- A generic BI balanced scorecard was created as starting point for the proposed BI balanced scorecard strategy map. The generic BI balanced scorecard was constructed using two main resource pools. Firstly, various academic literature sources focusing on the topic of BI and success have been consulted. Secondly, the concept of the preliminary BI balanced scorecard was based on prior work conducted by Van Grembergen and Van Bruggen (1997), Van Grembergen and Timmerman (1998), Martinsons *et al.* (1999) and Van Grembergen (2000).
- Once the BI balanced scorecard foundation has been constructed, the following was developed:
  - BI vision and strategy;
  - Perspectives and objectives;
  - KPIs: the proposed KPIs of the IT balanced scorecard was used as foundation for identifying, confirming and finalizing measurable items for each of the objectives. In addition, these KPIs were checked against the literature pool of CSFs obtained from academically published literature.
- As a final step, the selected measurements and performance outcomes were linked to display the anticipated cause and effect relationships.
- The completed strategy map was distributed to a number of BI industry experts currently performing consulting services across various industries. Their input was considered and implemented where appropriate.
- The revised version of the strategy map was used as the foundation for the construction of the interview template questions.
- The template was tested in a pilot interview with senior managers (the same level as the target population of this study). This step was included to ensure that the questions were unambiguous and that the instrument returned the expected results.

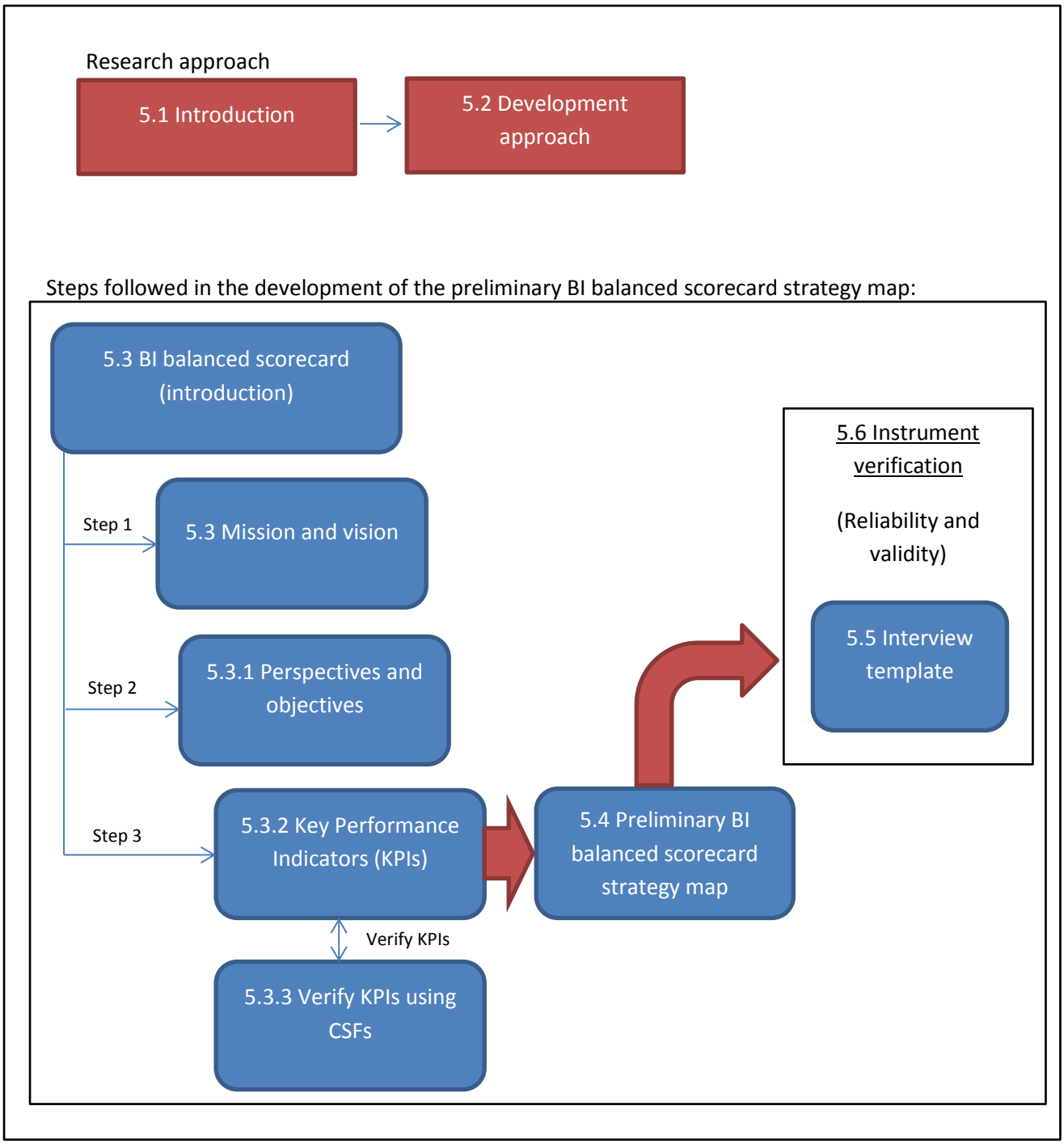


Figure 14 - Chapter five: mapping of concepts

5.3 The Business Intelligence balanced scorecard

The Business Intelligence second generation scorecard approach was selected as theoretical framework to investigate what value Business Intelligence adds to organisations. The first step in the investigative process, based on the theoretical framework selected, was to develop a balanced scorecard for Business Intelligence. Only once a balanced scorecard has been constructed, can a lower level strategy map for Business Intelligence be developed.

When creating a balanced scorecard the focus should be on establishing a clear vision and strategy for implementing BI in the organisation. Business Intelligence is the combination of products, processes and technologies supplying the right information to the right people at the right time in support of decision-making. Business Intelligence value, on the other hand, is the perceived (positive) contribution of BI technologies, products and processes to the overall positive status of the organisation. Maximum business value can only be achieved where traces of all of the BI elements (technologies, products and processes) have been (correctly) implemented. Based on the definition of BI, the BI vision and strategy is, therefore, to support all facets of organisational decision-making through a combination of products, processes and technologies. The objective is to provide the business with the right information at the right time, to the right people in a usable format so that they can make better, informed decisions faster. The strategy, therefore, is to empower and equip employees with information to make better decisions in order to support the overall strategic goal of being profitable.

5.3.1 BI balanced scorecard perspectives and objectives

As a second step in the balanced scorecard development process, the various perspectives were identified and adopted based on the various balanced scorecard versions supported by a strategic objective for each of the perspectives. For the purpose of the study, a combination of the empirically verified IT balanced scorecards as introduced by Van Grembergen and Van Bruggen (1997), Van Grembergen and Timmerman (1998), Martinsons *et al.* (1999) and Van Grembergen (2000) were adopted. The perspectives were:

- The **business value perspective** focuses on how the BI function is perceived by the business, i.e. what business value does BI add to the organisation? The objective is, therefore, to implement a BI capability that will increase long-term stakeholder value. In order to support this objective, BI will have to contribute to lower input costs (cost control, Martinsons *et al.* 1999), make better informed decisions to increase sales and subsequent revenue and growth (business value from BI projects as well as business risk, Martinsons *et al.* 1999), and ensure that the BI investment is profitable and return the benefits to support the capital investment as expected by stakeholders (business value of the BI function, Martinsons *et al.* 1999).

- The **user orientation perspective** focuses on meeting the service delivery expectations of both internal 'customers' (employees) as well as external clients. The objective is to deliver exceptional customer service which can only be achieved by supplying employees with fast, accurate information. Also, quality products should be offered to clients, while BI should provide information to improve or implement products according to client's requirements. The products should be offered at a competitive price in line with what competitors are offering. External customers should be able to use inter-organisational systems which should be user friendly and reliable.

- The **operational excellence perspective** focuses on BI in support of effective IT processes, namely planning, development and operations (Martinsons *et al.* 1999). The organisation should plan and focus on high priority BI implementations, develop and introduce new BI applications where necessary, and support and maintain current BI applications.

- The **future orientation perspective** focuses on anticipating and developing knowledge and skills in terms of resources in order for the organisation to remain a sustainable entity. This includes the identification and introduction of new technologies within the organisation whilst existing technologies are still within the expected life span. Also, from a BI perspective, this implies that the employees should have the necessary know-how (i.e. the ability to utilise the BI

tools acquired through training), technological tools (i.e. BI applications) to obtain data from the BI environment (for example a data warehouse) as well as a culture of knowledge discovery and sharing.

A summary of the proposed preliminary version of the Business Intelligence balanced scorecard perspectives are depicted in Table 15. Table 16 contains a list of objectives identified for each of the four perspectives.

Business value perspective	**User orientation**
What business value does BI add to the organisation in support of organisational goals and objectives?	Does the BI department meet the service delivery expectations of both internal 'customers' (employees) as well as external clients?
Operational excellence	**Future orientation**
Does the BI capability support effective processes, namely planning, development and operations?	Do we have the BI skills and technologies to stay competitive and meet future challenges (Van Grembergen, 2000)?

Table 15 - BI balanced scorecard perspectives (derived from the IT balanced scorecard (Van Grembergen & Van Bruggen 1997))

Perspective	**Objective**
Business Value	Control of BI expenses
	Business value (BI projects and BI department)
	Risk management
	Stakeholder perception
User Orientation	Access to information
	Customer service
	Customer relationships
Operational Excellence	Planning and implementation
	Development
	Operations and maintenance

Perspective	Objective
Future Orientation	BI capability development
	Research into emerging BI technologies and trends
	Applications portfolio

Table 16 - Summary of BI balanced scorecard perspectives and objectives

5.3.2 BI balanced scorecard measureable items (KPIs)

The original Kaplan and Norton (1992) balanced scorecard is well-known for the utilisation and implementation of key performance indicators (KPIs). These KPIs are based on specific desirable outcomes identified for each of the perspectives and subsequent objectives.

An additional characteristic of the utilisation of KPIs is the utilisation of leading and lagging indicators. However, due to the subjective nature of indicators, it was decided that the consideration of this additional characteristic is out of scope for the purpose of the study. For example, a particular KPI can either be leading or lagging depending on the context in which the KPI is applied and the purpose for which the KPI is considered.

5.3.2.1 Business value perspective KPIs

As mentioned above, the mission of the business value perspective is to implement and maintain a BI capability that will increase long-term stakeholder value. Also, BI should contribute to the achievement of the overall organisational goals. In support of the business value perspective, four objectives have been identified namely the control of BI expenses, the business value of both the BI department and projects, risk, as well as the management of stakeholder perception (Table 16).

The control of BI expenses (Van Grembergen *et al.* 2003) or costs (Martinsons *et al.* 1999) are one of the few objectives where tangible measurements could be identified to support the objective. The identified measurements were:

- Cost variance of BI projects compared to an acceptable standard (derived from Van Grembergen *et al.* 2003);

- Cost of BI projects compared to the allocated BI project budget (similar to the provisioning of an adequate budget as identified by Fedouaki, Okar & Alami 2013);
- Cost Performance Index (CPI);
- BI expenses per user (for example, product licensing costs) (derived from Van Grembergen *et al.* 2003);
- Actual expenses compared to budgetary allocation of items (derived from Van Grembergen, *et al.* 2003);
- Total BI budget as a percentage of IT and overall turnover (derived from Van Grembergen *et al.* 2003).

One of the objectives of the business value perspective is to establish the business value of existing or new BI projects (Van Grembergen *et al.* 2003; Martinsons *et al.* 1999). Financial measurements in support of the study include earned value[16], ROI[17], NPV[18], IRR[19] and Payback Period[20] calculations (Van Grembergen & Van Bruggen 1997). In addition, the Information Economics[21] method (Van Grembergen & Van Bruggen 1997; Parker & Benson 1987) can be utilised to establish the business value of the BI department (Van Grembergen 2003). Other measurements include the perceived increase in sales as a result of BI system utilisation.

The management of risk is vital to the achievement of business value. The management of risk has been identified by Martinsons *et al.* (1999) and can be measured using the risk section of the Information Economics method (Parker & Benson 1987). Risk measurements include calculations for business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk and project risk.

[16] Earned value: A project management technique used to measure project performance and progress using project scope, project schedule and project costs in the calculation.
[17] ROI: Return on Investment refers to the evaluation of an investment considering the benefit to the investor when compared to the investment cost.
[18] NPV: The Net Present Value refers to the difference between the present value of cash inflows and the present value of cash outflows.
[19] IRR: Internal Rate of Return is an approach used in capital budgeting. The discount rate is used to set the nett present value of project cash flows equal to zero for ease of comparison.
[20] Payback period: An approach used in capital budgeting referring to the period of time required for the investment to settle the sum of the original capital investment amount.
[21] Information Economics: A decision making approach popularised by Parker, Benson & Trainor (1988) used in the calculation of the value of an investment. The approach includes the value of intangible measures not normally considered in traditional financial methods.

Finally, a positive stakeholder perception is the last objective of this perspective. The measure identified in support of the objective is the subjective measurement of management's perception of the BI department (derived from Martinsons *et al.* 1999).

A summary of the proposed measurements for the business value perspective is depicted in Table 17.

Perspective	**Objective**	**Measure**
Business value	Control BI expenses	Cost Variance
		Cost Performance Index
		BI expenses per user
		Actual expenses compared to budget
		Total BI budget as a percentage of IT and overall turnover
		Project cost variance against acceptable standard
	Business Value	Earned value
		Return on Investment, Net Present Value, IRR, Payback Period
		Information economics
		Perceived increased sales as a result of BI system utilisation
	Risk severity and occurrence	Information Economics:
		• business strategy risk
		• business organisational risk
		• IT strategy risk
		• definitional uncertainty
		• technical risk
		• IT service delivery risk

Perspective	Objective	Measure
		• project risk
	Stakeholder perception	Management's perception of the BI department (measured using surveys)

Table 17 - Summary of measurements for the business value perspective

5.3.2.2 User orientation perspective KPIs

The mission of the user orientation perspective is to meet the internal and external user expectations by providing exceptional service through the fulfilment of information requirements. Three objectives have been identified in support of the mission, namely fast access to the right information when needed, exceptional customer service and the building of strong internal (users) and external customer relationships.

In order to achieve the objective of timely access to information when required, the following measurements have been identified:

- Time measured in minutes to obtain information;
- Number of times logged on to the BI system (Isik 2010; Nelson *et al.* 2005);
- Perceived usefulness of information (Clark *et al.* 2007; Farley 1998);
- Intention to use the BI system (Dinter *et al.* 2011).

Both the time measured in minutes to obtain information and the number of times logged on to the BI system are quantitative measurements. The perceived usefulness of information and the intention to use the BI system are subjective measurements assessed using subjective measurement methods such as Likert-scale scoring.

The objective of exceptional customer service (Martinsons *et al.* 1999; Van Grembergen *et al.* 2003) is a perception of both internal and external BI users. Subjective measurement methods are, therefore, utilised to establish both the internal and external BI user satisfaction rates (Adamala & Cidrin 2011; Chen *et al.* 2000; Dinter *et al.* 2011; Lonnqvist & Pirttimaki 2006).

One of the objectives of the user perspective is to establish and build relationships between internal and external clients. The measurements used to support this objective is the number of current clients compared to the number of clients for the same period the previous year; the number of new clients; number of BI users actively using the system (Hawking 2011), as well as the user enthusiasm for using the BI system (McMurchy 2008). Although the measurement of user enthusiasm can be challenging, the number of active BI users can give an indication of user enthusiasm. This can also be an indicator of user acceptance, an important critical success factor for BI (Chenoweth, Corral & Demirkan 2006).

A summary of the objectives and measurements are presented in Table 18.

Objective	**Measure**
Access to the right information when needed	How long it takes to obtain information (measured in minutes)
	Number of times logged on to the BI system
	Usefulness of information (subjective)
	Intention to use (subjective)
Exceptional customer service	Internal BI user satisfaction rate (subjective)
	External customer satisfaction rate (subjective)
Relationship building with internal and external clients	Number of current clients compared to the previous selected period
	Number of new clients compared to the previous selected period
	Number of active BI users
	User enthusiasm (subjective)

Table 18 - Summary of user orientation measurements

5.3.2.3 Operational excellence KPIs

The mission of the operational excellence perspective is to support the organisation in achieving goals by effective BI processes. In order to achieve the mission, proper BI project planning should be conducted in order to ensure successful project implementations. In addition, BI should function using efficient operational processes

and contribute to the overall operational efficiency of the organisation. Proper maintenance and development tasks should be contained in the BI competency to ensure that the BI system is in good condition, stable and reliable.

The planning and implementation objective is in line with good project management practice and refer to the successful implementation of the BI project(s) (derived from Van Grembergen 2000). The measurements identified to support this objective are the:

- Number of BI tools and projects implemented on time in relation to the total number of BI projects completed;
- Number of BI tools and projects implemented within budget in relation to the total number of BI projects completed.

The objective of providing efficient BI operations and maintenance tasks is the second objective in support of the operational excellence perspective. This objective is derived from the IT balanced scorecard presented by Van Grembergen (2000). One of the aspects measured as part of this objective refer to the issue of data reliability, consistency and quality. It was quite challenging Identifying measurements relating to this objective due to the subjective nature of this objective. For example, various stakeholders and data consumers might disagree on the quality of the data output. Technical MIS resources might rate data quality high due to positive scores achieved using simple ratio measurements (objective evaluation). On the other hand, end users of the data might rate the quality of the same data low if not analysed in the correct business context (subjective evaluation) (Pipino, Lee & Yang 2002). The target population of this study is stakeholders from business and the problem under evaluation is of non-technical nature. For this reason, the evaluation is subjective focusing on the participants' *perception* of data reliability, data consistency and data quality. The list of measurements includes:

- Time in minutes to obtain an existing report (system response time) (Hawking 2011; Van Grembergen 2000)
- Time in minutes to obtain a new report (system response time, Hawking 2011; Van Grembergen 2000)
- Time in minutes for unplanned system downtime (system availability, Van Grembergen 2000)

- Number of unplanned BI system interruptions (system availability)
- Number of planned BI system interruptions (system availability)
- Number of operational failures (system reliability, Hawking 2011)
- Data accuracy rate
- Data availability rate (data reliability, Hawking 2011)
- Data consistency rate (Hawking 2011; Rudra & Yeo 2000)
- Data quality rate (Hawking 2011)
- System quality rate (Clark *et al.* 2007; Dinter *et al.* 2011; Wixom & Watson 2001)
- Customer / user satisfaction rate (service quality) (Dinter *et al.* 2011)
- User friendliness rate (Fedouaki, Okar & Alami 2013; Hawking 2011), although this measure is related to the time spent on training with the associated cost.
- Provide information to the right people at the right time

Finally, information or data quality was identified by Dinter *et al.* (2011), Fedouaki, Okar & Alami (2013) and Hawking (2011). For the purpose of this study, this key performance indicator was included in the data quality rate measure.

Another objective of the operational perspective is to develop the BI capability within the organisation. BI developments should cover all aspects of the business as well as its supportive processes (Fedouaki, Okar & Alami 2013; Hawking 2011). It is, therefore, important to measure the extent to which business processes and business performance measurements are covered in the BI solution (Hawking 2011). This will ensure that BI, in particular the organisational data warehouse as well as other data structures - provides the relevant information when required by the organisation. For this reason, BI solutions are often referred to as providing departmental users access to one source system containing all the required data. This is also known as ‘one version of the truth’. This view is supported by Sammon and Finnegan (2000) as well as Isik (2010). They suggested that the data should be integrated across various applications into one structure (such as a data warehouse) and should contribute to specific BI critical success factors (identified in their study).

Other technical related items identified as CSFs in BI studies included metadata management (Little & Gibson 2003; Watson & Haley 1998), as well as a structured

approach to BI development (Adamala & Cidrin 2011; Little & Gibson 2003). The issue of metadata management was not included as a measurement as business stakeholders might not be familiar with the technical terminology.

A summary of the objectives and measurements is presented in Table 19.

Objective	**Measure**
Planning and implementation	Number of BI projects and tool implementations on time in relation to the total number of BI projects completed (overall scheduled performance index; schedule variance)
	Number of BI projects and tool implementations within budget in relation to the total number of BI projects completed
Operations and maintenance	Time in minutes to obtain an existing report
	Time in minutes to obtain a new report
	Time in minutes for unplanned system downtime (system availability)
	Time in minutes for planned system downtime (system availability)
	Number of unplanned BI system interruptions
	Number of planned BI system interruptions
	Number of operational failures (system reliability)
	Data accuracy rate
	Data availability rate (data reliability)
	Data consistency rate
	Data quality rate
	System quality rate
	User friendliness rate
	Number of up-sell and cross-sell opportunities using data obtained from BI systems
Development	Percentage of business processes and business performance measurements covered in BI solution
	Methodology followed during development

Objective	Measure
	Number of users involved in the development process (including user requirements gathering and testing)

Table 19 - Summary of operational excellence measurements

5.3.2.4 Future orientation KPIs

The objective of the future orientation perspective in the strategy map is to retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

In support of the mission statement, three objectives have been identified. The first objective focuses on the development of expertise levels to cater for the current and future BI knowledge and skills requirement. Secondly, the current applications portfolio should be monitored to ensure that the current BI tools are available, supported, and in line with the user's expectation rate. Finally, the research into emerging technologies and trends will ensure that the organisation stay abreast with competitors in using the best tools and techniques available to deliver a BI service.

The first objective focuses on ensuring that the BI users are equipped with the necessary expertise levels (Van Grembergen *et al.* 2003). This includes the development of BI specialist capabilities (Martinsons *et al.* 1999), as well as training and education of BI personnel (Van Grembergen *et al.* 2003). The following measurements have been identified:

BI specialist capabilities (Martinsons *et al.* 1999):

- Number of employees with BI technology skills (per technology) (derived from Martinsons *et al.* 1999; Dinter *et al.* 2011; Fedouaki, Okar & Alami 2013)
- Number of employees with BI technology skills for emerging technologies (derived from Martinsons *et al.* 1999; Dinter *et al.* 2011)
- Age distribution of BI staff (derived from Martinsons *et al.* 1999; Van Grembergen 2000)
- Number of years of BI experience per staff member (Van Grembergen 2000)

- Perceived satisfaction of BI employees (Martinsons *et al.* 1999)
- Turnover or retention of BI employees (Martinsons *et al.* 1999; Chasalow 2009)
- Productivity of BI employees (Martinsons *et al.* 1999)

Training and education of BI personnel (Van Grembergen *et al.* 2003):

- Number of days BI human resources attended BI-related educational activities (Van Grembergen 2000; Chasalow 2009; Clark *et al.* 2007; Dinter *et al.* 2011; Hobek *et al.* 2011);
- BI training and development budget as a percentage of the overall IS budget (Martinsons *et al.* 1999; Van Grembergen 2000);
- BI training and development budget as a percentage of the overall BI budget (derived from Martinsons *et al.* 1999; Van Grembergen 2000);
- Number of times an external consultant is contracted to perform internal BI tasks (Little & Gibson 2003).

It is important to keep track of the BI applications portfolio within the organisation (Martinsons *et al.* 1999). This will ensure that the current application portfolio is not outdated, the technical performance of applications are in line with user expectations as well as the user satisfaction rate. It contains strong elements of the operational health and performance of the applications. The following measurements have been identified by Van Grembergen *et al.* (2003):

- Age distribution of current applications (cf. Martinsons *et al.* 1999; Van Grembergen 2000).
- Technology distribution (platform distribution as per Martinsons *et al.* 1999). The measure investigates the availability of the appropriate tools to assist in the information delivery requirement of the organisation (Fedouaki, Okar & Alami 2013). For example, when an OLAP cube is implemented in an organisation, employees should be equipped with an OLAP tool enabling the extraction of the information out of the sophisticated structure.
- Technical performance of the applications portfolio (cf. Martinsons *et al.* 1999). It is imperative that the BI system is available to users when required and that downtime is minimized. Measurements identified include the planned and unexpected downtime of systems (measured in minutes) in a twenty-four hour

period; system availability as well as the time required for a particular database enquiry to return data.

- The user satisfaction rate with the applications portfolio (cf. Martinsons *et al.* 1999).

The objective of the research objective in the strategy map is to perform research related activities into emerging BI technologies and trends (Martinsons *et al.* 1999; Van Grembergen 2000). One such example is the movement towards cloud computing and the subsequent handling of data in this environment.

The following measurements support this objective:

- BI research budget as a percentage of the overall BI budget (derived from Martinsons *et al.* 1999; Van Grembergen 2000);
- BI research budget as a percentage of the overall IT budget (derived from Van Grembergen 2000);
- Perceived satisfaction of top management with the reporting on how specific emerging technologies may or may not be applicable to the company (Martinsons *et al.* 1999);
- Number of new business ventures introduced as a result of new BI technological trends (Hawking 2011).

A summary of the objectives and measurements is presented in Table 20.

Objective	**Measure**
Staff expertise	**BI specialist capabilities:**
	Number of employees with BI technology skills
	Number of employees with BI technology skills focusing on emerging technologies
	Age distribution of BI staff
	Number of years of BI experience per staff member
	Perceived satisfaction of BI employees (employee satisfaction rate)
	Turnover / retention rate of BI employees
	Productivity of BI employees (number of database queries per

Objective	Measure
	employee per day)
	Training and education of BI personnel:
	Number of educational days per person
	BI training and development budget as a percentage of the overall IT budget
	BI training and development budget as a percentage of the overall BI budget
	Number of times an external consultant is contracted to perform internal BI tasks
Applications portfolio	**State of current application portfolio:**
	Age distribution of applications
	BI technology distribution including platform distribution
	Performance:
	Downtime of BI systems
	Availability of systems
	Database query response time
	User satisfaction rate
Research into emerging BI technologies and trends	BI research budget as a percentage of the overall BI budget
	BI research budget as a percentage of the overall IT budget
	Perceived satisfaction rate of management on how specific emerging technologies may or may not be applicable to the organisation
	Number of new business ventures introduced as a result of new BI technological trends

Table 20 - Summary of future orientation measurements

5.3.3 Verification of BI balanced scorecard measureable items (KPIs)

Although basic KPIs have been identified and derived from the original IT balanced scorecard postulated by Van Grembergen and Van Bruggen (1997), Van Grembergen and Timmerman (1998), Martinsons *et al.* (1999) and Van Grembergen (2000), additional peer-reviewed literature focusing on BI success and the

subsequent critical success factors for implementations was consulted. The main objective was to identify, verify and adopt CSFs for each of the four proposed BI balanced scorecard perspectives. Therefore, a critical success factor (CSF) approach was used in the verification process.

The utilisation of critical success factors (CSFs) is a popular method used by many authors to investigate and warrant success (Dinter *et al.* 2011; Fedouaki, Okar & Alami 2013; Isik 2010; Olszak & Ziemba 2012). KPIs are tightly linked to the concept of critical success factors (CSFs). KPIs are the measureable items directly linked to the CSFs and are often used to track the effect of the CSF. Therefore, the first step in identifying KPIs is to identify the CSF. Once the CSFs are identified, these can be converted to measurable items or KPIs. The relationship between CSFs and KPIs are graphically depicted in Figure 15.

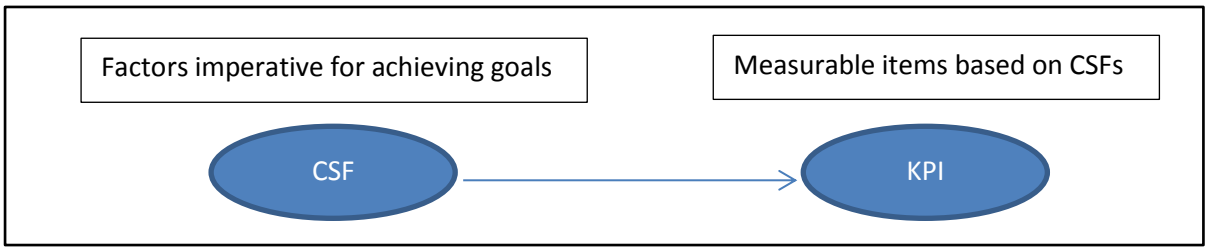


Figure 15 - Relationship between CSFs and KPIs

The utilisation of critical success factors (CSFs) is the first step to organisational strategy execution. It is a mechanism for operationalizing the strategy into controllable items for implementation (Schneier, Shaw & Beatty 1995). In general, literature refers to critical success factors (CSFs) as items or actions that should be present in a particular project or situation in order to be successful. This is in line with Kaplan and Norton's (1992, 1996, 2001) view of CSFs. Furthermore, they elaborate on the general understanding of CSFs and describe CSFs as those elements that an organisation should excel at to gain or continue achieving a competitive advantage. In a BI context, Olszak and Ziemba (2012:136) refer to CSFs as a *"set of tasks and procedures that should be addressed in order to ensure BI systems accomplishment".* These items should, therefore, be present to ensure a successful BI implementation and are, therefore, subject specific. For this reason, each type of project, industry or context will dictate specific CSFs (Olszak & Ziemba 2012).

A summary of all the CSFs identified in literature is contained as an annexure (Annexure A).

5.3.3.1 Verification of business value KPIs

All the CSFs identified as part of the literature review were scrutinized for applicability to the business value perspective. Unfortunately, this was the only perspective where the utilisation of CSFs seemed challenging. The KPIs identified and adopted as part of the proposed IT balanced scorecard by numerous authors were of a tangible[22] nature (for example financial indicators such as Return on Investment and Earned Value), whilst the CSFs focused on more intangible aspects of the other proposed perspectives (user orientation, operational excellence and future orientation). Therefore, the KPIs displayed in these perspectives are in line with measurements proposed by authors from the IT balanced scorecard (Van Grembergen & Van Bruggen 1997; Van Grembergen & Timmerman 1998; Martinsons *et al.* 1999; Van Grembergen 2000).

5.3.3.2 Verification of user orientation KPIs

The majority of the KPIs based on the IT balanced scorecard could be verified against the set of CSFs identified in literature (see Annexure A for complete list). The only two exceptions were that of the 'number of current clients compared to the previous selected period' and the 'number of new clients compared to the previous selected period'.

A summary of the measurements are presented in Table 21. The measure identified along with the corresponding CSF identified in literature is indicated accordingly. The CSF number column (CSF #) refers to the complete list of CSFs identified in literature and contained in Annexure A.

Objective	**Measure**	**CSF #**
Access to the right information when	How long does it take to obtain information (measured in minutes)	3.9, 3.10

[22] Whilst the majority of the KPIs in the business value perspective focus on tangible, financial-type calculations, one exception is the stakeholder perception KPI.

Objective	Measure	CSF #
needed	Number of times logged on to the BI system	2.8, 2.9, 2.10
	Usefulness of information (subjective)	2.6
	Intention to use (subjective)	2.8
Exceptional customer service	Internal BI user satisfaction rate (subjective)	2.7
	External customer satisfaction rate (subjective)	2.7
Relationship building with internal and external clients	Number of current clients compared to the previous selected period	N/A
	Number of new clients compared to the previous selected period	N/A
	Number of active BI users	2.5
	User enthusiasm (subjective)	2.11

Table 21 - Summary of verified user orientation measurements

5.3.3.3 Verification of operational excellence KPIs

With the exception of three measurements, all the measurements could be verified when compared to BI CSFs identified in the BI academic literature. These include the measurements pertaining to the planning and implementation objective as well as the number of up-sell and cross-sell opportunities as a result of BI data utilisation (operations and maintenance perspective). These were indicated using an 'N/A' label in the table below (Table 22). Although these measurements could not be verified it was included in the operational excellence set due to the inclusion of these measurements in the various versions of the IT balanced scorecard.

The objectives and corresponding proposed measurements are listed in the Table 22. Each measurement is compared to the list of CSFs identified in literature. If the measure is available in the CSF list, the number of the CSF is indicated in the column name 'CSF #'. In instances where the measure could not be found in

literature, an 'N/A' label is inserted in the same column[23]. The CSF number refers to the complete list of CSFs identified in literature and contained in Annexure A.

Objective	**Measurement**	**CSF #**
Planning and implementation	Number of BI projects and tool implementations on time in relation to the total number of BI projects completed (overall scheduled performance index; schedule variance)	N/A
	Number of BI projects and tool implementations within budget in relation to the total number of BI projects completed	N/A
Operations and maintenance	Time in minutes to obtain an existing report	3.9, 3.10
	Time in minutes to obtain a new report	3.9, 3.10
	Time in minutes for unplanned system downtime (system availability)	3.11
	Time in minutes for planned system downtime (system availability)	3.11
	Number of unplanned BI system interruptions	3.11
	Number of planned BI system interruptions	3.11
	Number of operational failures (system reliability)	3.11
	Data accuracy rate	3.1
	Data availability rate (data reliability)	3.11
	Data consistency rate	3.7
	Data quality rate	3.1
	System quality rate	3.3
	User friendliness rate	3.14
	Number of up-sell and cross-sell	N/A

[23] The original measures are adopted from the proposed IT balanced scorecard as postulated by Van Grembergen & Van Bruggen (1997), Van Grembergen & Timmerman (1998), Martinsons *et al.* (1999) and Van Grembergen (2000).

Objective	Measurement	CSF #
	opportunities using data obtained from BI systems	
Development	Percentage of business processes and business performance measurements covered in the BI solution	2.18
	Methodology followed during development	2.14
	Number of users involved in the development process (including user requirements gathering and testing)	2.29

Table 22 - Summary of verified operational excellence measurements

5.3.3.4 Verification of future orientation KPIs

A number of measurements identified by the originators of the IT balanced scorecard were not mentioned in the academic literature focusing of BI CSFs. These are indicated using an 'N/A' label in the CSF # column in Table 23. These include:

- BI training and development budget as a percentage of the overall IT budget
- BI training and development budget as a percentage of the overall BI budget
- Age distribution of applications
- BI technology distribution including platform distribution
- BI research budget as a percentage of the overall BI budget
- Perceived satisfaction rate of management on how specific emerging technologies may or may not be applicable to the organisation

A summary of the measurements are presented in Table 23. The measurement identified along with the corresponding CSF identified in literature is indicated accordingly. The CSF number column (CSF #) refers to the complete list of CSFs identified in literature and contained in Annexure A.

Objective	Measurement	CSF #
Staff expertise	**BI specialist capabilities:**	
	Number of employees with technology skills for BI	2.22, 2.28,

Objective	Measurement	CSF #
	solutions	2.21
	Number of employees with technology skills focusing on emerging BI technologies	2.22, 2.28, 2.21
	Age distribution of BI staff	2.22
	Number of years of BI experience per staff member	2.22
	Perceived satisfaction of BI employees (employee satisfaction rate)	2.7
	Turnover or retention rate of BI employees	2.22
	Productivity of BI employees (number of database queries per employee per day)	Related to 2.24
	Training and education of BI personnel:	
	Number of educational days per person	2.24
	BI training and development budget as a percentage of the overall IT budget	N/A
	BI training and development budget as a percentage of the overall BI budget	N/A
	Number of times an external consultant is contracted to perform internal BI tasks	2.27
Applications portfolio	**State of current application portfolio:**	
	Age distribution of applications	N/A
	BI technology distribution including platform distribution	N/A
	Performance:	
	Downtime of BI systems	Related to 3.11
	Availability of BI systems	Related to 3.11
	Database query response time	3.9
	User satisfaction rate	2.7
Research into emerging BI	BI research budget as a percentage of the overall BI budget	N/A

Objective	Measurement	CSF #
technologies and trends	BI research budget as a percentage of the overall IT budget	N/A
	Perceived satisfaction rate of management on how specific emerging technologies may or may not be applicable to the organisation	N/A
	Number of new business ventures introduced as a result of new BI technological trends	1.10

Table 23 - Summary of verified future orientation measurements

5.3.3.5 CSF as verification method: limitations, challenges and exclusions

The utilisation of the CSF method for verification purposes introduced a number of challenges. One of these challenges was the introduction of clear critical success factors in academic material without identifying measurable, quantifiable performance outcomes (Adamala & Cidrin 2011). For this reason, some measurements (or KPIs) were derived from the proposed CSFs.

It is important to note that the some CSFs identified in literature (and classified in the organisational factor category) were excluded as measurable items in the respective perspectives of the proposed BI balanced scorecard, namely: management support (CSF number 1.1), management sponsorship (CSF number 1.2), strategic alignment (CSF number 1.3), concise organisational vision, business case and goals (CSF number 2.1), business involvement (CSF number 1.4), data stewardship (CSF number 2.2), business and system champion (CSF number 2.3), change management (CSF number 1.5) and the fostering of a decision-making culture based on data (CSF number 1.7). The main reason for the exclusion is that these items are included in higher level scorecards and are, therefore, implied in the lower vertical level (also referred to as departmental) BI balanced scorecard. The remainder of the CSFs were included in the preliminary version of the BI balanced scorecard strategy map.

5.4 Preliminary Business Intelligence balanced scorecard strategy map

As mentioned in one of the sections above, the strength of using a balanced scorecard strategy map approach is the ability to establish the cause and effect relationship between the various measurements identified as part of the four perspectives. The figure below (Figure 16) displays a high level overview of the linkage between the identified objectives and the four perspectives. A high level

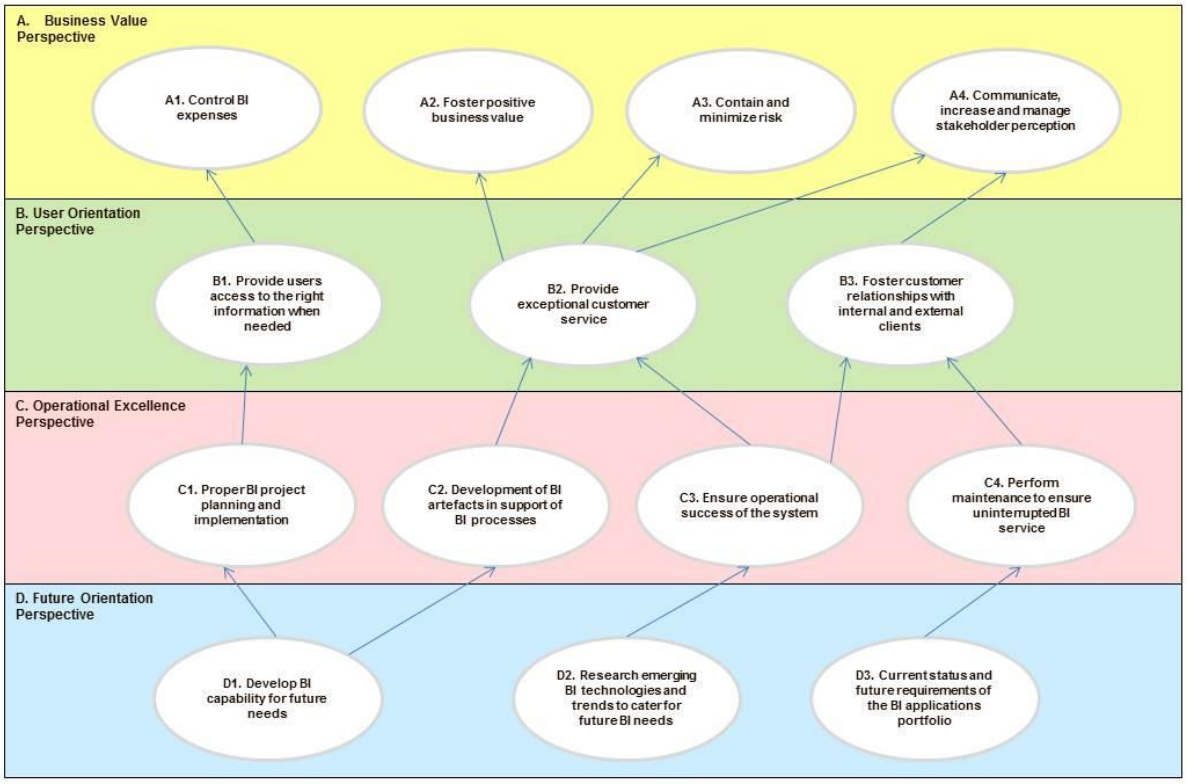


Figure 16 - BI balanced scorecard high level perspectives (preliminary version)

overview version of the balanced scorecard is used to display the causal relationships between objectives. The main reason for using the high level version is that it might be visually challenging to display the causal relationships between the various objectives when key performance indicators are indicated on the same figure, i.e. on the full strategy map. The individual perspectives with their corresponding KPIs are contained in Annexure C.

The discussion of the strategy map starts with the **future orientation perspective** (bottom perspective) as this is the foundation of the strategy map. All the objectives and measurements identified as part of this perspective contribute to the operational excellence perspective, which influences the user orientation perspective and finally the business value perspective. For example, BI resources with the necessary

specialised capabilities, equipped with the latest or best suited BI tools (introduced as a result of adequate research into products and trends) as well as a stable BI environment (managed using a properly defined applications portfolio) will contribute to operational excellence in the form of project planning and implementation, development, operations and maintenance. Therefore, resources with knowledge and skills achieved through proper training and education (BI capability development) might contribute to the quicker implementation of BI projects, and positively affect the project budget and timeframe. Also, skilled resources will have a quicker turnaround time when delivering new artefacts such as reports. A skilled workforce will have the know-how to perform regular maintenance and preventative tasks to ensure less data warehouse downtime (for example), contributing to the requirement of timely information delivery (access to information in the user orientation perspective). Employees will be able to make informed business decisions to minimize risks in decision-making. Also, the stakeholder perception of the BI systems will increase due to quality deliverables (such as reports) produced by the BI department. Evidently, all the perspectives of the proposed strategy map are, therefore, interconnected.

BI resources should have the correct blend of knowledge and skills in order to develop BI systems in the shortest possible time according to best practice. This is also referred to by Adamala & Cidrin (2011) as a ‘balanced team composition’. The organisation cannot afford to have a high rate of employee turnover as this will impact on the development, implementation and support of operational activities. Time should be allowed for new resources to adjust to a new organisational environment which might impact on service delivery. The correct blend between senior and younger employees should be employed to ensure that organisational knowledge is contained within the organisation. Again, this will ensure that BI resources will have the right blend of capabilities to ensure that the right information is delivered at the right time to the applicable resources.

Research into the latest BI trends will ensure that the BI capability continues to provide the organisation with adequate tools and techniques when providing their service. This will ensure that the correct tool and techniques are utilised for the appropriate system or service requested to ensure a faster response time.

The objective of this section is to investigate the primary research question as well as the second, third and fourth research questions (as displayed in table 25).

Operational excellence

As part of the operational excellence perspective, the BI competency should support the achievement of organisational goals through the provision of effective BI processes. Imperative to this objective, is the implementation of BI projects according to project plans and within budgetary constraints (plan and implement section). Proper planning will allow organisational users' faster access to information (user orientation, access to information). As a result, informed decisions can be based on accurate data. This can either increase the business value by minimizing the risk of decisions (business value perspective, risk) or have a positive effect on sales due to better informed decision-making with regard to, for example, which product to sell (business value perspective, business value).

It is important to keep track of the extent to which organisational data sources are covered within a BI related structure such as the data warehouse. This will ensure that information is extracted from one central source, also known as 'one version of the truth'. Various users, although from different departments, will, therefore, obtain the same information when the same enquiry is conducted. This contributes directly to the very important requirement of system reliability, data reliability, data consistency and data quality (Hawking 2011) (part of the operations section of the proposed strategy map). This, in turn, will provide customers (internal and external) with reliable data, therefore, contributing to the overall customer satisfaction of system users (user orientation, customer service). Also, if users are involved in the BI systems development process, users are more likely to adopt the system as their own and utilise as it has been designed for their specific requirements.

The operational success of the BI system is vital for the provision of information when required. Also, the operational process should be supported by competent resources and served by a stable up to date BI application. Proper maintenance should be conducted on regular, scheduled intervals to limit the number of operational failures as these might influence customer relationships. For example,

unavailable systems might negatively influence the relationship with external customers utilising some information elements from the BI systems.

The objective of this section is to investigate the primary research question as well as the second, third and fourth research questions (as displayed in table 25).

User orientation

One of the main objectives of any BI system is the provision for and supplying of information to both internal and external customers (also referred to as the system end-users). There might be a positive correlation between the actual utilisation of the system and usefulness of information provided. For example, if the information provided had not seemed to be useful, the systems would not be used (reflected by a low system utilisation rate by means of number of times logged onto the system). Providing the required (reliable) information to end-users when needed will contribute to the trustworthiness of the system, foster good decision-making and, therefore, impact key business decisions and subsequent business value.

The availability of information to external customers (in some instances suppliers) can foster good relationships and increase business value. For example, in instances where information is directly used by suppliers for business purposes, the user experience will be positive if the supplied information is always available, reliable and accurate. As a result, more suppliers might want to partner with the business, therefore, increasing potential revenue and growth.

The objective of this section is to investigate the primary research question as well as the second, third and fourth research questions (as displayed in table 25).

Business value

The business value perspective is influenced by all of the lower level perspectives of the preliminary BI strategy map (as explained in the discussion sections of the perspectives). The controlling of expenses in any profit organisation is (obviously) necessary as it has a direct effect on organisational profit. In the instance of BI, the costs associated with BI projects are carefully monitored to ensure that the project is delivered within budget and that the benefits obtained from these projects are

worthwhile when compared to the actual expenses involved. Also expenses with regard to BI user tools, for example, should be monitored and contained.

The quality of customer service and the satisfaction rate of customers might influence the management of risk. This risk can only be properly managed where decision makers are provided with the necessary information. For example, where customers have a low customer satisfaction rate, the risk of losing customers might increase impacting on the number of products sold. This risk can only be properly managed where decision makers are provided with the necessary information. In profit driven organisations, where external customers (or suppliers) are imperative to the existence of the organisation, the risk of unhappy suppliers or bad customer relationships should be highlighted and managed accordingly. In addition, bad customer relationships can have a negative influence on stakeholders' perception of the organisation.

The objective of this section is to investigate the primary research question as well as the first, second, third and fourth research questions (as displayed in table 25).

5.5 Empirical instrument: Semi-structured interview template

A semi-structured interview template is based on the various perspectives, objectives and key performance indicators contained in the preliminary version of the proposed BI balanced scorecard. The template made provision for capturing information about the interviewer as well as the date of the interview. A note section indicates the anticipated duration of the interview as well as the objectives of the study. Acronyms are clarified followed by definitions of terminology used during the interview (see Appendix E for interview template).

The semi-structured interview template consists of five sections. The first section focuses on obtaining general demography related information whilst the remainder of the sections focuses on each of the four perspectives of the BI balanced scorecard (business value, user orientation, operational excellence and future orientation).

The first section of the interview template focuses on obtaining the industry, sector classification and organisational size information. It is important to establish and confirm the position of the interviewee at the start of the interview process to ensure that the level of the participant is in line with the target population of the study, i.e. senior or middle management. The study also focuses on organisations that either attempted or completed some BI implementations previously, irrespective of which tool or technology was used and which process was followed. The question focusing on the BI elements implemented, therefore, also serves as a pre-interview qualification validation. Finally, participants will be asked prior to the start of the formal interview questions if BI adds value in their opinion. This question will prepare the interviewee for future topic-related questions.

The remainder of the sections contained direct questions with the option to substantiate the answer. Participants were prompted to select particular answers in the form of selections (yes or no) or answers grouped in categories (for example, question B1.1.1 (b) (how many times on average do external BI users log on to the system per day) offer options from which selections must be made: < 10, 11 to 20, 21 – 29 and >30. Where applicable, participants were prompted to substantiate answers.

The questions are formulated focusing on non-technical aspects of the BI implementation, in line with the non-technical senior to upper management level of participants. Although participants are prompted to select a particular option in response to interview questions, participants are also given the opportunity to elaborate on their answers and provide additional information where possible.

The various metrics identified in the BI balanced scorecard strategy map are used to formulate direct questions. The table below (Table 24) presents the identified metric together with the interview question.

The metric number used in the table (Table 24) corresponds with the number used in the interview template. For example, metric number 1.1 in the tabular BI strategy map (Total actual BI expenses compared to the allowable BI budget) corresponds to question 1.1 of the interview template.

Perspective	Metric number[24] / Interview question number	Metric description	Interview question
Demographic information	1.	Industry	Industry
	2.	Sector classification	Public or government sector (public, government, NGO)
	3.	Position of interviewee	Position of the interviewee within the organisation
	4.	Organisational size	Size of your organisation (total number of employees*): Micro (<10), Small (<50), Medium (<250), Large (>250)
	5.	BI elements implemented	Which of the following BI-related items were implemented in your organisation: data warehouse, dashboards, reports, OLAP cubes, other.
	6.	Perception of BI value	In your opinion, does BI add value to your organisation?
	7.	BI organisational capabilities	Do you have a separate BI division or Competency Centre fulfilling the BI needs within the organisation?
A. Business value	1.1	Total actual BI expenses compared to allowable BI budget	Does your organisation keep track of BI expenses on departmental level? If '**yes**', is the total of actual BI expenses more or less than the allowable budget for the BI department?
	1.2	BI expenses per user per annum	What are the estimated BI expenses per user per year (including licensing costs)?
	1.3	Total BI budget as a % of IT budget	What percentage of the overall IT budget is attributed to BI?
	1.4	Total BI budget as a % of overall turnover	What percentage does the BI budget contribute to the overall turnover?
	1.5	Project cost variance	Do you calculate the Project Cost Variance at any stage during a BI project? If **'yes'**, is the variance more or less than the acceptable standard?
	1.6	Cost Performance Index	Do you calculate the Project Cost Performance Index at any stage during a BI project? If **'yes'**, is the index more or less than the acceptable standard?
	2.1	Traditional calculation methods (earned value, ROI, NPV, IRR, payback period, information economics)	Does your organisation make use of any 'traditional' financial calculation methods to calculate the potential value of BI projects prior, during or after the project? If **'yes'**, what method do you use? (earned value, ROI, NPV, IRR, payback period, Information economics,

[24] The metric number refers to the number used in the tabular presentation of the proposed BI balanced scorecard strategy map. The tabular version is contained in Annexure B of this document.

Perspective	Metric number[24] / Interview question number	Metric description	Interview question
			other)
	2.2	Perceived sales increase as a result of BI system utilisation	In your opinion, did your organisation experience an increase in sales as a direct or indirect result of BI implemented in your organisation?
	3.1	Risk severity and occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)	Do you identify, calculate or monitor any of the following risks pertaining to BI either on organisational or project level? Specify Yes / No and method used for each type of risk: BI strategy risk, IT strategy risk, definitional uncertainty, technological risk, organisational risk, IT infrastructure risk (Parker *et al*. 1988)
	4.1	Management survey	(a) In your opinion, what is your management's perception of the delivered BI products? (b) In your opinion, what is your management's perception of the BI department? (c) Do you scientifically establish the management perception towards BI in your organisation by means of surveys?
B. User orientation	1.1	Number of times logged on to the BI system	(a) How many times (on average) do internal BI users log on to the BI system (per day)? (b) How many times (on average) do external BI users log on to the BI system (per day)?
	2.1	Perceived usefulness of information survey	In your opinion, is the information obtained from the BI system useful and trustworthy?
	3.1	Intention to use the system (survey)	Are there any other users (internal or external) who intend to use the system in the near future?
	4.1	Time measured in minutes to obtain information	How long does it take for internal and external BI users to obtain information from the BI system? Is the length of time taken acceptable?
	5.1	BI user satisfaction rate (internal and external)	(a) In general, are the BI <u>internal</u> users satisfied with the current BI system they interact with? (b) In general, are the BI <u>external</u> users satisfied with the current BI system they interact with?
	6.1	Number of clients compared to the previous selected period	Did you experience an increase in the number of clients since the implementation of a BI system?
	7.1	Number of times logged on to the BI system	Same as point B1 (1.1) above
	7.2	Number of active BI users	How many users (internal and external) actively utilise the current BI system?
al excellenc	1.1	Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	How many BI projects and / or tools have been implemented in your organisation in the past five years? How many BI projects and / or tools have been implemented on time and within budget in the

Perspective	Metric number[24] / Interview question number	Metric description	Interview question
			past five years?
	1.2	Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance	Do you make use of one of the following calculations during BI projects: Project Scheduled Performance Index and Project Schedule Variance? If' **yes**', is it within an acceptable standard?
	2.1	Adherence to methodological prescriptions	Do you follow a particular methodology when conducting BI projects?
	3.1	Percentage coverage in BI of business processes and business performance measurements	What percentage of business processes and business performance measurements are covered by your BI system?
	4.1	Number of users involved in the development process (requirements gathering, testing)	Were any users involved in the development of the BI products or during implementation of any aspects of the BI system? If 'yes', during which stage of development? (requirements gathering, development, testing, maintenance)
	5.1	Time in minutes to obtain an existing report	How long does it take to obtain an existing report from the BI solution?
	5.2	Time in minutes to obtain a new report	How long does it take to obtain a new report from the BI solution?
	5.3	System quality rate	Is the data contained in the outputs of the BI system (such as reports, dashboards or analytical calculations) trustworthy and of high quality?
	5.4	User friendliness rating	Would you describe the current BI system as user friendly?
	5.5	Number of times when information is not available when needed	How many times in a business week is the information not available from the BI system when requested by the business?
	6.1	Data accuracy rate	'Rate' your current BI system by using the following scale: 1-Extremely satisfied; 2-Satisfied but scope for improvement; 3-Not satisfied at all
	6.2	Data availability rate	
	6.3	Data consistency rate	
	6.4	Data quality rate	
	6.5	Number of queries related to data quality	Do you often get enquiries from end-users questioning the data quality contained in reports or any other BI related output?
	6.6	Number of up-sell and cross-sell opportunities using data obtained from BI systems	Does your organisation use the data obtained from the BI system or BI toolset to up-sell and cross-sell products to customers?
	7.1	Response time in minutes after call was logged	Is there adequate support for the end-users utilising the current BI system or toolset? If **'yes'**, what is the response time?
	8.1	Customer / user satisfaction survey	In general, are the following users satisfied with the BI system? (a) BI end users; and

Perspective	Metric number[24] / Interview question number	Metric description	Interview question
			(b) external customers.
	9.1	Time in minutes for unplanned system downtime	How many unplanned system downtime events occur during a month?
	9.2	Number of unplanned BI system interruptions	How many unplanned BI system interruptions occur during a month?
	9.3	Number of planned BI system interruptions	How many planned BI system interruptions occur during a month?
	9.4	Number of operational failures	How many operational failures of the BI system or toolset do you experience during a month? What is the acceptable standard?
D. Future orientation	1.1	Number of employees with BI technology skills	How many employees in your organisation are competent in using the current BI system?
	1.2	Number of employees with BI technology skills for emerging technologies	How many employees in your organisation are competent in using emerging and / or the latest BI products and BI technologies such as mobile technologies for BI, BI self-service or big data analytics?
	1.3	Age distribution of BI staff	What is the average age of the staff members responsible for the BI capability within the organisation?
	1.4	Number of years of BI experience per staff member	What is the average number of years of BI experience per staff member?
	1.5	Perceived satisfaction of BI employees (employee satisfaction rate)	Do you measure the BI staff satisfaction rate within your organisation?
	1.6	Turnover rate of BI employees	On average, how long do BI staff members work for your organisation?
	1.7	Retention rate of BI employees	What is the retention rate for BI staff per year (indicated as a percentage)?
	1.8	Productivity of BI employees (number of queries per employee per day)	How many enquiries does an employee handle per month? (per BI support staff and BI development staff)
	2.1	Number of educational days per person	How much training (in days) have BI personnel spent on formal BI related education and training programmes during the past year?
	2.2	BI training and resource development budget as a percentage of the overall IT budget	What is the BI training and resource development budget as a percentage of the overall IT budget (per year)?
	2.3	BI training and development budget as a percentage of the overall BI budget	What is the BI training and resource development budget as a percentage of the overall BI budget (per year)?
	2.4	Number of times an external consultant is contracted to perform internal BI tasks	Do you make use of external BI consultants to assist in any BI related activities?
	3.1	BI research budget as a percentage of the overall IT budget	What is the budget for BI research as a percentage of the overall IT budget (per year)?
	3.2	BI research budget as a percentage of the overall BI	What is the budget for BI research as a percentage of the overall BI budget (per year)?

Perspective	Metric number[24] / Interview question number	Metric description	Interview question
		budget	
	3.3	Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation	In your opinion, will emerging BI technologies be applicable to the future ventures of the organisation?
	3.4	Number of new business ventures introduced as a result of new BI technological trends	How many new business ventures have been introduced as a result of new BI technological trends?
	4.1	Age distribution of applications	On average, what is the age of your current BI system (such as the data warehouse) and software technologies used?
	4.2	Number of BI technologies utilised	How many different (a) BI technologies (software vendors and software platforms such as Microsoft and Oracle) and; (b) tools (cubes, dashboards, reports) do you utilise in your organisation?
	5.1	Downtime of BI systems	How many unplanned system downtime events occur during a month? How many planned system downtime events occur during a month? (The same as section C, question 9.1 and 9.2)
	5.2	Availability of systems	*BI system availability can be calculated using information obtained from questions in Section C, 9.1 to 9.4.*
	5.3	Database query response time	How long does it take for a database query to produce a result? Is this an acceptable response time?
	5.4	User satisfaction rate	(a) In general, are the BI internal users satisfied with the current BI system they interact with? (b) In general, are the BI external users satisfied with the current BI system they interact with? (The same as section B, question 5.1)

Table 24 - BI balanced scorecard strategy map metrics and corresponding interview questions

The research questions stated in chapter one is linked to the respective BI balanced scorecard perspective. This relationship is displayed in Table 25 below.

Research question	BI balanced scorecard strategy map perspective where addressed	Section in interview template

Research question	BI balanced scorecard strategy map perspective where addressed	Section in interview template
PRQ: How does BI add value to organisations?	Business value perspective User orientation perspective Operational excellence perspective Future orientation	A B C D
SRQ1: What is the perceived value of BI implementations amongst senior management in organisations?	Business value perspective Demographic information section	A.4 Stakeholder perception Demographic and General Information section
SRQ2: What was the impact of BI on the organisation?	Business value perspective User orientation perspective Operational excellence perspective Future orientation	A B C D
SRQ3: What is the relationship between BI implementations and organisational performance?	Business value perspective User orientation perspective Operational excellence perspective Future orientation Note: the causal links between the metrics, objectives and perspectives are used	A B C D Visual strategy map
SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?	Business value perspective User orientation perspective Operational excellence perspective Future orientation	A B C D

Table 25 - Research questions linked to interview template

5.6 Instrument verification

Two levels of verification were identified and implemented in this study. Firstly, the instrument created for data gathering purposes were evaluated, and secondly, the completed research was evaluated according to scientific guidelines.

This section focused on the first level of verification, namely the reliability and validity of the data gathering instrument used. The second level of verification deals with the evaluative procedures followed during and on completion of this study and will be described in more detail in chapter eight.

Whilst some authors suggest that the establishment of a proper verification process is adequate to validate research outputs in qualitative studies, other authors, such as Morse *et al.* (2002) argue that it is important to perform verification checks throughout the research process. This is also known as constructive procedures (i.e. during the process) versus the evaluative procedures (on completion of the research). As indicated in the previous paragraph, both approaches were adopted in this study. Whilst the constructive approach is adopted to verify the instrument used (semi-structured interview template) in this section, the evaluative procedures were followed on completion of the study and will be discussed in more detail in chapter five as part of the research methodology.

In line with the constructive approach, Lewis, Templeton & Byrd (2005) propose a methodology for developing constructs pertaining to the Management Information Systems (MIS) discipline. The methodology suggests a development process of three stages. Of importance here is stage two, the instrument development process. This stage involves a pre-test, pilot test and item screening activity to complete a final draft version of the measurement instrument. Similar to this approach, this study followed some of the proposed activities to perform empirical validation (Straub, Boudreau & Gefen 2004). For the purpose of instrument verification aspects such as validity and reliability was considered. An item such as generalizability was not considered on instrument level.

Validity

Content validity refers to the ability of a construct to measure what it is intended to measure (Lewis *et al.* 2005). As part of the study, the first version of the preliminary semi-structured interview template was distributed to two BI senior specialists as part of a pilot study. The participants of the pilot study were given both the objective of the question (i.e. the reason for the question) and with the formulated question. Participants had to provide feedback on the appropriateness of the question to obtain the stated objective. After feedback was received and minor adjustments made, the new version of the template was distributed to a senior BI business manager (the same level as the intended audience). Feedback received was evaluated for validity. As a result, minor modifications were implemented as suggested.

Reliability

Construct reliability refers to the consistency of the feedback received when participants respond to a question. For example, the answers to the same question from all the participants in the pilot study was compared to ensure that the understanding and feedback received was related and in line with the expectation.

Finally, the instrument was confirmed for completeness. This was achieved by identifying various CSFs published in peer reviewed literature, consolidated and cross-checked against the items contained in the interview template. The majority of the items did indeed correspond with the proposed scorecard (58.6 %) and were included in the list of CSFs for the purpose of the study. A total of 24.1 % of CSFs considered fell outside the scope of the perspectives of the theoretical framework used and were therefore not considered. The remainder of the CSFs, namely 17.2 %, were implied in higher levels of the balanced scorecard (and therefore inherently included) and were therefore not considered as a separate item.

CSF category	Total Number of CSFs	CSFs related to BI balanced scorecard perspectives	CSFs implied in higher level balanced scorecards	CSFs not related
Organisational factors	14	1	6	7
Project related factors	30	21	4	5
Technical factors	14	12	0	2
TOTAL	**58**	**34**	**10**	**14**

5.7 Chapter conclusion

The main focus of this chapter was the construction and validation of the main data gathering instrument to investigate the value of Business Intelligence to organisations, namely a semi-structured interview template. As part of the construction process, a preliminary version of the BI balanced scorecard strategy map was proposed and discussed in detail. This was used as main basis for constructing the template. Also, the proposed preliminary version of the BI balanced scorecard strategy map was checked for completeness against numerous peer-reviewed studies identifying critical success factors (CSFs) for BI implementations. As a final check the proposed semi-structured interview template was considered for validity and reliability.

The next chapter offers a discussion of the data analysed using individual case studies (also referred to as in-case analysis) as well as a final cross-case analysis comparing the results from various individual studies.

Chapter 6

Data analysis

Section 1: Background and introduction

Chapter 1: Introduction

Section 2: Literature review

Chapter 2: Existing BI value models and contributing factors

Chapter 3: Theoretical framework

Section 3: Research

Chapter 4: Research design

Chapter 5: Empirical instrument development

Chapter 6: Data analysis

Section 4: Towards a BI balanced scorecard

Chapter 7: BI balanced scorecard (intermediate version)

Chapter 8: BI balanced scorecard (verified version)

Section 5: Conclusion

Chapter 9: Conclusion and recommendation

Section 6: Supporting information

Annexures

Bibliography

Content

6.1 Introduction

The objective of this chapter is to analyse and interpret data from the main sources of evidence as identified in chapter four. These include data from the semi-structured interviews[25] (phase one), physical artefacts, technical documentation and company websites. The data obtained from the interviews during phase two is not included in this chapter. This phase focuses on the verification of the artefact compiled after the analysis of data obtained in phase one. The result is therefore included in the chapter focusing on the verification of the balanced scorecard (chapter eight).

The first section of this chapter describes the individual case studies of the four organisations participating in the study (also referred to as in-case analysis). These individual case studies are constructed based on the subjective analysis of all the sources of evidence. A matrix for each of the perspectives is presented indicating the various measurements used in the investigation process and the result of these measurements. These matrixes provided a summary of the status of measurements discussed for each of the perspectives. A measurement matrix containing all the measurements from all the perspectives is presented as a summary at the end of each organisational case study. This is used as an overall view of the status of the various measurements on which the relationship to the research questions are based.

The section describing the comparison of results is referred to as cross-case analysis. In this section the results obtained from the analysis of each of the individual cases are summarized in a table for easy comparison. A matrix is also used to consolidate the status of the measurements used for each of the perspectives in the four participating organisations. All the information is consolidated and aligned with the research questions. The chapter is concluded with a summary of all the benefits and value items in relation to the research questions of the study. Finally, a number of barriers towards the achievement of value as a result of BI implementations are identified.

Figure 17 diagrammatically displays the outline of the chapter.

[25] The semi-structured interview template was constructed based on the preliminary version of the balanced scorecard.

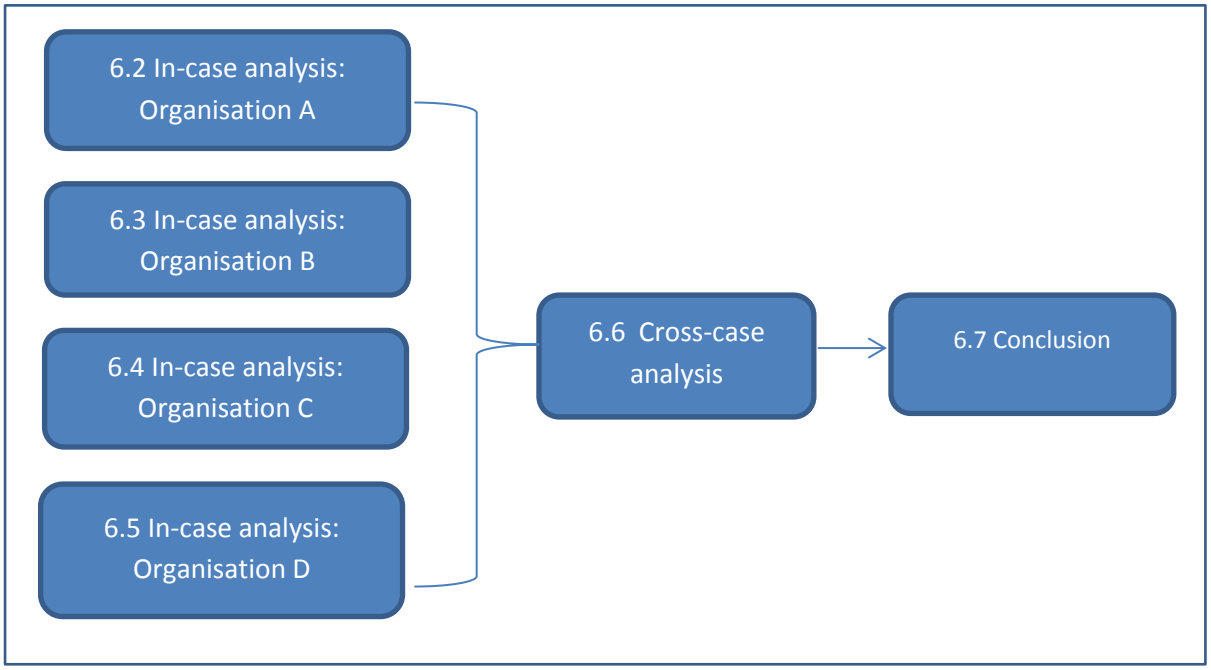


Figure 17 - Chapter six outline

6.2 Case study 1: Organisation A

Organisation A is a BI consultancy and technology services firm currently trading in the Information Technology sector. This public sector organisation offers a wide range of consultancy and development services focusing on the delivery of BI solutions to clients, irrespective of the industry or size of the client. They advocate the implementation and utilisation of a particular software toolset and are also a product re-seller. Many BI related items are developed and maintained depending on the client's need, including data warehouses, dashboards and reports. They also specialize in data modelling.

Figure 18 graphically displays the proportion of BI-related items implemented for clients. According to the results obtained, they implement an equal number of data warehouses, dashboards, and reports as well as data models for clients. The 'other' category in this graph refers to the development of data models. The 'other' category is utilised because the categories in the semi-structured interview template did not cater for data models. No OLAP cubes were designed, developed and implemented.

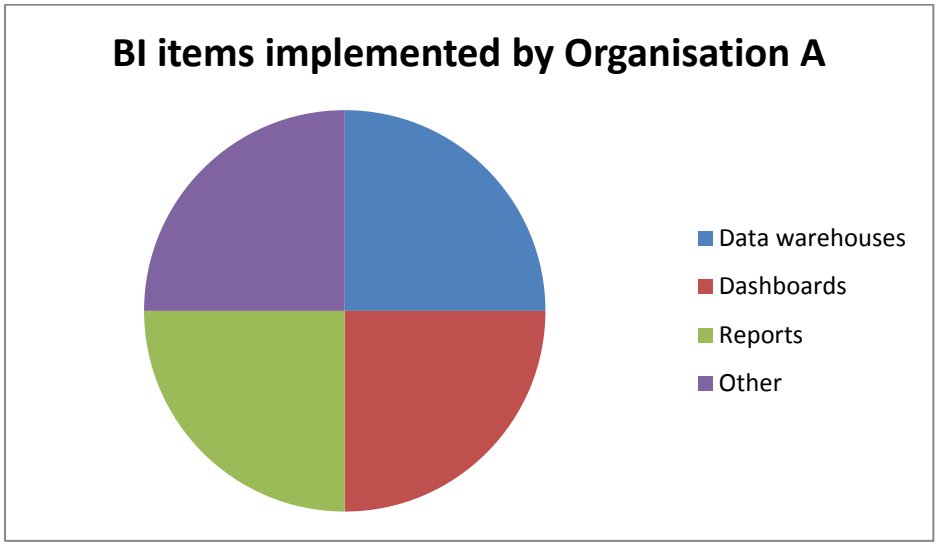


Figure 18 - BI items implemented by organisation A

Although the organisation employs less than ten people on a full-time basis, and therefore classified as a micro organisation, their highly skilled, dynamic consultants manage a relatively large client base and budget.

The semi-structured interview was conducted on site with a panel of senior technical BI consultants as well as the owner and CEO of the organisation.

When asked if, in their opinion, BI adds value to the various organisations, the interview panel responded as one man, without hesitation, that BI definitely adds value to organisations. In their own words: *"This is the main objective of our business and main reason for our successful existence. Organisations will not be able to survive without BI, as BI enables adequate decision-making."*

The four perspectives of the proposed BI scorecard are discussed in more detail in line with the feedback received from organisation A.

6.2.1 Business value perspective

Mission: to implement and maintain a BI capability that will increase long-term stakeholder value.

The first of four objectives identified as part of the proposed BI balanced scorecard was to identify the extent to which BI expenses are controlled. This objective is important to achieve the mission of implementing and maintaining a BI capability that will increase long-term stakeholder value. It is assumed from a financial perspective that if costs are contained, income and profit margins will increase.

The organisation does not keep track of specific departmental expenses incurred as a result of BI implementations on behalf of clients. The lack of measurement might be attributed to the fact that they are not requested to do so. However, the panel estimated that the organisations they interact with spend an estimated total of between R1 million to R20 million annually (depending on the size of the organisations). These costs are incurred as a result of BI users utilising the system, and are therefore mainly software licensing costs. These expenses are usually budgeted for and contained in the IT budget. Although this might vary between clients, it is estimated that an average of 15 % of the IT budget is attributed to BI. Organisation A did not have insight into the percentage of the BI budget contribution to the overall turnover of the organisations.

The organisation has never been asked by any client to perform project-related cost calculations (such as project cost variance or project cost performance index). It was not clear if the clients performed these calculations internally. In fact, no traditional

financial calculation methods (for example ROI, NPV, IRR or payback period) have ever been requested.

Two measurements are used in this study to establish the direct business value of BI investments in an organisation, namely return on investment (ROI) calculations and an increase or decrease in sales as a direct result of BI implementations. As indicated above, the ROI calculation is not done in this organisation. The other measure, the increase or decline in sales as a result of a BI utilisation, was perceived as positive, i.e. there has been an increase in sales. However, the amount or percentage increase is not officially disclosed. If one considers the fact that no traditional financial calculation methods are used by organisations, it can be assumed that the business value is only a perception and not substantiated using actual financial calculations.

The risk objective investigates the extent to which organisations identify, calculate and monitor risk. Risk, in this instance, refers to business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk and project risk. Organisation A indicated that they have never been requested to assist in any risk calculation efforts. As a result, none of the identified risks were identified, calculated or monitored.

When asked how management perceive the BI department, all respondents were in consensus that the perception was positive. However, this was never established scientifically (with surveys). The response was based on the fact that the BI projects are normally initiated by management and one could therefore assume that the project would not have been initiated if the management perception was negative. Management is involved in the BI project development process. The project is often instigated with the development of a BI artefact to showcase the potential look and feel of the solution. This artefact is developed by the consultants after a thorough analysis of the business whereafter an interactive iterative approach is followed to refine the business requirement. Based on this artefact the client makes final cosmetic and functional decisions. The client therefore takes ownership of the solution which contributes to a positive perception of the BI competency.

Table 26 contains a summary of the various measurements used in the business value perspective (perspective A). The ‘X’ in a particular column indicates that the

option is true for that particular measure. For example, measure number 1.1 *"Total actual BI expenses compared to allowable BI budget"* is an estimated measurement if an 'X' appears in the *"Estimated measurement"* column. A 'W' or 'O' indicates that the measurement is measured and that it falls within the acceptable or allowable range ('W') or that it falls outside the acceptable range ('O'). This was important for the purpose of evaluating the potential value and contribution of this item to the overall positive status of the organisation. Not all measurements were evaluated if they fall within acceptable ranges. Therefore, a 'W' or 'O' indicator will not be applicable to all measurements.

Based on the outcome of the interview with organisation A the following conclusions pertaining to the business value perspective can be made:

- In general, no expenses with regard to BI implementations are considered or monitored. The total expenses pertaining to software licensing costs for BI end users as well as the BI budget as a percentage of the IT budget are based on estimations only.
- The two measurements identified to investigate the business value of BI, namely the utilisation of traditional calculation methods (such as ROI) and an increase in sales, were not calculated. Despite the lack of measurement, organisation A felt that BI does add value to organisations and that there has been an increase in sales.
- No methods, whether on project or organisational level, were considered or implemented to identify, calculate or monitor risk.
- Despite the fact that no measurements are implemented to scientifically establish the management perception towards the BI competency, organisation A felt that management in general see the value of a BI competency within their organisation. This can be attributed to the direct involvement of management through the BI project life cycle.
- Very few measurements were implemented in the business value perspective.

Business value perspective: Status of actual metrics implemented to measure business value in organisation A

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum		X			
		1.3 Total BI budget as a % of IT budget		X			
		1.4 Total BI budget as a % of overall turnover				X	
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2 Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation				X	
A3. Contain and minimize risk	3 Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
A4. Communicate, increase and manage stakeholder perception	4 Management's perception of the BI department	4.1 Management survey			X		

Table 26 - Business value perspective measurements for organisation A

6.2.2 User orientation perspective

Mission: Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.

The objective of the user orientation perspective is to establish the extent to which the user expectation of both internal and external users is met by providing exceptional service through the fulfilment of information requirements.

The frequent utilisation of BI artefacts can be an indication of a positive user experience towards the BI implementation. Organisation A indicated that the BI artefacts implemented are frequently used by internal[26] BI users. It is estimated that end-users access the system between 11 and 20 times a day. This includes the utilisation of mobile technology to view some BI artefacts such as dashboards. It was not clear exactly how many external BI users (i.e. external to the organisation for which Organisation A provides a service) access the system on a daily basis. This was difficult to estimate as organisations in general are reluctant to expose BI information to an external client base. However, there has been a tendency lately to start publishing some BI elements to be viewed by external customers. Despite the tendency, no specific group of internal or external BI end users requested or indicated their intention to utilise the BI system in the near future. This was not formally established using surveys.

The data contained in BI artefacts are both trustworthy and useful. This is reflected in the fact that the data is used on both strategic and operational levels to make important decisions. The information obtained from the system to support important decisions are instantaneous. This is in line with the user expectation for BI response time. The user expectation is directly influenced by the quick response time standards set by Facebook and Google (for example). The BI internal users are therefore satisfied with the BI system they interact with although this was not scientifically established. The satisfaction rate is derived from the number of active BI users utilising the current BI system. The assumption is that disgruntled users will not actively utilise the BI system. It should be noted though that the exact number of

[26] Internal users in this case study refers to the internal employees working within the organisation for which Organisation A provides a service.

active users per client was not exactly known to the panel interviewees as it can vary substantially between clients. In general, customers do not currently expose their BI system to external users.

In instances where organisations utilised their BI system to make important product and sales-related decisions, organisations experienced an increase in the number of clients since the implementation of their BI system. Not only was there an increase but this increase in sales was also substantial and noteworthy. However, as mentioned in the business value perspective, this was not established scientifically and based on the perception of the panel interviewees.

One of the focus areas of the customer relationship objective was to measure both the internal and external growth in the client base as a result of the BI implementation. The internal client base refers to the internal utilisation of the BI artefacts (therefore internal users) whilst the external client base refers to a growth in the organisations' client base. Although more clients requested access and utilised the BI artefacts than within the previous reported period, the growth in the customer base as a result of the BI implementation is estimated and perceived as being positive. The number of BI users actively using the BI system as well as the number of times logged on to the BI system was not known.

All the measurements discussed in the user orientation perspective (perspective B) are displayed in table 27. Based on the outcome of the interview with organisation A the following conclusions pertaining to the user orientation perspective can be made:

- Although the majority of the measurements were based on estimations, it seems as if the BI system is utilised regularly by internal users. No external user activity was recorded due to the fact that the system was only restricted to internal users. This might be influenced by organisational reluctance to expose their system to external users or formal access requests by external users.
- Although user satisfaction was not scientifically established, it seems as if internal users are in general satisfied with the BI system they interact with. This can be attributed to the perceived trustworthiness and usefulness of the data and the quick system response times.

- In organisations where BI is used to make important product and sales related decisions, a general increase in the number of clients as well as sales were perceived.

User orientation perspective: Status of actual metrics implemented to measure user orientation in organisation A

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				
	2. Usefulness of information	2.1 Perceived usefulness of information survey		X			
	3. Intention to use the system	3.1 Intention to use the system (survey)		X			
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period		X			
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users		X			

Table 27 - User orientation perspective measurements for organisation A

6.2.3 Operational excellence perspective

Mission: To support the organisation in achieving goals by providing effective BI processes.

The operational excellence perspective refers to the goal of supporting the organisation towards achieving its objectives. The support referred to in this instance refers to the provision of effective BI processes. This includes proper BI project planning and the fact that the BI function should support efficient operational processes to contribute to the overall operational efficiency of the organisation. Adequate and frequent maintenance should therefore be included to ensure that the BI system is in a good, stable and reliable state. All the measurements identified as part of this perspective is displayed in table 28.

Organisation A has implemented many BI projects and tools for numerous clients over the past five years. This was not surprising as the implementation of BI projects is the main objective of their business.

These projects were, in general, implemented within the allocated project timelines as well as budgetary constraints (where applicable). As mentioned before, although project cost calculations might have been conducted by the clients themselves, organisation A was not directly involved in these calculations. The two examples of project calculations included project scheduled performance index and project schedule variance methods. It is therefore unknown if the project was implemented within acceptable ranges in terms of project financials and timelines.

The BI artefacts developed for clients were developed using elements of the Software Development Life Cycle (SDLC). However, this methodology was not strictly followed but the main elements of the methodology were used. This increased the risk of possible project ‘short cuts’ and subsequent project failure. However, where applicable, an iterative approach was used to revise components until the desired result was achieved. For example, stakeholders were involved from the beginning of the project. The consultants obtain the input of these stakeholders as well as potential system users, design a possible solution, develop the artefact and present the solution using ‘show and tell’ sessions. The input from these

sessions is then considered during the next phase or cycle of the project to improve the solution. The same approach is followed until all stakeholders are satisfied with the outcome of the proposed solution.

Potential BI system users are involved in all stages of the development process (requirements gathering, development and testing except maintenance). This approach resulted in a quick project delivery time with small project milestones visible during the process. One of the senior consultants explicitly highlighted the fact that although they follow some aspects of, for example the Kimball dimensional modelling approach[27] in data warehouse projects time restrictions prevent them from following the approach thoroughly. Other approaches, such as the Inmon data warehouse approach[28], are not even considered due to the limited time in which such projects can be delivered. The first BI artefact is usually developed within 6 to 8 weeks whereafter it takes approximately between 3 to 6 months to refine the BI solution after considering the input of stakeholders. It was not clear what percentage of the overall business processes was covered in the BI systems developed for customers. The risk is that there might be gaps in the business processes covered by the BI systems. For this reason, a complete picture containing all the information across the various business processes cannot be obtained, raising the risk of making ill-informed or poor decisions.

The operational functioning of the BI systems delivered in general was within acceptable ranges. One of the measurements considered was the time taken to obtain an existing report from the BI solution. The assumption was made that, if the BI system functions operationally as intended, it will be quick to obtain both existing and new reports from the system. The benchmark to evaluate response rates of the BI system was set by the various clients. All the clients expected instant results when retrieving existing reports from their BI system. On average, it takes a super user to develop a new report within two hours (after training). Also, it took less than one

[27] The Kimball approach to data warehouse design is also known as the dimensional modelling approach to data warehousing design. It involves the identification of fact and dimension tables. Fact tables typically contain numeric, aggregate data. Dimension tables describe the fact tables. The approach also proposes the design and implementation of data marts. Data marts are business process oriented structures containing data.

[28] The Inmon data warehouse approach postulates that a big, centralized data warehouse is constructed, after which small data marts can be constructed according to the need of specific business functions. It does not follow the dimensional approach but rather follows an entity relationship modelling approach.

minute for a SQL database query to return data results. This was well within the acceptable standard. The relevant information will therefore be available timely when requested.

Other variables considered when evaluating the operational functioning of the delivered BI systems, include trustworthiness, data quality, accuracy, availability and data consistency. The general feeling was that the data contained in reports displayed characteristics of trustworthiness and high quality. Data accuracy, data consistency and data quality scored extremely high when the BI system was rated upon request. This indicated that clients were extremely satisfied with these elements. In addition, the BI products (such as reports) were always available with limited downtime. The data availability characteristic also scored extremely high when indicating client satisfaction. Organisation A also mentioned that, although data characteristics are important to clients (trustworthiness, data quality, data accuracy, data availability and data consistency), they have noticed that data accuracy and consistency are more important to organisations in the financial sector. Data availability is more important to organisations in the marketing sector, whilst data quality is important in all the various sectors and not limited to a specific industry.

The accuracy of the data contained in the BI system is often measured using the number of data related enquiries received by the data consumers. Organisation A indicated that they did not receive any data quality related enquiries.

The BI artefacts are frequently used to up-sell and cross-sell products to customers. Although there is a perceived increase in the number of sales as a result of the data obtained from the BI system, it was not sure what the impact was. The impact was measured using the total number of additional products and services sold per month as a result of the BI system utilisation. The BI system, in this instance, therefore supports the operational task of marketing where applicable in retail type organisations.

Adequate support was available for users of the BI system. The response time to the support queries were classified as satisfactory. Also, both the BI system end users as well as external users (customers and suppliers) were satisfied with the system. This might be attributed to the clean, uncluttered, *"user friendly"* and *"visually*

appealing" design of artefacts. This design was demonstrated by the client using some examples of operational dashboards and low level reporting.

The BI system was perceived as a stable system without the occurrence of any unnecessary, unscheduled downtime events. The number of unplanned events was estimated at approximately less than five per month with less than five unplanned BI system interruptions per month. The same scenario was applicable to the number of BI system operational failures. All these events were within acceptable limits with hardly any scheduled downtime necessary to perform routine maintenance tasks.

Table 28 comprises a summary of all the measurements pertaining to the operational excellence perspective. The following key items are important:

- Organisation A is not actively involved in any client related financial or project related calculations. It is therefore difficult to establish if the BI projects implemented are indeed introduced on time and in budget.
- Although some elements of a structured BI specific methodology (for example Kimball) are followed, there is no time to follow these methodologies meticulously. The risk of this approach is that so-called 'short-cuts' might contribute to a sub-standard deliverable.
- The extent to which the implemented BI solutions covered the business processes were not known. It could therefore not be established if the various BI implementations for the various clients focused on a particular business area only or if the solution covered multiple business processes across various functional areas.
- Various business stakeholders are actively involved in the development and implementation of the solution. This ensured that the client took ownership of the solution which can have a positive effect on the adoption of the solution in the organisation.
- The BI system performance and quality was within acceptable limits where the measurements were implemented. This was supported by the following measurements:
    - it was relatively quick to obtain new and existing reports from a user friendly system;
    - the data output (contained in reports for example) was of high quality;

- limited incidents occurred where data was unavailable;
- all the data characteristics evaluated (trustworthiness, data quality, accuracy, availability and data consistency) obtained a high score of satisfaction;
- the system was adequately supported, although no physical response time was recorded since a call was logged;
- the customer or user satisfaction was rated as high due to the fact that very few enquiries were received and a substantial number of users (in particular internal users) actively utilised the system.

- The system was reliable and available when needed. Limited unplanned as well as planned system downtime and interruptions were experienced. The number of operational failures was limited.

Operational excellence perspective: Status of actual metrics implemented to measure user orientation in organisation A

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	X				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions	X				
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)		X			
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report			X		
		5.3 System quality rate	X				
		5.4 User friendliness rating			X		
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	X				
		6.2 Data availability rate	X				
		6.3 Data consistency rate	X				
		6.4 Data quality rate	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		6.5 Number of queries related to data quality	W				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems	W				
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	X				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	W				
		9.2 Number of unplanned BI system interruptions	W				
		9.3 Number of planned BI system interruptions	W				
		9.4 Number of operational failures	W				

Table 28 - Operational excellence perspective for organisation A

6.2.4 Future orientation perspective

Mission: To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

The focus of the future orientation perspective is on providing and making available BI specialist capabilities, training and education on BI related tools and technologies, research effort focusing on BI emerging trends and technologies, the age of current applications and technologies utilised as well as the current BI system performance in general. These focus areas support the main objective of retaining current employees and ensure that current employees are equipped with the right mix of capabilities and skills to meet the current and future information needs of the organisation. Where appropriate, the latest and best technologies should be introduced in the organisation in order to remain competitive. All the measurements of this perspective are displayed in table 29.

Consultants attended product related training regularly. On a business 'super user' level (for business oriented users not requiring in-depth development training) a two day training course is sufficient. Although these training sessions are conducted regularly, the estimated annual BI training and resource budget as a percentage of the overall IT budget was not known. This was also applicable to the annual BI training and resource development budget as a percentage of the overall BI budget. The main reason for this is that the number might vary substantially between clients (and the size of clients). In addition, external BI consultants are often consulted to assist in additional BI development activities. It is estimated that these resources are consulted between six to ten times annually.

The annual BI research budget is not known as this might vary between clients. However, in organisations A's opinion, emerging BI technologies will play a vital role in the future ventures of the organisation. Emerging BI technologies, in this instance, refer to the utilisation of social media analysis using specialized tools. Organisation A

was not sure how many (if any) new business ventures are introduced as a result of new BI technological trends.

The age of the current number of BI systems and technologies utilised could not be established due to the unique situation of each of the various clients.

There has been a strong tendency to move towards Social Intelligence. Social Intelligence, in this instance, refers to the utilisation of technology to examine complex social relationships amongst social media messages with the objective of gaining insight into opinions on a particular subject. An example of such utilisation is the national election in the United States and the implication thereof. The office of the presidency used social media to lure young voters who are active on social media and also gathered, monitored and evaluated the messages of voters. Based on this information, the office would then formulate responses and target particular groups based on concerns identified in social media. Although the implementation of Social Intelligence is still in its infancy in South Africa, various specialized tools are explored. In future Social Intelligence will provide a valuable method for real time analysis during real life scenarios, also in South Africa.

Table 29 displays the future orientation perspective with all the identified measurements graphically. The following summary of findings can be concluded:

- Although the existence and allocation of a separate BI training budget are unknown for the various clients, consultants attend product specific training on a regular basis.
- The existence or size of a research budget focusing on emerging BI technologies is not known. However, Organisation A estimated that these technologies will play a vital role in future BI ventures. One example of such a venture is the utilisation of Social Intelligence to gather information about the attitude and perception of a particular product (for example).
- The age of BI tools and applications were not disclosed.
- The performance of the BI system in terms of downtime, availability and database query response time was within acceptable limits.
- A positive BI end user satisfaction was probable.

Future orientation perspective: Status of actual metrics implemented to measure future orientation in organisation A

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				
		1.3 Age distribution of BI staff				X	
		1.4 Number of years of BI experience per staff member				X	
		1.5 Perceived satisfaction of BI employees (employee satisfaction rate)				X	
		1.6 Turnover rate of BI employees	X				
		1.7 Retention rate of BI employees	X				
		1.8 Productivity of BI employees (number of queries per employee per day)			X		
	2. Level of training and education of BI personnel	2.1 Number of educational days per person	X				
		2.2 BI training and resource development budget as a percentage of the overall IT budget				X	
		2.3 BI training and development budget as a percentage of the overall BI budget				X	
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	X				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget				X	
		3.2 BI research budget as a percentage of the overall BI budget				X	

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation		X			
		3.4 Number of new business ventures introduced as a result of new BI technological trends				X	
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications				X	
		4.2 Number of BI technologies utilised				X	
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	W				
		5.3 Database query response time	W				
		5.4 User satisfaction rate		X			

Table 29 - Future orientation perspective for organisation A

6.2.5 Organisation A: Conclusion

Table 30 contains a summary of the status of the measurements in the proposed BI balanced scorecard after consultation with organisation A. A total of eleven measurements for business value perspective (perspective A) were evaluated during the interview with organisation A. The majority of the measurements (63.6 %) was not taken using any type of calculation method, including project related methods, traditional financial calculation methods or surveys. Despite the apparent lack of measurement, when asked, organisation A indicated that BI does add value to both their organisation and the organisations for which they do BI implementations. The question therefore remains if the perceived value is a true indication of the current status quo without supporting evidence. However, organisations continue to spend considerable monetary resources on BI implementations. It can therefore be assumed that, although the value is not established by means of measurements, some value is reaped. Cognisance should also be taken that this organisation based their input on the benefits reaped by their existing clients.

A total of eight measurements were evaluated for the user orientation perspective for organisation A. The majority of these measurements (62.5 %), evaluated to establish if the BI system meets internal and external user expectations through exceptional service, were estimated measurements and this fact was therefore not scientifically established. However, cognisance was taken of the challenges to attach measurements to items such as usefulness of information and intention to use the system. Although challenging, some organisations have previously displayed methods successfully applied to the measurement of these, for example the utilisation of surveys.

In instances where measurements were scientifically taken, such as the time taken to obtain information and the number of times logged into the BI system, the measurements were within acceptable limits.

The BI system was used regularly by internal BI users. Regular internal BI system utilisation can be an indication of user satisfaction. The assumption can be made that disgruntled internal BI users will not use the BI system. No data is currently

available to external organisational BI users due to general organisational reluctance to publish data externally.

In this environment, BI systems played an important role in the increase in the number of clients and product sales. It is therefore assumed that the user orientation perspective fulfils the mission of meeting the internal user expectation through the provision of timely information.

A considerable number of measurements in the operational excellence perspective (perspective C) were taken (77.2 %). Where the organisation was prompted to indicate if these measurements felt within acceptable ranges, they indicated that all the measurements were within these ranges. This was an important indication of the ability of the BI system to provide in the organisation's information needs by means of system and data quality, data availability, data consistency and system stability.

The majority number of measurements in the future orientation perspective was labelled as *'not sure'* (45.5 %). This indicated that organisation A was not sure if these measurements were either implemented in the organisation or measured within the various departments. These measurements included demographic type measurements of the current human resources (such as age, number of years' experience, system satisfaction) as well as training related metrics, research budget metrics. However, it became evident that the number of employees with the necessary BI technological skills for current as well as emerging technologies was adequate. The turnover rate of employees and retention rate of employees were also considered and perceived as satisfactory. This might be an indication of employee satisfaction (although not scientifically measured).

System performance was within acceptable limits.

Although some of the measurements had a status of *'not measured'*, *'estimated'* or *'not sure'*, it was still important to get the opinion of an established BI consultancy organisation with regard to the status of measurements they are requested to perform for organisations. What was of importance was the fact that these estimated values were within acceptable limits for the various organisations. Also, no new measurements were identified during the interview. None of the measurements presented to organisation A was identified as *'not applicable'.*

The question remains if the organisation, as preferred BI service and technology provider, will disclose any project related challenges and or failures or lack of value as a result of a BI implementation. However, it seems as if the organisation is a highly skilled, knowledgeable consultancy service.

6.2.6 Organisation A: Map to research questions

The information obtained from the study after consultation with organisation A was mapped against the research questions. Each of the questions was considered and the results of the various sources of evidence are summarized below:

PRQ[29]: How does BI add value to organisation A? and

SRQ1[30]: What is the perceived value of the BI implementation amongst senior management in organisation A?

According to stakeholders in organisation A BI adds value to their organisation. How the value is achieved as part of the business value perspective is not disclosed as no measurements are scientifically implemented and evaluated against targets or benchmarks.

BI adds value to organisation A through the provisioning of up to date data for decision-making purposes. The system is extensively used by a considerable number of BI users to obtain relevant and useful information. As a result of the BI system utilisation, the number of clients compared to the previous period has increased substantially (although the exact growth percentage is an estimated measure).

The operational excellence perspective contained a number of measurements indicating the value of BI to organisation A. For example, the organisation indicated that data characteristics such as high availability, accurate, consistent data of high quality support adequate decision-making. BI end-users were also satisfied with the BI system in general including the level of system support. The number of unplanned system events, operational failures as well as planned system events did not impact on the availability of information in the organisation.

[29] Primary research question
[30] Secondary research question

Measurements in the future orientation perspective indicated that BI will be able to continue to add value to the organisation if the organisation is to continue their investment in BI related training (although an official BI training budget was not disclosed).

SRQ2: What was the impact of BI on the organisation A?

The impact of BI on organisation A was evident through the extensive utilisation of the BI systems for the purpose of decision-making. The BI system was perceived as stable and provided high quality, accurate information. Also, there seems to be a perceived growth in the number of clients since the implementation of the BI system.

SRQ3: What was the relationship between BI implementations and organisation A's performance?

BI played a vital role in the existence of organisation A. As the interviewee indicated: "*This is the main objective of our business and main reason for our successful existence. Organisations will not be able to survive without BI, as BI enables adequate decision-making."*

The relationship between BI implementations and organisational performance was evident through the estimated growth in the number of clients compared to the same previous selected period. The response to the other metric used to investigate the relationship, namely the perceived increase in sales as a result of BI system utilisation, was "not sure". The number of up-sell and cross-sell opportunities increased substantially after the BI implementation. The impact was therefore substantial on the organisational *financial* performance. Operational performance should also have increased when the extensive utilisation of the BI system is considered. This research question is further addressed in chapter 7 using the graphical display of the proposed BI balanced scorecard.

SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?

The biggest impact was perceived in the sales environment. This is evident through the various positive impacts on the metrics such as the growth in the customer base, increase in sales and number of up-sell and cross-sell opportunities. Organisation A

was not sure how many new business opportunities were introduced as a result of new technological trends.

Organisation A: BI balanced scorecard measurement matrix

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum		X			
		1.3 Total BI budget as a % of IT budget		X			
		1.4 Total BI budget as a % of overall turnover				X	
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation				X	
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey			X		

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				
	2. Usefulness of information	2.1 Perceived usefulness of information survey		X			
	3. Intention to use the system	3.1 Intention to use the system (survey)		X			
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period		X			
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users		X			
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	X				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions	X				
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)		X			
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report			X		

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		5.3 System quality rate	X				
		5.4 User friendliness rating			X		
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	X				
		6.2 Data availability rate	X				
		6.3 Data consistency rate	X				
		6.4 Data quality rate	X				
		6.5 Number of queries related to data quality	W				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems	W				
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	X				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	W				
		9.2 Number of unplanned BI system interruptions	W				
		9.3 Number of planned BI system interruptions	W				
		9.4 Number of operational failures	W				
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				
		1.3 Age distribution of BI staff				X	

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		1.4 Number of years of BI experience per staff member				X	
		1.5 Perceived satisfaction of BI employees (employee satisfaction ate)				X	
		1.6 Turnover rate of BI employees	X				
		1.7 Retention rate of BI employees	X				
		1.8 Productivity of BI employees (number of queries per employee per day)			X		
	2. Level of training and education of BI personnel	2.1 Number of educational days per person	X				
		2.2 BI training and resource development budget as a percentage of the overall IT budget				X	
		2.3 BI training and development budget as a percentage of the overall BI budget				X	
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	X				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget				X	
		3.2 BI research budget as a percentage of the overall BI budget				X	
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation		X			
		3.4 Number of new business ventures introduced as a result of new BI technological trends				X	
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications				X	
		4.2 Number of BI technologies utilised				X	

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	W				
		5.3 Database query response time	W				
		5.4 User satisfaction rate		X			

Table 30 - Organisation A: BI balanced scorecard measurement matrix

6.3 Case study 2: Organisation B

Organisation B is a public sector financial institution. The institution operates nationally with offices in all of the main provinces in South Africa. Whilst the main focus has been on delivering investment banking services to private, corporate and institutional investors, the organisation was recently selected as the service provider for hosting the national governmental social grants programme. The organisation is a medium sized organisation, employing no more than two-hundred-and-fifty employees nationwide.

The interview was conducted with the Chief Technology Officer and Head of Operations (risk division). He is currently the sole custodian of all data provisioning tasks and often drives BI interventions. No other role players were consulted due to the absence of a BI division, competency centre or data provisioning department. Various documents were evaluated as supporting documentation to the interview, for example technical architectural documentation as well as the physical BI artefacts currently utilised in the organisation.

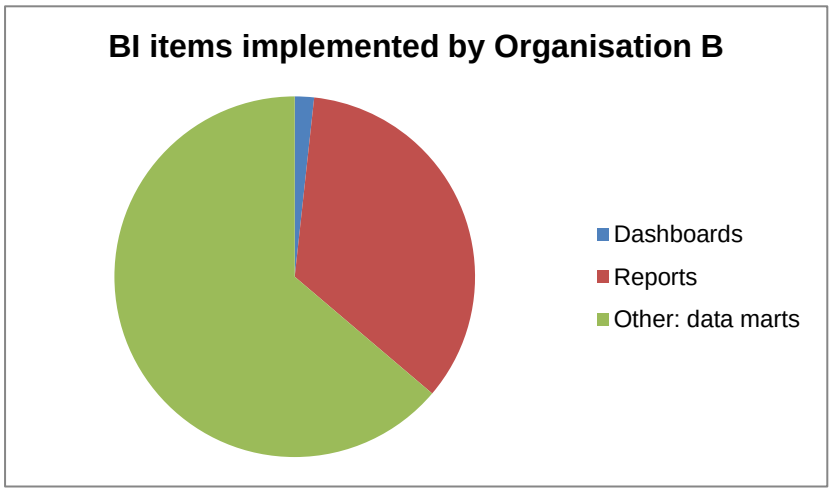


Figure 19 - BI items implemented by organisation B

A pie chart is used to display the proportion of BI items implemented in organisation B (Figure 19). An enormous number of data marts are deployed within the organisation. The interviewee referred to these structures as *"data warehouse type structures"* and estimated that a total of thirty-seven structures are currently in production. Some of these structures are outsourced to third party vendors for monitoring and maintenance purposes. These structures are labelled as data marts

in Figure 19. An estimated number of twenty (20) pre-developed reports are available for end user consumption based on data contained in these data mart structures (displayed as ‘reports’ on the pie chart legend). On-demand reports, i.e. the functionality allowing end-users to generate their own reports, are also available but the exact number was not disclosed. Each user can therefore create their own customized reports according to their specific need. The challenge was that end-users would have to know which data element to display on the report, which is often incorrectly used. An organisational dashboard was developed and deployed within the organisation.

Whilst a vast number of reports were developed and used, end-users currently utilise Microsoft Excel as an ad-hoc reporting tool. Data connections to the various data marts are pre-defined in Microsoft Excel making it easy for the end user to connect and obtain the relevant data. These Microsoft Excel spreadsheets are in some instances used to aggregate data and are often shared amongst users. Not surprisingly the organisation sometimes has difficulties in comparing these spreadsheets amongst users as data is often manipulated. The interviewee also mentioned that this technology (spreadsheets) is currently not fulfilling all their reporting needs.

The interviewee demonstrated and explained the main organisational dashboard used in the organisation. The dashboard, also known as the *“capability maturity model”* measured the maturity of the organisation. The current maturity level is directly linked to the goals of the organisation. The main argument was that should the maturity of, for example processes improve the probability of achieving organisational goals will increase.

In the interviewee’s opinion, BI does add value to their organisation. The value of BI and importance to the organisation is evident, and subsequently measured, through the adherence to regulatory requirements as prescribed by industry regulations. If certain reporting requirements are not met, the organisation can face huge penalties and subsequent closure. Also, BI systems (and the information contained in these systems) play an important role in the monitoring of organisation risk. Risk, in this instance, refers to credit risk, risk of non-compliance to industry regulations and fraudulent activities. In this industry, bank compliance is split into compliance

regulated by the bank regulation act as well as other non-regulated items. There is also a strong focus on the King III governance measurements. BI plays a vital role in reporting these measurements. The value of BI in this organisation is therefore not just driven by financial indicators (to increase profit and income) but also regulatory requirements as well as risk requirements (credit, compliance and fraud).

6.3.1 Business value perspective

Mission: to implement and maintain a BI capability that will increase long-term stakeholder value.

Organisation B has a unique situation with regard to BI implementations. There is currently no allocated BI budget for any development or maintenance purposes. The interviewee referred to current as well as planned BI implementations as *"black operations"* projects. This means that although no budgetary line item is provisioned for BI, the current BI implementation and maintenance are funded by other items catered for as part of the IT budget. For this reason, no formal BI expenses are reflected in organisational financial indicators. In addition, open source software is utilised where necessary therefore minimizing licensing cost to below ten-thousand rand per user. The interviewee indicated that they might purchase proprietary software in future but that open source software allows them to keep their options open. They are currently evaluating the adoption of a number of BI software tools. The interviewee has taken ownership of this initiative. A number of products are shortlisted based on the interviewees' preference. The most important criteria for selection are ease of use and the ability to hide the complexity of back-end systems from the end user.

Due to the absence of a formal BI budget and registered project charter, no formal calculations are conducted. However, they do some form of retrospective analysis using an opportunity cost approach. In other words, they evaluate what their risk status will be, for example if the BI item was *not* implemented.

In addition to the lack of project performance calculations, no other traditional calculation methods are used to calculate the potential value of BI projects prior to,

during or after a project. The ‘increase in sales’ measure is not applicable to this organisation.

The organisation currently uses the COBIT version 4.1 regulatory framework to perform any performance type calculations as well as risk evaluations. These include but are not limited to BI strategy risk, IT strategy risk, definitional uncertainty, technological risk, organisational risk and IT infrastructure risk. As mentioned above, value, in this organisation, is not perceived in financial terms (profit and earnings) but in the management of risk (of non-compliance).

Organisation B indicated a positive management’s perception of the implemented BI products, although not scientifically measured. *“They (management) only realize the value after delivery of accurate, up-to-date information. They understand the necessity but fail to grasp the effort in developing the necessary back-end structures for supporting the visual representation of data”.* Although the stakeholder perception is therefore positive towards BI investments management still fails to understand the financial investment required to implement a proper BI system.

Conclusion:

Although the management’s perception of BI in the organisation is positive and conducive to BI implementations, the lack of formal financial provisioning for BI systems should be a matter of concern. This might adversely affect the ability of the organisation to reap the full business benefits of the potential ability of the BI system to increase long-term stakeholder value.

Surprisingly, organisation B has implemented remarkably many BI structures and according to the interviewee, definitely repeats the benefits of these implementations. This is particularly evident in the risk management provision, a vital component in the sustainability of their current business. The biggest value of BI in organisation B is therefore evident in their management of risk in order to comply with regulatory requirements. Also, the sharing of vital information amongst external users, in particular the governmental social grants programme, is invaluable.

Business value perspective: Status of actual metrics implemented to measure business value in organisation B

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum	W				
		1.3 Total BI budget as a % of IT budget			X		
		1.4 Total BI budget as a % of overall turnover			X		
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation					X
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)	W				
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)	W				
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey		X			

Table 31 - Business value perspective measurements for organisation B

6.3.2 User orientation perspective

Mission: Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.

The user orientation perspective focuses on the extent to which internal and external users' expectations are met. The assumption is that if the user expectation is met and the information requirements are satisfied, better decisions can be made as a result. Better, faster decisions can therefore have a positive effect on the trading of the organisation and therefore increase the financial position. Also, the availability and sharing of information with external users, in particular third party vendors and suppliers, might contribute to a streamlined supply chain and subsequent positive relationship.

Organisation B has a vast amount of internal users utilising the BI system (including pre-developed reports or using a data connection in Microsoft Excel) on a daily basis. Although external users make use of BI data, this data is not available through a universal BI interface. However, the data is 'shared' with external users by means of data files and reports. The sharing of data is in general managed by external vendors to whom the data is outsourced. Therefore the number of external BI users cannot be established.

Very few data related queries are received by data consumers. Therefore, it can be assumed that the data contained in the BI systems utilised by both internal and external users are perceived to be trustworthy and useful.

The organisation did not plan to expand their BI system in the future to either internal or external users. However, the Act regulating the sharing of information (and other current relevant governmental regulations) will have an impact on how data is shared between internal BI users and external data consumers. This issue will have to be considered upon finalisation of the Act.

Access to BI data is available instantaneously to both internal and authorised external users. This is within the acceptable standard.

In general both BI internal and external users are satisfied with the BI system they interact with using Microsoft Excel. No formal BI interface has been deployed in the organisation. It should therefore be noted that they refer to the data contained in their data warehouse structures as ‘reference data’. External users, in the form of external auditors, are currently using data contained in the data warehouse for regulatory and compliance audit purposes. As mentioned before, this is vital for the sustainability of the organisation.

The last objective of the user orientation perspective investigates the extent to which customer relationships are influenced by the BI implementation. Organisation B was not sure if the number of clients has increased since the implementation of their ‘unofficial’ BI system. Also, it seems as if a number of internal users are currently actively using the data from the data structures. A total of four entities (or external organisations) are currently utilising the BI data. However, it was not known exactly how many users are in an entity. The regular utilisation of the data structures can be an indication of user satisfaction.

Conclusion:

It seems as if both the internal and external user expectation with regard to the provisioning of information is met. In particular with regard to the management of risk, users are actively using the BI data structures as main source of information. The lack of data enquiries relating to data can also be an indication of user satisfaction and that the expectation is met.

Due to the fact that Microsoft Excel is the only available BI tool in the organisation, the interviewer is of the opinion that should more sophisticated BI tools become available, the user satisfaction and user expectation will increase. However, the introduction of foreign tools can also have an adverse effect. Users are comfortable with a common tool such as Microsoft Excel and might resist more sophisticated, complicated toolsets.

The biggest value added by BI to this organisation is the fact that the user expectation is fully met with regard to information for risk management activities (regulatory and compliance audits).

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User orientation perspective: Status of actual metrics implemented to measure user orientation in organisation B

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	W[31]				
	2. Usefulness of information	2.1 Perceived usefulness of information survey		X			
	3. Intention to use the system	3.1 Intention to use the system (survey)			X		
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period				X	
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users	W				

Table 32 - User orientation perspective measurements for organisation B

[31] The information for this measure is only for internal BI users.

6.3.3 Operational excellence perspective

Mission: To support the organisation in achieving goals by providing effective BI processes.

The objective of effective BI processes is to support and contribute to the overall operational efficiency of the organisation. In order to achieve this, proper project planning mechanisms should be followed to ensure successful project implementations and therefore minimizing wastage of resources. Proper maintenance and development tasks should be implemented in the BI competency to ensure that the BI system is in good condition, stable and reliable. BI systems can only add value to an organisation if it is available when required and contains reliable information.

Organisation B indicated that they have only implemented one BI project in the past five years. As mentioned before, the implementation of the BI project was not transparent to the organisation with no allocated project budget or project plan. The project was labelled as a *"black operations"* project and included the development and implementation of 'small' data warehouse type structures (referred to as data marts for the purpose of this study). As a result of the lack of transparency with regard to the implementation, no formal project related calculations (such as project scheduled performance index and project schedule variance) were used. Also, no formal analysis was conducted to investigate to what extent the organisational business processes are covered in the implemented data marts.

Due to the informal implementation and so called *"black operations"* status of the project, no formal development methodology was followed. Some end users were involved in the project requirements gathering process and consulted during the project implementation. This involvement included the evaluation of BI software tools and were included as part of their daily tasks. The following evaluation process was followed: a number of BI end-user tools are identified, shortlisted and evaluated. The relevant tools are then used to develop prototypes of reports and dashboards. These prototypes are handed over to business decision makers to evaluate. Based on the evaluations, recommendations are made on which the final tool selection is based.

It takes approximately between one to four minutes to obtain an existing report from the current BI solution. This is an acceptable time to users. However, it can take more than ten minutes to obtain a new report from the BI solution. Users also indicated that this is an acceptable time. In addition, if a new report needs to be created, it can take up to one week to develop. This is acceptable to users. A strict version control mechanism is used when dealing with new report requests.

The complexity of the data warehouse is hidden from the end-users by using data views where applicable. This contributes to the perceived user-friendliness of the system. The user perceives the data as being trustworthy and of high quality. The end-users rated the data availability, accuracy, consistency and quality very high. This is supported by the fact that very little enquiries are received from end-users questioning the data quality contained in reports. However, there is a supporting mechanism in place for these data enquiries as well as end users pertaining to the utilisation of BI tools and technologies. The response time of this supporting mechanism is within acceptable ranges.

Although organisation B does not directly utilise data from their BI system to up-sell and cross-sell products to customers, external customers might do so.

In general, it seems as if both BI internal end-users and external users (customers and suppliers) are satisfied with the BI system in general.

BI system maintenance is within acceptable limits for both unplanned and planned events. Although it seems that the indicated five occurrences of both unplanned and planned system downtime events and system interruptions are substantial, users indicated that the number is within acceptable standards. No additional BI system or toolset operational failures are reported. In particular in the instance of toolset failures, this was not applicable due to the sole utilisation of Microsoft Excel as main toolset.

Conclusion:

The unofficial BI system is reliable, stable and in good working condition. This is evident when the development time is considered for both new and existing reports. The system is perceived as being user-friendly and data characteristics such as data accuracy, availability, consistency and quality is rated high. It is therefore assumed

that the BI system offers adequate support to the organisational operational processes.

Due to the fact that Microsoft Excel is used as the main toolset, no operational failures are reported.

Operational excellence perspective: Status of actual metrics implemented to measure user orientation in organisation B

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed		X			
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions			X		
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)	W				
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report	W				
		5.3 System quality rate		X			
		5.4 User friendliness rating		X			
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	W				
		6.2 Data availability rate	W				
		6.3 Data consistency rate	W				
		6.4 Data quality rate	W				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		6.5 Number of queries related to data quality		X			
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems					X
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey		X			
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	W				
		9.2 Number of unplanned BI system interruptions	W				
		9.3 Number of planned BI system interruptions	X				
		9.4 Number of operational failures					X

Table 33 - Operational excellence perspective measurements for organisation B

6.3.4 Future orientation perspective

Mission: To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

Organisation B has a vast number of skilled BI users currently utilising the BI system. This can be attributed to the fact that the organisation mainly uses Microsoft Excel as toolset. In addition, eight developers are employed to perform back-end operational tasks such as the development of database views. Only two of these developers are full time employees of organisation B. The remainder of the developers are employed on a fixed term contract basis. Although the organisation is not planning on using emerging BI technologies (such as mobile technologies, BI self-service or big data analytics) a number of employees (including fixed term contractors) are competent in using these toolsets. The number is quite substantial when compared to other case studies.

The average age of the BI human resource pool is currently between thirty and thirty-nine years. The average number of BI years' experience per staff member ranges from six to ten years. This is an important measure indicating that the current workforce might be too mature and that new, younger employees are necessary for knowledge transfer to ensure continuation of the BI knowledge base. Currently one BI human resource is employed on an apprenticeship. This might not be sufficient to fulfil the future needs of the organisation.

The satisfaction of BI staff members is indirectly measured. When the number of service years are considered of BI staff members (between two to five years) it seems as if the employees are relatively satisfied working for the organisation. This is supported by a turnover rate of less than 5 % for BI employees and a 100 % retention rate per annum.

It was not disclosed whether any BI employees (support or development staff) handles data related enquiries on a regular basis.

Due to the fact that organisation B mainly utilises Microsoft Excel as main BI reporting tool, the number of training days spent was limited. Open source technology was utilised to develop and maintain back-end structures such as data warehouses and the movement of data from the main data source into the data structures.

Despite the lack of training requested by resources, some provision was made for training (in general) in the IT budget, although estimated to be less than 5 %. As stated previously, no budget for BI was formalized and disclosed. For this reason, the measurements considering the BI research as percentage of the overall IT and BI items could not be established.

The organisation makes use of a number of external contractors (more than eleven times a year) to assist in various BI tasks. External contractors in this instance refer to external employees who have long term contracts with the organisation.

The research into new and emerging BI technologies is mainly the responsibility of the Chief Technology Officer (CTO). The research is conducted on a regular basis whereby the CTO will research particular concepts and present a short list of these concepts and tools. The short list is then delegated to various BI resources for further consideration.

The interviewee was not sure if any emerging BI technologies will be used in future business ventures of the organisation. In fact, the number of new business ventures introduced as a result of new BI technological trends was unknown.

The age of the current BI system and technologies were not known to the interviewee. The organisation currently uses PostgreSQL open source software with no three dimensional data structures (OLAP cubes) implemented. It was not known how many self-service reports exist, whilst the pre-developed reports are estimated at twenty. The system response time, in instances where new or pre-developed reports are requested, is within acceptable ranges.

Conclusion:

Human resources employed by organisation B have the necessary mix of capabilities and skills to meet the current BI needs of the organisation. They also

have the necessary knowledge with regard to emerging BI technologies, although this is not a formal request at the moment. Unfortunately the age of the human resource pool is mature raising the risk of a lack of knowledge transfer should these employees retire. A skilled workforce is invaluable to the delivery of quality BI products. It can also be assumed that the workforce is dedicated and satisfied working for organisation B when the employee retention and turnover rate are considered.

The lack of training can be attributed to the fact that a common software tool such as Microsoft Excel is used. This might change when new BI technologies are introduced when the organisation embarks on new (formal) BI implementations.

Future orientation perspective: Status of actual metrics implemented to measure future orientation in organisation B

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	W				
		1.2 Number of employees with BI technology skills for emerging technologies	W				
		1.3 Age distribution of BI staff	W				
		1.4 Number of years of BI experience per staff member	W				
		1.5 Perceived satisfaction of BI employees (employee satisfaction rate)	W				
		1.6 Turnover rate of BI employees	W				
		1.7 Retention rate of BI employees	W				
		1.8 Productivity of BI employees (number of queries per employee per day)				X	
	2. Level of training and education of BI personnel	2.1 Number of educational days per person				X	
		2.2 BI training and resource development budget as a percentage of the overall IT budget	W				
		2.3 BI training and development budget as a percentage of the overall BI budget					X
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	W				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget					X
		3.2 BI research budget as a percentage of the overall BI budget					X
		3.3 Management perceived satisfaction rate on how					X

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		specific emerging technologies may or may not be applicable to the organisation					
		3.4 Number of new business ventures introduced as a result of new BI technological trends					X
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications					X
		4.2 Number of BI technologies utilised	W				
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	W				
		5.3 Database query response time	W				
		5.4 User satisfaction rate		X			

Table 34 - Future orientation perspective measurements for organisation B

6.3.5 Organisation B: Conclusion

Table 34 contains a summary of the status of the measurements in the proposed BI balanced scorecard after an investigation into the value of BI in organisation B. Although the majority of the measurements in the business value perspective were not measured (55 %), the measurements were within acceptable limits. The main application of these measurements was risk related with the focus on risk occurrence and severity. This confirmed one of the main reasons for the implementation of a BI system in organisation B. One of the biggest business benefits of BI in organisation B was the ability to assist in business risk provisioning.

The majority of the measurements in the user orientation perspective were measured (50 %), whilst some measurements were estimated (25 %). The minority of the measurements were either not measured (12.5 %) or the interviewee was not sure if these measurements were measured (12.5 %). In line with the findings of the business value perspective, the system is actively used to obtain information for risk management activities. For this reason both internal and external users are actively using the system. It can therefore be assumed that users are satisfied with the system.

The operational excellence perspective contained twenty-two measurements of which 55 % was measured. Only 17 % of these measurements were not compared to a target or benchmark value as part of the measurement process. The remainder of the measured measurements (38 %) all fell within acceptable ranges. This indicated that, in general, the BI system achieved the mission of supporting the organisation in achieving goals through the provisioning of effective BI processes.

The future orientation perspective also contained twenty-two measurements of which 50 % was measured. All of these measurements, where applicable, felt within acceptable ranges. It can therefore be concluded that the organisation has the correct set of skills focusing on new technologies to assist in future ventures with emerging technologies. The workforce is stable and happy within the organisation. Human resources are also equipped with the necessary knowledge and skills to perform tasks to fulfil in the organisational BI requirements. However, a substantial

number of measurements were not measured in the organisation or the interviewee was not sure of the status of these measurements (50 %).

6.3.6 Organisation B: Map to research questions

The results of the investigation into organisation B is summarized according to the research questions identified. These include:

PRQ: How does BI add value to organisation B? and

SRQ1: What is the perceived value of the BI implementation amongst senior management in Organisation B?

The biggest value added to organisation B by their unofficial BI system was the ability to manage risk occurrence and severity. The perceived value is evident in the risk management provision, which is directly linked to the sustainability of their current business. The biggest value of BI in organisation B is therefore evident in their management of risk in order to comply with regulatory requirements.

The BI system is actively used by both internal and external BI users. It can therefore be assumed that users are satisfied with the system and that the system provides in their current information needs. The user expectation is fully met with regard to the provision of information for risk management activities (regulatory and compliance audits).

Although there seems to be a lack of human resource training, the current skilled human resources have the ability to support the organisation in providing in the necessary information needs. The fact that the organisation uses a common front end tool makes it easier for the user to utilise the data (although this might raise the risk of data manipulation).

The BI system is reliable, stable and in good working condition. In addition, the system is perceived as user-friendly and data accuracy, availability, consistency and quality are rated as high.

SRQ2: What was the impact of BI on the organisation B?

The impact of BI is mostly evident through the ability to comply with regulatory and compliance audits. The BI system provides the audit agents with the necessary

information to perform these audits. From a continuous risk management perspective, the information obtained from the BI system is vital towards the monitoring and mitigation of risk factors.

SRQ3: What was the relationship between BI implementations and organisation B's performance?

The relationship between BI implementations and organisation B's performance is indirectly visible through the risk management provision. The focus in this organisation is not necessarily to use the information from the BI system to make marketing and sales related decisions, but more on the achievement of regulatory goals for the purpose of sustainability.

SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?

Although this question is graphically displayed using the intermediate version of the BI balanced scorecard in chapter seven, the functional area in which the perceived value is the highest (in terms of the BI implementation) is the risk and regulatory function.

Organisation B: BI balanced scorecard measurement matrix

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum	W				
		1.3 Total BI budget as a % of IT budget			X		
		1.4 Total BI budget as a % of overall turnover			X		
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation					X
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)	W				
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)	W				
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey		X			

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	W[32]				
	2. Usefulness of information	2.1 Perceived usefulness of information survey		X			
	3. Intention to use the system	3.1 Intention to use the system (survey)			X		
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period				X	
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users	W				
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed		X			
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions			X		
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	

[32] The information for this measure is only for internal BI users.

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)	W				
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report	W				
		5.3 System quality rate		X			
		5.4 User friendliness rating		X			
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	W				
		6.2 Data availability rate	W				
		6.3 Data consistency rate	W				
		6.4 Data quality rate	W				
		6.5 Number of queries related to data quality		X			
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems					X
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey		X			
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	W				
		9.2 Number of unplanned BI system interruptions	W				
		9.3 Number of planned BI system interruptions	X				
		9.4 Number of operational failures					X

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	W				
		1.2 Number of employees with BI technology skills for emerging technologies	W				
		1.3 Age distribution of BI staff	W				
		1.4 Number of years of BI experience per staff member	W				
		1.5 Perceived satisfaction of BI employees (employee satisfaction ate)	W				
		1.6 Turnover rate of BI employees	W				
		1.7 Retention rate of BI employees	W				
		1.8 Productivity of BI employees (number of queries per employee per day)				X	
	2. Level of training and education of BI personnel	2.1 Number of educational days per person				X	
		2.2 BI training and resource development budget as a percentage of the overall IT budget	W				
		2.3 BI training and development budget as a percentage of the overall BI budget					X
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	W				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget					X
		3.2 BI research budget as a percentage of the overall BI budget					X
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation					X

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		3.4 Number of new business ventures introduced as a result of new BI technological trends					X
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications					X
		4.2 Number of BI technologies utilised	W				
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	W				
		5.3 Database query response time	W				
		5.4 User satisfaction rate		X			

Table 35 - Organisation B: BI balanced scorecard measurement matrix

6.4 Case study 3: Organisation C

Organisation C is a large Fast Moving Consumer Goods (FCMG) organisation currently trading on a national level in the public sector. Some of the branches are in remote locations of South Africa, making it challenging to deploy IT related solutions that are dependent on data connectivity to the main branch.

The interview was conducted using communication technology with the IT operations technical manager. The interview template was completed prior to the scheduled interview and contained a consolidated view of inputs from the entire team.

Various BI related items were implemented throughout the organisation, including a data warehouse, three dashboards, approximately fifty pre-developed reports and two three-dimensional data structures (OLAP cubes). The number of reports created by end-users was not known. In addition, five Operational Data Stores (ODS) were implemented. An ODS is a database structure storing transactional data. The number of items implemented is proportionally displayed in a pie chart (Figure 20). The maintenance and support of these items are the responsibility of a BI division or competency centre.

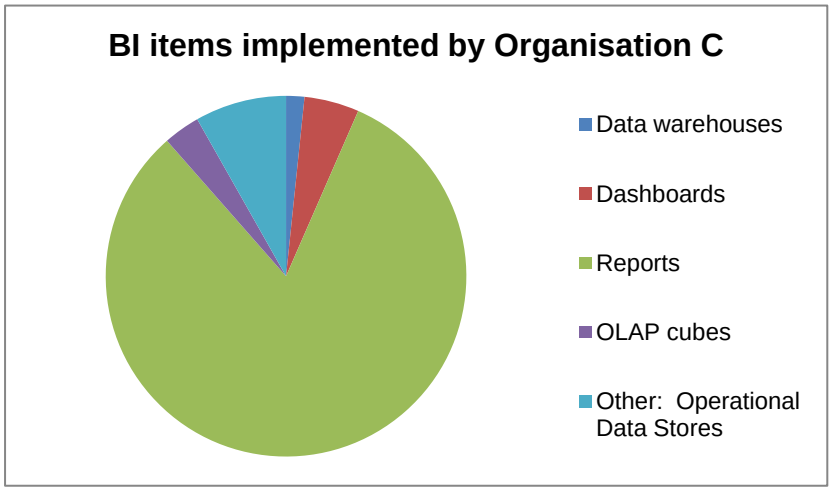


Figure 20 - BI items implemented by organisation C

According to organisation C, BI adds substantial value to their organisation. The IT operations technical manager stated: *"With the large amount of data by modern industries, the information contain within the data can provide a competitive edge*

over other manufacturers. This can be accomplished by supplying the business with detailed views on sales, demographics, and trending analysis."

6.4.1 Business value perspective

Mission: to implement and maintain a BI capability that will increase long-term stakeholder value.

The management of cost expenditure is important to organisation C. They are operating in a very competitive FMCG environment, making the management of costs and expenses even more vital. Also, at least 5 % of the overall IT budget is allocated to BI related activities. However, the only method utilised for tracking expenses on project level is the calculation of project cost variance throughout the project lifecycle. In contrast, the project cost performance index is not calculated. BI expenses are also not monitored on a departmental level, including the calculation and management of BI expenses per user per year. As indicated by the interviewee, the calculation of project cost variance is sufficient for their purpose of monitoring expenses.

Return on Investment (ROI) calculations is a popular method used by organisation C to determine the potential value of BI projects prior, during and after the project. They also reap benefits of BI implementations through a substantial increase in sales as a result of the various BI elements implemented in their organisation. Due to the fact that BI has been a priority for the organisation for many years, the estimated increase in sales is perceived as significant, although the exact financial impact is not calculated. The perceived positive correlation between BI and sales might be one of the many factors that contributed to a positive management's perception of BI in the organisation. All the stakeholders actively utilises the toolset to make key decisions in particular in the sales environment. For this reason, the interviewee indicated that they perceive BI as an invaluable asset to their organisation, although this was not scientifically confirmed with surveys.

The interviewee was not sure if any form of risk management existed in the organisation. These included BI and IT strategy risk, definitional uncertainty, technological, organisation or IT infrastructure risk.

Conclusion:

Organisation C strongly focused on the management of costs and expenses pertaining to BI implementations. The basic cost management calculations have been used for this purpose.

Formal ROI calculations are conducted prior, during or after the project lifecycle to ensure that the BI investment have a positive contribution to the organisation.

The organisation experiences an increase in sales as a result of their BI implementations.

Management have a strong positive perception of BI although this was not scientifically confirmed.

It was not known if any risk management interventions existed in organisation C.

Business value perspective: Status of actual metrics implemented to measure business value in organisation C

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum				X	
		1.3 Total BI budget as a % of IT budget	X				
		1.4 Total BI budget as a % of overall turnover					X
		1.5 Project cost variance	W				
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)	W				
		2.2 Perceived sales increase as a result of BI system utilisation	X				
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)				X	
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)				X	
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey			X		

Table 36 - Business value perspective measurements for organisation C

6.4.2 User orientation perspective

Mission: Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.

The user community in organisation C is quite diverse. It ranges from highly skilled super users to basic end users requesting aggregated operational data. The BI system is currently extensively utilised by internal and external users.

Organisation C had various challenges over the years in consolidating data from various sources. Adding to the challenge is the fact that the same information in different systems did not always correspond. For this reason, the trustworthiness of data was questioned. However, the interviewee indicated that *"a lot of work has been put into making the data analysis more accurate".*

The interviewee indicated that a number of both internal and external users have indicated their intention to use the BI system in the near future.

Data from the BI system is instantly available to users. The main reason for the quick response rate is that the BI team refresh the data contained in dashboards and pre-developed reports whereafter a 'cached' version of the items are stored. The end-users therefore access reports containing slightly older data. Should the BI system become unavailable for some reason, the items will remain available to the end-users therefore minimizing the impact on the operational activity of the organisation.

More external than internal users currently utilises the system. Both internal and external BI users are in general not satisfied with the BI system they interact with. Despite data related challenges the organisation has difficulties with implementing the BI system in the various remote branches of the business. Apart from the data connectivity challenges, data and process issues have an impact on the providing of timely information.

Despite all the technical and process related challenges the organisation experienced an increase in the number of clients since the implementation of their BI systems. The increase was quite substantial.

Conclusion:

Both the internal and external users of the BI system are in general not satisfied with the BI system they interact with. This can be attributed to historic issues relating to the trustworthiness of data as well as process issues in the deployment of the solution to remote branches. However, users do extensively use the system whilst more users indicated their intention to use the system in future. The system response time falls within acceptable limits.

Despite all the challenges, there was a substantial increase in the number of clients since the implementation of the BI system. The assumption can be made that the utilisation of the BI implementation might contribute to better product and market related decision-making. However, this was assumed as the interviewee could not confirm if the data from the BI system was used in cross and up-sell marketing activities.

User orientation perspective: Status of actual metrics implemented to measure user orientation in organisation C

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				
	2. Usefulness of information	2.1 Perceived usefulness of information survey	X				
	3. Intention to use the system	3.1 Intention to use the system (survey)		X			
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)	O				
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period	W				
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users	W				

Table 37 - User orientation perspective measurements for organisation C

6.4.3 Operational excellence perspective

Mission: To support the organisation in achieving goals by providing effective BI processes.

More than three BI projects have been implemented in organisation C in the past five years. However, only two of these projects have been implemented on time and within budget. However, the interviewee indicated that he was not sure if project schedule variation calculations were conducted to highlight these deviations. In fact, it was not disclosed how the deviation from project schedules were calculated.

Although the interviewee was not sure if a particular project methodology was followed in the project implementation process, end-users were involved in all facets of the development process, including gathering of requirements, development, testing and maintenance. Also, the percentage coverage of the business processes and business performance measurements in the BI system were not known.

As indicated in the previous perspective, system response times to obtain an existing report were quick and within acceptable limits. This might be attributed to the fact that the reports are not returning live, up to date information. The time allocated to obtain a new report can take more than ten minutes. This is not acceptable to the business. Also, the BI systems are unable to provide the end users with the requested information at least once or twice per week. When the number of unplanned system events is considered, the unavailability of information should be considerably more. However, the fact that reports contain pre-processed data allows the organisation to retrieve data despite the system unavailability.

The interviewee disclosed historic issues of data quality and data trustworthiness. However, these issues have been resolved and end-users perceive the outputs of the BI system (reports and dashboards) as items of high quality. In general data characteristics such as data accuracy, availability, consistency and quality are rated as ‘satisfied but with scope for improvement’. They often receive enquiries from end-users questioning the data quality contained in reports. The number of enquiries is quite substantial and estimated to more than ten per month. A support team address these enquiries within an acceptable response time.

The BI system was perceived as user friendly and easy to use. This can be attributed to the fact that the majority of BI items (in particular dashboards) are Microsoft Excel based items. In the majority of the instances end-users subscribe to various items whereby the items are distributed to their individual e-mail accounts.

The interviewee was not sure if the data obtained from the BI systems were used in any cross-sell or up-sell activities.

Many unplanned system events and interruptions as well as BI system operational failures occur during a month. The number of events is not within the acceptable standard. However, it seems as if the planned system events are limited to an acceptable number.

Conclusion:

A number of BI projects were not implemented on time and within budget. The reason for these overruns was not disclosed. The fact that no formal project methodology was followed will make it difficult to identify the cause of the slippage.

Although no formal investigation was made into the extent to which BI covered the current business processes and performance measurements, the impression was that the various BI items implemented did cater for the majority of business needs. However, the following items were identified that are currently hindering overall user satisfaction: data related challenges; technical deployment issues; and system unavailability.

The perception is that the BI system is currently unstable. Although the number of planned system downtime events is within acceptable limits, the number of unplanned events seems substantial. For this reason it seems as if the BI system is not adequate supporting effective organisational processes.

Operational excellence perspective: Status of actual metrics implemented to measure user orientation in organisation C

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	O				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance				X	
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions				X	
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)	X				
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report	O				
		5.3 System quality rate	X				
		5.4 User friendliness rating	X				
		5.5 Number of times when information is not available when needed	O				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	W				
		6.2 Data availability rate	W				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		6.3 Data consistency rate	W				
		6.4 Data quality rate	W				
		6.5 Number of queries related to data quality	O				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems				X	
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	W				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	O				
		9.2 Number of unplanned BI system interruptions	O				
		9.3 Number of planned BI system interruptions	W				
		9.4 Number of operational failures	O				

Table 38 - Operational excellence perspective measurements for organisation C

6.4.4 Future orientation perspective

Mission: To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

A fair number of employees currently have the competency to use the BI system. Although Microsoft Excel is used in many instances to display operational measurements on a dashboard a sophisticated data analytical tool is used for more complicated data analysis. Some employees also have the competency to use emerging and the latest BI products and technologies. The average age of the staff members fell in the age category thirty to thirty-nine and they have on average less than five years BI related experience. External consultants are regularly contracted to assist in BI related activities in the organisation.

The satisfaction of BI employees has not currently been scientifically established. However, it seems as if employees are in general happy if the average working years are considered – between six and ten years. The turnover rate of BI staff per year is less than 5 % and the retention rate is close to 100 % per annum.

Both BI support and development staff handle more than ten BI related enquiries per month. This includes data related enquiries by end users. Although the responsible BI staff members handle these enquiries within acceptable response time, the number of enquiries received per month is not acceptable.

The interviewee was not exactly sure how much training days BI staff members attended for BI related education and training programmes. However, it is estimated at less than ten days per person per annum. It is estimated that less than 5 % of the IT budget is reserved for BI training programmes, whilst the percentage allocated for training as part of the overall BI budget was not disclosed.

It was not known if a separate research budget existed in the organisation to cater for research efforts into emerging BI technologies and the possible adoption thereof

in the organisation. However, it was envisaged that emerging technologies will play a vital role in future ventures of the organisation. Currently no new business ventures, according the interviewee, are introduced as a result of emerging technologies.

The current BI system, in particular the data warehouse, is currently 60 months old. The implementation of the various software technologies used, in particular the data analytics tools (namely ProClarity) is between 24 and 60 months old. Software technologies from two different suppliers are used. Although database queries return data fairly quickly and within acceptable limits, the number of unplanned system events and downtime is a matter of concern to the organisation.

Conclusion:

Organisation C has a relatively mature BI workforce when the age of the employees is considered. The human resource pool is well equipped with the necessary skills to use the BI system as well as emerging technologies, although a separate training budget could not be confirmed for continuous training.

It seems as if the BI employees are relatively satisfied with their current environment. This is supported by the high retention rate, low turnover rate and number of service years.

Although it is envisaged that emerging BI technologies and new trends will have a huge impact on the future ventures of the organisation, no formal research budget has been allocated to explore and test the various possibilities.

The current BI applications are 60 months old. The number of unplanned system events and downtime might be influenced by the maturity of the system.

BI adds value to organisation C through:

- Their highly skilled workforce assisting in the development, maintenance and support of BI artefacts;
- The knowledge of the current workforce due to their extensive experience of the employees measured in the number of service years in the organisation;

- The future role identified of emerging technologies in the sustainability of the organisation.

However, BI has not reached its full potential in this perspective and can add more value in the future orientation perspective if issues are addressed.

Future orientation perspective: Status of actual metrics implemented to measure future orientation in organisation C

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				
		1.3 Age distribution of BI staff	X				
		1.4 Number of years of BI experience per staff member	X				
		1.5 Perceived satisfaction of BI employees (employee satisfaction rate)			X		
		1.6 Turnover rate of BI employees	W				
		1.7 Retention rate of BI employees	W				
		1.8 Productivity of BI employees (number of queries per employee per day)	W				
	2. Level of training and education of BI personnel	2.1 Number of educational days per person				X	
		2.2 BI training and resource development budget as a percentage of the overall IT budget	X				
		2.3 BI training and development budget as a percentage of the overall BI budget					X
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	W				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget			X		
		3.2 BI research budget as a percentage of the overall BI budget			X		
		3.3 Management perceived satisfaction rate on how	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		specific emerging technologies may or may not be applicable to the organisation					
		3.4 Number of new business ventures introduced as a result of new BI technological trends				X	
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications	W				
		4.2 Number of BI technologies utilised	W				
	5. Performance of BI systems	5.1 Downtime of BI systems	O				
		5.2 Availability of systems	O				
		5.3 Database query response time	W				
		5.4 User satisfaction rate	O				

Table 39 - Future orientation perspective measurements for organisation C

6.4.5 Organisation C: Conclusion

There has been a strong focus on cost and expenditure management pertaining to BI implementations in organisation C. This can be attributed to the very low profit margins that are characteristic of this industry. The organisation also indicated that a number of BI projects were not implemented on time and within budget. No reason for these overruns was disclosed.

The absence of any risk management tasks was not known and it was assumed that the management of risk was not a high priority in this organisation.

There has been an increase in sales as well as the number of clients since the implementation of their BI system, although the interviewee could not confirm if any BI related data was used in any cross and up-sell marketing activities. The increase in sales and number of clients might be a contributor to management's strong positive perception with regard to BI (although not scientifically confirmed).

The organisation faced huge challenges pertaining to end-user satisfaction. This is due to historic issues of data quality and trustworthiness as well as deployment issues to geographically remote branches. Connectivity issues in remote branches created the impression of an unstable BI system. This impacted on system response time although it fell within acceptable limits. Despite all the challenges more end-users indicated their intention to use the system. However, the overall impression was that the BI system is not currently supporting effective organisational processes.

Despite the challenges with regard to BI end-user satisfaction, employees in general are satisfied with their working environment. This is evident through a high retention rate, low turnover rate and high number of service years.

The extent to which the BI system catered for the information needs of current business processes and performance measurements was not established. However it seemed as if the BI system fulfilled in the majority of the business needs.

The workforce, although mature in age, have the necessary competency and skill to obtain information from the BI system as well as skills with regard to emerging BI

technologies. No formal budget was allocated to research these emerging technologies for future business ventures.

6.4.6 Organisation C: Map to research questions

PRQ: How does BI add value to organisation C?

The value of BI systems in organisation C is evident through:

- The ability of their highly skilled workforce to provide in the information needs of the organisation;
- The knowledge of the current workforce to interpret BI data for the purpose of decision-making, enabled through their extensive experience measured in the number of service years in the organisation;
- The increase in the number of customers since the implementation of a BI system;
- The increase in the number of sales since the implementation of a BI system.

SRQ1: What is the perceived value of the BI implementation amongst senior management in organisation C?

The perceived value of the implemented BI system amongst senior management was highly positive. Not only did they continue to implement BI solutions, they also attempt to address data and connectivity related issues. As stated by the interviewee: *"With the large amount of data by modern industries, the information contained within the data can provide a competitive edge over other manufacturers. This can be accomplished by supplying the business with detailed views on sales, demographics, and trending analysis."*

SRQ2: What was the impact of BI on the organisation C?

The biggest direct impact of BI on organisation C was mostly evident through the increase in the number of customers as well as the increase in sales statistics since the implementation of their BI system. It can be assumed that the utilisation of BI data contributed to better decision-making with regard to product and marketing related decisions.

SRQ3: What was the relationship between BI implementations and organisation C's performance?

The increase in the number of customers and subsequent sales statistics impacted positively on the financial performance of the organisation.

The ability to make informed decision using data from the BI system can also positively impact on organisation process level.

SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?

The organisational functional areas identified were the areas responsible for product sales and marketing.

Organisation C: BI balanced scorecard measurement matrix

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum				X	
		1.3 Total BI budget as a % of IT budget	X				
		1.4 Total BI budget as a % of overall turnover					X
		1.5 Project cost variance	W				
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)	W				
		2.2 Perceived sales increase as a result of BI system utilisation	X				
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)				X	
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)				X	
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey			X		
B1. Provide users access to the right	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
information when needed	2. Usefulness of information	2.1 Perceived usefulness of information survey	X				
	3. Intention to use the system	3.1 Intention to use the system (survey)		X			
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	2.12 BI user satisfaction rate (internal and external)	O				
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period	W				
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W				
		7.2 Number of active BI users	W				
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	O				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance				X	
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions				X	
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X	
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)	X				
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report	O				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		5.3 System quality rate	X				
		5.4 User friendliness rating	X				
		5.5 Number of times when information is not available when needed	O				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	W				
		6.2 Data availability rate	W				
		6.3 Data consistency rate	W				
		6.4 Data quality rate	W				
		6.5 Number of queries related to data quality	O				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems				X	
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	W				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	O				
		9.2 Number of unplanned BI system interruptions	O				
		9.3 Number of planned BI system interruptions	W				
		9.4 Number of operational failures	O				
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				
		1.3 Age distribution of BI staff	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		1.4 Number of years of BI experience per staff member	X				
		1.5 Perceived satisfaction of BI employees (employee satisfaction ate)			X		
		1.6 Turnover rate of BI employees	W				
		1.7 Retention rate of BI employees	W				
		1.8 Productivity of BI employees (number of queries per employee per day)	W				
	2. Level of training and education of BI personnel	2.1 Number of educational days per person				X	
		2.2 BI training and resource development budget as a percentage of the overall IT budget	X				
		2.3 BI training and development budget as a percentage of the overall BI budget					X
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	W				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget			X		
		3.2 BI research budget as a percentage of the overall BI budget			X		
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation	X				
		3.4 Number of new business ventures introduced as a result of new BI technological trends				X	
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications	W				
		4.2 Number of BI technologies utilised	W				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
	5. Performance of BI systems	5.1 Downtime of BI systems	O				
		5.2 Availability of systems	O				
		5.3 Database query response time	W				
		5.4 User satisfaction rate	O				

Table 40 - Organisation C: BI balanced scorecard measurement matrix

6.5 Case study 4: Organisation D

Organisation D is a large (more than 250 employees) public administration organisation currently trading in the South African government sector. The organisation has become known for its efficiency and effectiveness and is also perceived as one of the best government departments in South Africa. The interview was conducted with the Senior Data Analytics Manager currently looking after the data analytics needs of the organisation. The semi-structured interview was completed prior to the interview after the interviewee had consulted a number of internal resources. The results were discussed in the interview.

A number of BI items were implemented by the organisation, including a data warehouse, dashboards and reports. Five data warehouses serve as the main data source providing data to five three dimensional data structures (also referred to as OLAP cubes), ten pre-developed reports as well as one dashboard. An infinite number of pre-developed reports were available to various users. These reports were created by end-users using Microsoft Excel as main toolset. A data analytic tool is available for end-users with the necessary analytical knowledge and skills to perform in-depth data analytics. All these BI items are graphically displayed on a pie chart (Figure 21). No separate BI division or competency centre has been implemented to support these items and to fulfil the additional BI needs in the organisation. However, each department has a unique set of BI and data analytics resources attending to individual departmental needs.

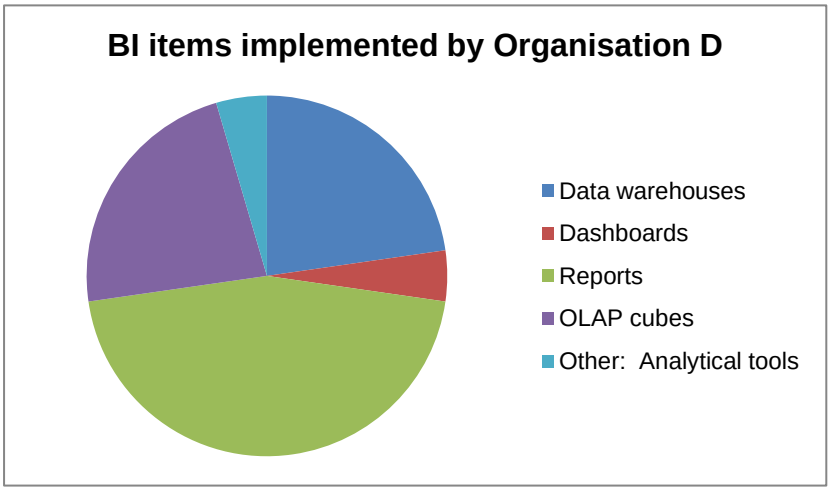


Figure 21 - BI items implemented in organisation D

According to the interviewee BI (or data analytics as he referred to BI) adds enormous value to their organisation. BI provides valuable input into their decision-making process and provides essential information to both internal and external stakeholders. The information is used as input to the country's Gross Domestic Product (GDP)[33] calculations as well as national trade statistics. He also argued that should the quality of the national trade statistics increase (as a result of information obtained from a well-defined data warehouse) the trade deficit in the GDP will also improve. Their perceived value of BI is therefore experienced on a national level.

6.5.1 Business value perspective

Mission: to implement and maintain a BI capability that will increase long-term stakeholder value.

Organisation D does not keep track of BI expenses on departmental level and was unsure about the estimated BI expenses per user per year. It was estimated that 5 % of the overall IT budget was allocated to BI implementations. However, the interviewee was not sure if the BI budget contributed to the overall turnover[34].

Surprisingly no project related (project cost variance or project cost performance index) or traditional calculation methods were used to calculate project costs or perform investment type enquires. In fact, it was quite challenging to establish the business value added to the organisation as no impact on sales statistics could be established. This was due to the fact that no sales related activities were applicable to this organisation. However, the interviewee stated that the operational functions of the organisation improved as a result of timely information (obtained from BI systems) as well as numerous indirect benefits.

No form of risk is currently calculated, including BI and IT strategy risk, definitional uncertainty, technological risk, organisational risk and IT infrastructure risk.

[33] The GDP is a monetary value of all finished goods and services produced within the borders of South Africa over a set time period.
[34] Overall turnover in this instance refers to gross receipts of money.

Although the stakeholders' perception is not scientifically established, the various business stakeholders have a *"highly positive"* perception of BI. They have a high regard for the BI competency within the various teams as well as the analytical capability within the various departments.

Conclusion:

Organisation D perceives BI as a vital component contributing to the success of their business. The biggest impact of BI on their operational functions is on improved decision-making, the availability of timely information to stakeholders as well as improved operational functions. Numerous indirect benefits had also been reaped although these were not disclosed.

No formal calculations such as project cost calculations, traditional financial calculations or any risk related calculations are conducted.

Business value perspective: Status of actual metrics implemented to measure business value in organisation D

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X		
		1.2 BI expenses per user per annum			X		
		1.3 Total BI budget as a % of IT budget	X				
		1.4 Total BI budget as a % of overall turnover			X		
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation					X
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey		X			

Table 41 - Business value perspective measurements for organisation D

6.5.2 User orientation perspective

Mission: Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.

A substantial number of internal and external users utilise the BI system per day (more than 30). External users, in this instance, include public users, i.e. any South African citizen. Therefore, the number of external users is only based on estimation due to the lack of control over their public domain. On the other hand, some data elements are only available to external users once a formal subscription process has been followed (subscription is free of charge). Apart from the current internal and external system users, no other users (in particular departmental users) have indicated their intention to make use of the organisations' BI system.

The data contained in the BI system is useful and trustworthy. Their data testing process is extremely intensive and rigorous with the involvement of external parties. After an internal testing process a technical report is compiled and attached with the data. This is presented to the Statistics South Africa and treasury departments for verification. Once verification is received the finance minister of South Africa signs-off on the report. The results are audited by the Auditor General at regular intervals.

Data from the BI system (in the form of reports) are immediately available when requested from both internal and external users. In some instances, data is only available through a subscription process. Once the process is finalised the data becomes available to the subscriber. Specific data requests are attended to by one person at a time. This might result in some bottlenecks. However, the time to obtain data in general from the BI system is within acceptable limits.

Both internal (approximately 120 users) and external users (unknown number of users) in general are satisfied with the BI system with which they interact. However, it is 'normal' for data consumers to question data. In this environment, some data enquiries are also received but these are usually related to a lack of understanding of the context in which the data is presented.

The interviewee is of the opinion that the number of data consumers of the system has increased since the implementation of the system. It is also assumed that the number of external users increased due to the availability of more data elements.

Conclusion:

Data provided by the BI system to both internal and external users are of high quality and very trustworthy. As in many other instances, data is often questioned. These enquiries are often related to a lack of contextual understanding. In general, users are satisfied with the system with which they interact. It seems as if the basic information requirements are fulfilled by the data contained in the BI system.

User orientation perspective: Status of actual metrics implemented to measure user orientation in organisation D

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				
	2. Usefulness of information	2.1 Perceived usefulness of information survey	W				
	3. Intention to use the system	3.1 Intention to use the system (survey)			X		
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period		X			
	7. User enthusiasm	7.1 Number of times logged on to the BI system	X				
		7.2 Number of active BI users	X				

Table 42 - User orientation perspective measurements for organisation D

6.5.3 Operational excellence perspective

Mission: To support the organisation in achieving goals by providing effective BI processes.

Numerous BI projects have been implemented in organisation D in the past five years (more than three). Although the organisation does not enforce strict budgetary constraints, all of these projects were implemented within a larger departmental budget. Project plans are used to guide the project implementation process as well as implementation of the project within a particular timeframe. However, no formal project related calculations pertaining to the project schedule and timeline is conducted, including project scheduled performance index and project schedule variance.

No particular project methodology is followed when BI projects are implemented although elements of the software development lifecycle (SDLC) are sometimes included in the management of projects.

It was not known what percentage of the business processes and business performance measurements are covered in these projects. It is therefore difficult to establish the exact extent to which the current BI system fulfils in the overall information needs of the organisation.

BI projects are initiated after the identification of a formal information requirement by business stakeholders. This need is then communicated to development staff by the various departmental stakeholders. No end-users are involved in the project implementation including requirements gathering, development, testing and maintenance.

The operational functioning of the BI system is well within the acceptable benchmarks set by the organisation. For example, it takes between one to four minutes to obtain existing or new reports from the BI system. It should be noted, however, that the reports are based on pre-processed data. The reports contained high quality, trustworthy data as described in the user orientation perspective due to rigorous testing processes.

The BI system is perceived to be user friendly but is not entirely developed with the objective of self service. Therefore, end users sometimes need system training before they have the know-how to obtain reports.

BI reports are always available due to the fact that the reports contained pre-processed data. Data in these reports are not older than a day but these contain data from the previous hour. However, the interviewee indicated that there is scope for improvement in terms of the availability of real-time data. Other data characteristics including data accuracy, consistency and quality scored high in terms of the satisfaction rate. Despite these high scores, organisation D often receives data related enquiries from end-users (more than ten enquiries a month). Organisation D is not concerned about the number of enquiries due to the fact that data users often do not understand the context in which the data is presented. The enquiries as well as BI system support is handled by a support team. The response times as well as level of support is within acceptable limits. As a result of the data quality, accuracy, trustworthiness and availability, combined with the adequate system support, internal BI users indicated that they are in general satisfied with the BI system. External user satisfaction is not established.

Data from the BI system is not used for any sales related activities due to the nature of their business.

Organisation D experienced less than five unplanned system downtime events and system interruptions per month. The interviewee is not sure if this is within acceptable limits. Planned system interruptions are estimated to be at less than five a month. Again, the interviewee is not sure if this falls within acceptable limits. However, no complaints are received when notification of these planned events is communicated. Less than five BI system or toolset operational failures are recorded per month. This is within acceptable limits.

Conclusion:

System response time was within acceptable limits. However, the pre-processing of reporting data contributed to this.

Organisation D scored the quality of their data characteristics very high, including data quality, accuracy, availability and consistency. Although a number of data

related enquiries are received, the perception is that it is more related to the inability of end-user to understand the context in which the data is presented. A support team are adequately addressing these enquiries. Internal BI users are therefore satisfied with the current BI system although the system was not developed with the objective of end-user self-service. The satisfaction of external BI users is not established.

Although a number of planned and unplanned BI system events occur per month, it seems as if the number is within acceptable limits. The BI system and toolset can therefore support organisation processes when required.

Operational excellence perspective: Status of actual metrics implemented to measure user orientation in organisation D

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	X				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions			X		
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements			X		
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)					X
C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				
		5.2 Time in minutes to obtain a new report	W				
		5.3 System quality rate		X			
		5.4 User friendliness rating		X			
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	X				
		6.2 Data availability rate	X				
		6.3 Data consistency rate	X				
		6.4 Data quality rate	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		6.5 Number of queries related to data quality	W				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems					X
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	X				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	X				
		9.2 Number of unplanned BI system interruptions	X				
		9.3 Number of planned BI system interruptions	X				
		9.4 Number of operational failures	X				

Table 43 - Operational excellence perspective measurements for organisation D

6.5.4 Future orientation perspective

Mission: To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

A competent internal workforce, more than thirty end-users, is currently actively utilising the BI system. These human resources are also skilled in the utilisation of emerging and latest BI technologies. The average age of the current human resources are estimated to be between thirty and thirty-nine. They have an average of between six to ten years' experience per staff member.

The user satisfaction of BI staff members are not scientifically measured on organisation level. However, some elements of employee satisfaction are measured as part of employees' personal performance management plans. It seems as if the employees are currently relatively satisfied with working conditions. On average, staff members work for the organisation for approximately two to five years. A BI staff turnover rate is estimated to be less than 5 % per year with a retention rate of 100 % per year.

BI development staff handles approximately fifteen BI related enquiries from end-users per month. The number of enquiries is acceptable. The number of enquiries handled by BI support staff was not known. It seemed as if the number of enquiries is substantial per month. However, the interviewee indicated that *"although the number of enquiries seemed substantial, it does not necessarily indicate errors in the data. The majority of the time the users do not understand the context of the data and therefore have difficulties interpreting data".*

A total of approximately ten training days are allocated to formal BI related education and training programmes per year. However, both the BI training and resource development budget as a percentage of the overall IT and BI budget is not known. The organisation extensively made use of external BI consultants per year to assist in BI development related activities.

Although organisation D foresees that BI technologies will play a vital role in their future ventures in the organisation and contribute to the sustainability of their business, the interviewee was not sure what percentage of the overall IT and BI budget was attributed to research these technologies. However, emerging BI technologies are not currently implemented in the organisation.

The BI systems and technologies implemented in organisation D are relatively new. A substantial number of items have been implemented.

When the number of system related planned and unplanned errors are evaluated it seems as if the system performs within acceptable ranges (although the client was not sure if fewer than five failures per month were acceptable). No complaints from end-users were received. The performance of the system in terms of the execution of data related queries on the database also falls within acceptable response times (less than one minute).

Conclusion:

Measurements investigated as part of the future orientation perspective indicated that a substantial number of skilled BI end-users are actively using the BI system. It can therefore be assumed that the provisioning of data is adequate in the organisation and that well-informed decisions can be based on this information. In general, employees are satisfied working for organisation D. This will have a monetary impact on the training of new employees and the ability to interpret data in the business context.

A substantial number of data enquiries are dealt with, which indicate that either the data accuracy or reliability is questioned; the system is used extensively; or data consumers do not understand the data in the context presented. According to responses from organisation D, this is a result of the extensive use of the system and the lack of data understanding within the context of the organisation.

The system performance is within acceptable ranges. It can therefore be expected that data is available to data consumers when required.

Future orientation perspective: Status of actual metrics implemented to measure future orientation in organisation D

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				
		1.3 Age distribution of BI staff	X				
		1.4 Number of years of BI experience per staff member	X				
		1.5 Perceived satisfaction of BI employees (employee satisfaction rate)			X		
		1.6 Turnover rate of BI employees	X				
		1.7 Retention rate of BI employees	X				
		1.8 Productivity of BI employees (number of queries per employee per day)	W				
	2. Level of training and education of BI personnel	2.1 Number of educational days per person	X				
		2.2 BI training and resource development budget as a percentage of the overall IT budget				X	
		2.3 BI training and development budget as a percentage of the overall BI budget				X	
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	X				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget				X	
		3.2 BI research budget as a percentage of the overall				X	

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		BI budget					
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation	X				
		3.4 Number of new business ventures introduced as a result of new BI technological trends	X				
D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications	X				
		4.2 Number of BI technologies utilised	X				
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	X				
		5.3 Database query response time	X				
		5.4 User satisfaction rate	X				

Table 44 - Future orientation perspective measurements for organisation D

6.5.5 Organisation D: Conclusion

The biggest benefit of BI in organisation D is evident on national level through an improvement in the quality of the national economic calculations. A number of indirect benefits are also reaped but it was difficult to identify and communicate these to stakeholders.

Although data from the system is of high quality and trustworthy, data is often questioned. In all the instances the enquiries can be ascribed to a lack of contextual understanding. It seems as if the system provides in the information requirements of the organisation.

System response time, data quality, accuracy, availability and consistency were within acceptable ranges. Although the system was not developed with the objective of self-service, internal system users were still satisfied with the system. The satisfaction of external BI users is not established. A support team was available to assist users where needed.

The system and BI toolset support the organisational processes where required. This was evident through the monthly occurrence of planned and unplanned BI system events within acceptable limits.

The future orientation perspective indicated that BI end-users are highly skilled and actively utilising the system. It can therefore be assumed that the provisioning of data is adequate in the organisation and that well-informed decisions can be based on this information. In general, employees are satisfied working for organisation D. This will have a monetary impact on the training of new employees and the ability to interpret data in the business context.

6.5.6 Organisation D: Map to research questions

PRQ: How does BI add value to organisation D? and

SRQ1: What is the perceived value of the BI implementation amongst senior management in organisation D?

The biggest value of BI implementations in organisation D is perceived as the positive impact of the quality of information on decision-making and national financial

calculations. An increase in the quality of information inputs into these national calculations lead to an increase in the quality of the calculation and the outcome of the calculation.

Organisation D also indicated that they reap a number of indirect benefits from their BI implementations but that they often struggle to identify and communicate these benefits. One example is the perceived improvement in operational functions as a result of the timely availability of information.

SRQ2: What was the impact of BI on organisation D?

The biggest impact of BI on organisation D was evident though the provisioning of data to both internal and external BI users as well as the improvement of national calculations due to an improvement in the quality of information used.

SRQ3: What was the relationship between BI implementations and organisation D's performance?

Organisation D has indicated that they reap indirect benefits from their BI implementations through the improvement of operational functions. An improvement in performance of various functions will lead to improved overall functioning of the organisation and subsequent performance.

SRQ4: In which organisational functional areas was the perceived value the result of a BI implementation?

The value as a result of the BI implementations was identified to have had the most impact in the functional area of finance.

Organisation D: BI balanced scorecard measurement matrix

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget				X	
		1.2 BI expenses per user per annum				X	
		1.3 Total BI budget as a % of IT budget	X				
		1.4 Total BI budget as a % of overall turnover			X		
		1.5 Project cost variance			X		
		1.6 Cost Performance Index			X		
A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X		
		2.2 Perceived sales increase as a result of BI system utilisation					X
A3. Contain and minimize risk	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
		3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X		
A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey		X			
B1. Provide users access to the right	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
information when needed	2. Usefulness of information	2.1 Perceived usefulness of information survey	W				
	3. Intention to use the system	3.1 Intention to use the system (survey)			X		
	4. Availability of information	4.1 Time measured in minutes to obtain information	W				
B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X			
B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period		X			
	7. User enthusiasm	7.1 Number of times logged on to the BI system	X				
		7.2 Number of active BI users	X				
C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	X				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X		
C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions			X		
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements			X		
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)					X
C3. Ensure operational success of the	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
system		5.2 Time in minutes to obtain a new report	W				
		5.3 System quality rate		X			
		5.4 User friendliness rating		X			
		5.5 Number of times when information is not available when needed	X				
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	X				
		6.2 Data availability rate	X				
		6.3 Data consistency rate	X				
		6.4 Data quality rate	X				
		6.5 Number of queries related to data quality	W				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems					X
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	X				
C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	X				
		9.2 Number of unplanned BI system interruptions	X				
		9.3 Number of planned BI system interruptions	X				
		9.4 Number of operational failures	X				
D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X				
		1.2 Number of employees with BI technology skills for emerging technologies	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		1.3 Age distribution of BI staff	X				
		1.4 Number of years of BI experience per staff member	X				
		1.5 Perceived satisfaction of BI employees (employee satisfaction ate)			X		
		1.6 Turnover rate of BI employees	X				
		1.7 Retention rate of BI employees	X				
		1.8 Productivity of BI employees (number of queries per employee per day)	W				
	2. Level of training and education of BI personnel	2.1 Number of educational days per person	X				
		2.2 BI training and resource development budget as a percentage of the overall IT budget				X	
		2.3 BI training and development budget as a percentage of the overall BI budget				X	
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	X				
D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget				X	
		3.2 BI research budget as a percentage of the overall BI budget				X	
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation	X				
		3.4 Number of new business ventures introduced as a result of new BI technological trends	X				
D3. Current status and future requirements	4. Age of current applications and	4.1 Age distribution of applications	X				

Objective	Measurement	Metric	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
of the BI applications portfolio	number of BI technologies utilised	4.2 Number of BI technologies utilised	X				
	5. Performance of BI systems	5.1 Downtime of BI systems	W				
		5.2 Availability of systems	X				
		5.3 Database query response time	X				
		5.4 User satisfaction rate	X				

Table 45 - Organisation D: BI balanced scorecard measurement matrix

6.6 Cross-case analysis

The organisations who participated in this study were from diverse industries in various public and government sectors in South Africa. The size of the organisations, established by evaluating the total number of employees in the organisations, ranged from micro to large organisations. The interviewees were conducted with employees on senior management level or higher. All the organisations implemented one or more data warehouses, dashboards and reports. One organisation implemented data marts whilst another organisation implemented data cubes (OLAP cubes) to allow super users to perform their own data analysis using sophisticated analytical tools. Two organisations had their own BI departments or BI competency centres, whilst one of the organisations made provision for BI related activities within the respective functional departments. The other organisation did not have any BI division or BI competency centre implemented.

All the organisations agreed prior to the interview that BI adds value to their organisations. The value, according to all the organisations, was mostly perceived as an enabler to improved decision-making. The quality of decisions was evident in the compliance to regulatory requirements and the improvement in national trade statistics. For another organisation, BI was the reason for their survival. Without successful BI implementations they will not exist.

A summary of all the measurements in the various perspectives for all the study participants are contained in table 46. The status of these measurements was used in the construction of the cross-case comparison for analysis purposes.

6.6.1 Business value perspective

Mission: to implement and maintain a BI capability that will increase long-term stakeholder value.

In general, the organisations displayed a lack of measurement pertaining to the quantitative measurement of the value of their BI investments. These include a lack of expenditure control, a lack of BI budget or the disclosure thereof as well as a lack of project cost calculations in general (although one organisation did some financial project evaluations). One organisation did ROI calculations for BI projects but the

other organisations indicate that no form of calculation was conducted. However, it seems that organisations experienced an increase in sales as a result of BI implementations, although this measurement was not applicable to all the organisations.

The value of BI implementations is often evident in the management of risk in organisations. Also, to reap benefits from an investment, it is imperative that the risk is managed when these implementations are conducted. However, this was only true for one of the study participants. In this instance, they used their BI implementation to manage risk for regulatory requirements. The remainder of the organisations did not actively monitor any risk-related activities.

The management perception of BI in all the organisations was highly positive. Unfortunately there was a perception that BI implementations are conducted quickly and without much effort. The work and effort involved in the development and implementation of such a system was not acknowledged. The perception was not scientifically measured but assumed through the involvement of management in the continuous implementation of BI projects and products. Also, management continued their sponsorship of BI projects and actively used the artefacts.

In summary - the value of BI is not always measured in organisations using scientific methods. However, BI adds value to the organisations through the following benefits (PRQ):

- Where applicable, an increase in organisational sales was experienced;
- Compliance to regulatory requirements;
- Risk management;
- The increase in the quality of operational and strategic decisions.

The perceived value of BI implementations amongst the sample of senior management participating in the study included (SRQ1):

- Invaluable asset
- Key to the organisational sustainability

The impact of BI on organisations was mainly evident through (SRQ2):

- Impact on organisational sales (where applicable depending on the nature of their business)
- Positive regulatory and audit outcomes
- Quality of operational and strategic decisions, although this indirect impact was difficult to measure
- Continuous organisational sustainability as a result of positive regulatory and audit outcomes and good decision-making.

The relationship between BI implementations and organisational performance was only evident in the following items in the business value perspective (SRQ3). This was also evident in the various functional areas (SRQ4):

- Compliance or risk area
- Sales function

When these measurements are evaluated, BI expenses and costs are not closely controlled in the organisations who participated in the study. It seems as if the short term stakeholder value is realized, although it was not sure if the long-term stakeholder value will be achieved if proper project control mechanism is not implemented. The assumption, that if proper cost management measurements are implemented and controlled, income and profit margins will increase, is a risk to future deployments.

6.6.2 User orientation perspective

Mission: Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.

The BI system is extensively used by the internal BI users on a daily basis. It seems as if the internal user enthusiasm with regard to the utilisation of the BI system is within the organisational expectation. Not all the organisations expose their BI systems to external users. In instances where information was available to external users, the extent to which external users utilised the system and subsequent information was not exactly known.

Although all the organisations agreed that their BI system contained useful and trustworthy information, some organisations indicated that they had challenges to reach this status. The biggest challenge for one organisation was to align the results of disparate systems to display the same result. When the number of data related enquiries are evaluated, organisations have indicated that these enquiries are not related to the quality of data. However, all the participants agreed that data related enquiries are often due to a lack of contextual understanding. Data consumers do not always grasp the meaning of the data in the context in which it is presented. Despite the data related enquiries, data is thoroughly tested and audited.

The majority of the organisations indicated that there was no indication from other internal or external users to utilise the BI system in future. One organisation did indicate that the proposed regulatory requirements pertaining to the sharing of data might also have an impact on the type of data shared amongst users in future.

Due to the benchmark set by applications such as Facebook and Google, BI users expect instantaneous results when interacting with the BI system. All the organisations have indicated that they supply their users with the information instantaneously. However, not all these data elements, for example reports, contain live data. In some instances reports are refreshed with the latest data and then saved and distributed for consumption (this is also known as cached reports or data). Internal BI users are in general satisfied with both the response time and the content of the BI items (such as cached reports), except for the organisation who experienced challenges with regard to the quality of data. The same scenario applies to the external BI user satisfaction rate.

Related to the fact that there was an increase in the number of sales where applicable to the various organisations (business value perspective), the same organisations experienced a substantial increase in the number of clients.

In summary – BI adds value to organisations (PRQ) in the user orientation perspective through the fulfilment of the user expectation in terms of the provisioning of information, an increase in the quality of decision-making and subsequent financial position of the organisation. This is evident and supported through:

- The BI system is actively used by both internal and external BI users;

- It can therefore be assumed that BI users are satisfied with the information provided by these systems;
- When investigated, BI users confirmed their satisfaction with the BI system;
- The provisioning of trustworthy, quality data confirmed by means of various data related audits;
- The timely availability of information when required.

The perceived value of the BI implementation amongst senior management focused on the quality of information and the utilisation thereof by users (SRQ1). Quality information was supplied to various end users and it was utilised extensively.

The main impact of BI (SRQ2) as well as the relationship between BI implementations and organisational performance (SRQ3) was evident through the increase in the number of sales and the substantial increase in the number of clients since the implementation of the BI system.

After evaluating the collective results from the interviews, it seems as if the internal and external user's expectations with regard to the provisioning of data have been met. This should therefore lead to better decision-making. The supposedly positive effect of the quality of decision-making on the trading of the organisation and subsequent increased financial position could not be scientifically confirmed.

6.6.3 Operational excellence perspective

Mission: To support the organisation in achieving goals by providing effective BI processes.

All the organisations implemented at least one or more BI projects in the past five years. Although the participants estimated that the projects were implemented within budget and allocated time span, no formal scientific measurements were implemented to prove this.

Two organisations indicated that they follow elements of the SDLC in their project management approach, although it was not followed strictly due to an iterative approach. No other project methodologies were followed. The majority of the organisations involved their business end-users during the development process

with regard to business requirements gathering, development and artefact testing. Not all the organisations involved their users in maintenance tasks.

In general, organisations were not sure to what extent the current business processes and business performance measurements were covered in their BI implementations, in particular the data warehouse.

As mentioned in the user orientation perspective the system response time was either instantaneous or between one to four minutes to obtain an existing report. However, the challenge is that the reports contain pre-processed data. Both the response times and the fact that the reports were pre-processed were acceptable to the organisations. The duration for obtaining a new report from the BI system ranged from more than ten minutes to one week. This is dependent on the complexity of the data structures, the tool selection as well as the current knowledge level and training of end-users. In the majority of the instances Microsoft Excel was used for reporting purposes – a tool most end-users are familiar with.

System user-friendliness can play a role in the development of new reports and subsequent utilisation of the data. All the organisations indicated that they score their current BI system high on user-friendliness, although one organisation did indicate that their system was not developed as a self-service application. The user-friendliness of the application was attributed to a clean, uncluttered, visually appealing interface display and the fact that the back-end complexity was hidden from the end-users. This can contribute to the perceived user satisfaction of the system.

Data from the BI system was always available, except for one organisation who indicated that data might be unavailable once or twice a week. The organisations who indicated 100 % data availability used pre-processed data, whilst the other organisation used live data for reports. The utilisation and availability of live data for reporting purposes were not disclosed in the other organisations.

The majority of the organisations scored the following data characteristics high in terms of end-user satisfaction: data accuracy, availability, consistency and quality. One organisation indicated, although they are satisfied with the current status, that there is scope for improvement on all the characteristics. The same organisation

indicated that they often have end-users questioning the quality of data, although this was the same organisation that indicated that there was scope for improvement with regard to various data characteristics. Data accuracy was sometimes questioned by BI-users as described in the user orientation perspective.

The measurements with regard to sales related activities were not applicable to all the organisations. Where applicable, one organisation indicated that they successfully utilise data from the BI system to perform product up-sell and cross-sell activities. One organisation was not sure if the data was used for this purpose and the other organisation indicated that external BI users might utilise this data for the purpose of sales activities.

The BI system was well supported within the various organisations and they indicated that the response time of the support team was within acceptable limits. As a result, organisations indicated that both the internal and external BI end users were satisfied with the BI system.

In summary – when the majority of measurements in the operational excellence perspective are evaluated, it seems as if the goal of supporting the organisation towards achieving its objectives is achieved. Effective BI processes support the organisation in terms of the provisioning of existing and new data artefacts as well as the availability of data and the utilisation and satisfaction of the current BI system. It seems as if the BI function currently supports efficient operational processes therefore contributing to the overall operational efficiency of the organisation. The contribution is identified as:

How BI adds value in an organisation in the operational excellence perspective (PRQ):

- BI projects were implemented on time and within budget (although this was a perception). For this reason no project overruns were identified. The anticipated benefits should therefore be realized.
- Pre-developed data artefacts (for example reports) were available timely on request.
- Data artefacts were developed and available in a toolset familiar to all BI end-users therefore contributing to a user-friendly system.

- It was relatively easy to obtain and interpret data from the BI system due to an uncluttered, visually appealing display.
- Data artefacts contained reliable, accurate, consistent and high quality data. The end-users therefore used the data artefacts with confidence for decision-making purposes.
- Data was used in up-sell and cross-sell activities. This might have a positive influence on the number of products sold positively impacting financial indicators.
- System support was available when needed and the response time of the responsible agents was within acceptable limits. For this reason, data related enquiries were resolved quickly.

The perceived value of BI implementations amongst senior management (SRQ1):

- A positive management perception of BI implementations was evident through:
    - the continuous implementation of new BI projects;
    - the timely availability of information when they need to make important operational and strategic decisions;
    - the ability to improve revenue through product up-sell and cross-sell activities;
    - positive customer and end-user system experience.

The impact of BI on organisations in particular in the operational excellence perspective (SRQ2):

- Improved decision-making in particular on operational and strategic level.
- Improved up-sell and cross-sell activities.
- Availability of relevant information when required.

The relationship between BI implementations and organisational performance was evident in the following items in the operational excellence perspective (SRQ3).

- Improved sales figures due to the utilisation of timely, accurate data in up-sell and cross-sell activities;
- Positive sales figures will have a positive impact on financial indicators;
- Increase in the performance of operational processes due to the availability of information for decision making purposes.

This was also evident in the various functional areas (SRQ4):

- Financial business function
- Various operational process level areas
- Sales function

6.6.4 Future orientation perspective

Mission: To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

A substantial number of employees in each of the participatory organisations in the study are competent in using the current BI system. In some instances, special training and skills were not required as some organisations used Microsoft Excel as toolset. Although organisations indicated that they have some skills pertaining to emerging and the latest BI products and technologies, organisations felt that their focus is not currently directed at efforts to utilise these toolsets in the short to medium term. One organisation, however, did indicate that they have an extensive human resources pool equipped with these skills. It was not sure exactly what their intention was in the utilisation of these skills.

Despite one organisation that indicated that they are unsure about the average age of staff members responsible for their BI capability within the organisation, the rest of the organisations indicated that the average age is between 30 and 39. This is relatively old, increasing the risk of employees retiring without reskilling younger employees.

Although two (out of four) of the organisations did not measure the perceived satisfaction of BI employees, the remainder of the organisations have established the employee satisfaction rate indirectly as part of individual performance management systems. The majority of the employees have worked on average between two to five years for the organisation. This can be an indication that employees are relatively satisfied being employed by the organisation. Only one organisation, the organisation with all the data quality challenges, indicated that their

employees have on average worked between six to ten years for the organisation. The turnover rate of employees in general was therefore less than 5 % per year and the estimated retention rate for the previous year was estimated at 100 %.

Very little information was available when the productivity of BI employees was investigated. The response of the participants was either that they did not have BI support staff, or that the number of enquiries dealt with handled by BI development staff was unknown. Only one organisation indicated that the number of data and BI related enquiries handled per BI human resources are within acceptable limits, but that the number of enquiries was not acceptable. The number of data related enquiries was not always related to the quality of data but rather due to a lack of contextual understanding of the data presented.

The feedback with regard to staff training on BI related education and training programmes during the past year was limited. Respondents were not sure about the number of training days allocated per person, or offered no training to end-users because Microsoft Excel is used as the preferred tool of choice. In instances where product related training was conducted it was estimated that two days were allocated, whilst the other organisations estimated approximately ten days of training in total for all the employees.

The majority of respondents did not know what the value of the BI training and resource development budget as a percentage of the overall IT budget for the year was. Only one respondent estimated that the value is approximately less than 5 % of the annual IT budget. The same response was obtained with regard to the overall BI budget per year. The lack of training might contribute to the need to use external BI consultants to perform some development and maintenance tasks. In some instances external consultants are contracted for a medium contract period, whilst some organisations only consult with external consultants if new BI developments are implemented.

It seems as if the research effort pertaining to new BI developments are neglected. Study participants were unsure about the amount (if any) allocated to research these technologies. For this reason, the budgetary line item for BI research as a percentage of the overall IT budget and overall BI budget per annum was not known. This response was surprising given the fact that three of the four organisations

estimated that new BI technologies would play a role in the future ventures of the organisation. Currently the organisations have indicated that they were not sure if any new business ventures were implemented as a result of new BI technological trends, whilst only one organisation indicated that no new business ventures were introduced.

The age of the various BI systems in the organisations was not known to all the participants. Two organisations have indicated that the age is estimated between twelve and sixty months. Whilst some organisations use Microsoft Excel as preferred BI tool of choice, the other organisations indicate that the age of tools are currently between twelve and sixty months. Organisations in general utilise one or at the most two brands of technologies in their BI solution. In general organisations only used BI tools from one particular brand, except for one organisation using a combination of open source and branded technologies. Only two organisations use an advanced data analytics tool. The most popular BI tools implemented were data warehouses, reports (either self-service or pre-developed) and dashboards. Very few organisations have implemented operational data stores (ODS), OLAP cubes or advanced analytical capabilities.

The performance of BI systems can be related to the current human resource capability to continuously support and maintain these systems. The performance was evaluated in terms of planned and unplanned downtime impacting on the availability of the BI system and the ability of the system to respond to service requests. All these items impact on the user satisfaction rate. Two organisations have indicated that their system downtime (both planned and unplanned) fell within acceptable limits. One organisation indicates that the number of downtime events was not within limits, whilst one organisation is not sure of the number of downtime events. The organisation indicating their disapproval of the number of downtime events has had major challenges with regard to the deployment of their BI solution to remote branch locations in South Africa. The major challenge was to ensure continuous and secure connectivity between the head office (located in one of the main provinces in South Africa) and the branches.

The system response time was acceptable to all participants. As mentioned in one of the other perspectives, this might be due to the fact that reports are pre-processed and therefore available and responsive despite system downtime events.

In summary – the future orientation perspective is perceived as a neglected area when measurements are implemented. In instances where measurements were implemented it seemed as if the outcome of the measurements should be a matter of concern. For example, the age of the current workforce should alert stakeholders that younger employees should be trained to perform business intelligence related tasks. The lack of focus and provisioning of human resource training (as part of the budget) as well as inadequate research activities into new and emerging BI technologies might have a negative impact on the long term sustainability of the organisation. The effect of this might not be visible in the short term but will definitely have an impact on longer term ventures using emerging BI technologies.

The focus of the future orientation perspective is on the provisioning for and availability of BI specialist capabilities, the training and education on BI related tools and technologies, the research effort focusing on BI emerging trends and technologies, the age of current applications and technologies utilised as well as the current BI system performance in general. These focus areas supported the main objective of retaining current employees and ensure that current employees are equipped with the right mix of capabilities and skills to meet the current and future information needs of the organisation. Where appropriate, the latest and best technologies should be introduced in the organisation in order to remain competitive.

The current contribution of BI to the overall organisations has been identified:

How BI adds value in organisation in the future orientation perspective (PRQ):

- The current human resource ability to retrieve and use data from the BI system using a familiar tool such as Microsoft Excel ensures that data is readily available and shared amongst users. Unfortunately no additional human resource training was provisioned for in the budget.
- Human resources are experienced and familiar with the business environment to interpret data in the context of the business scenarios. However, the risk should be raised that a skills transfer should be planned to ensure continuity.

- User satisfaction is an indication that users will utilise the system. The utilisation of the system will contribute to well-informed decision-making.
- Adequate system response time and limited system downtime ensured that information is available when needed.

The perceived value of BI implementations amongst senior management (SRQ1):

- Satisfied BI end users utilise BI systems extensively.
- Timely information is available from 'stable' systems with limited downtime.
- Employees are skilled in the retrieval and utilisation of data from the BI system.

The impact of BI on organisations in particular in the operational excellence perspective (SRQ2):

- BI end-users are equipped with the applicable knowledge and skill to provide the organisation with the necessary information when required;
- The majority of the BI employees have the applicable knowledge and skill with regard to emerging BI technologies. The impact of this will only be visible when the latest BI technologies are implemented. If implemented successfully the impact will be substantial on the competitive advantage of the organisation.
- Mature employees (when the number of service years in the organisation is evaluated) have the necessary contextual background to interpret data in the organisation.

The relationship between BI implementations and organisational performance was evident in the following items in the future orientation perspective (SRQ3):

- The ability of employees to make informed decisions will lead to improved organisational performance although indirect benefits are difficult to identify and communicate.

This was also evident in the various functional areas (SRQ4):

- The ability of mature employees to make contextual data interpretations is evident across all the various functional areas.

Summary and status of measurements used in organisation A, B, C and D

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
A1.	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget			X					X					X					X		
		1.2 BI expenses per user per annum		X				W								X				X		
		1.3 Total BI budget as a % of IT budget		X						X			X					X				
		1.4 Total BI budget as a % of overall turnover				X				X							X			X		
		1.5 Project cost variance			X					X			W							X		
		1.6 Cost Performance Index			X					X					X					X		
A2.	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)			X					X			W							X		
		2.2 Perceived sales increase as a result of BI system utilisation				X						X	X									X
A3.	3. Identify, calculate and monitor risk.	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)			X			W								X				X		
		3.2 Risk occurrence using information economics (business strategy risk, business			X			W								X				X		

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)																				
A4.	4. Management's perception of the BI department	4.1 Management survey			X				X						X				X			
B1.	1. Actual system utilisation	1.1 Number of times logged on to the BI system	X					W					X					X				
	2. Usefulness of information	2.1 Perceived usefulness of information survey		X					X				X					W				
	3. Intention to use the system	3.1 Intention to use the system (survey)		X						X				X						X		
	4. Availability of information	4.1 Time measured in minutes to obtain information	W					W					W					W				
B2.	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)		X					X				O						X			
B3.	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period		X							X		W						X			
	7. User enthusiasm	7.1 Number of times logged on to the BI system	W					W					W					X				
		7.2 Number of active BI users		X				W					W					X				
C1.	1. Successful and efficient BI tool	1.1 Number of BI projects and / or tool implementations on time and	X						X				O					X				

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
	implementation	within budget in relation to the total number of BI projects completed																				
		1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance			X					X						X				X		
C2.	2. Structured methodology followed	2.1 Adherence to methodological prescriptions	X							X						X				X		
	3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements				X					X					X				X		
	4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)		X				W					X									X
C3.	5. System performance and quality	5.1 Time in minutes to obtain an existing report	W					W					W					W				
		5.2 Time in minutes to obtain a new report			X			W					O					W				
		5.3 System quality rate	X						X				X						X			
		5.4 User friendliness rating			X				X				X						X			
		5.5 Number of times when information is not available when needed	X					X					O					X				

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
	6. Data reliability, consistency and high quality	6.1 Data accuracy rate	X					W					W					X				
		6.2 Data availability rate	X					W					W					X				
		6.3 Data consistency rate	X					W					W					X				
		6.4 Data quality rate	X					W					W					X				
		6.5 Number of queries related to data quality	W						X				O					W				
		6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems	W									X				X						X
	7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged	W					W					W					W				
	8. Customer / user experience	8.1 Customer / user satisfaction survey	X						X				W					X				
C4.	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime	W					W					O					X				
		9.2 Number of unplanned BI system interruptions	W					W					O					X				
		9.3 Number of planned BI system interruptions	W					X					W					X				
		9.4 Number of operational failures	W									X	O					X				
D1.	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	X					W					X					X				
		1.2 Number of employees with BI	X					W					X					X				

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
		technology skills for emerging technologies																				
		1.3 Age distribution of BI staff				X		W					X					X				
		1.4 Number of years of BI experience per staff member				X		W					X					X				
		1.5 Perceived satisfaction of BI employees (employee satisfaction rate)				X		W							X					X		
		1.6 Turnover rate of BI employees	X					W					W					X				
		1.7 Retention rate of BI employees	X					W					W					X				
		1.8 Productivity of BI employees (number of queries per employee per day)			X						X		W					W				
	2. Level of training and education of BI personnel	2.1 Number of educational days per person	X								X					X		X				
		2.2 BI training and resource development budget as a percentage of the overall IT budget				X		W					X								X	
		2.3 BI training and development budget as a percentage of the overall BI budget				X						X					X				X	
		2.4 Number of times an external consultant is contracted to perform internal BI tasks	X					W					W					X				

Objective #	Measurement	Metric	Organisation A					Organisation B					Organisation C					Organisation D				
			Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable	Measured (Within (W) / Outside standard (O)	Estimated measurement	Not measured	Not sure	Not applicable
D2.	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget				X						X			X						X	
		3.2 BI research budget as a percentage of the overall BI budget				X						X			X						X	
		3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation		X								X	X					X				
		3.4 Number of new business ventures introduced as a result of new BI technological trends				X						X				X		X				
D3.	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications				X						X	W					X				
		4.2 Number of BI technologies utilised				X		W					W					X				
	5. Performance of BI systems	5.1 Downtime of BI systems	W					W					O					W				
		5.2 Availability of systems	W					W					O					X				
		5.3 Database query response time	W					W					W					X				
		5.4 User satisfaction rate		X					X				O					X				

Table 46 - Summary and status of measurements used in organisation A, B, C and D

6.7 Chapter conclusion

A total of four organisations was interviewed for the purpose of the study. In addition all relevant sources of evidence were evaluated to substantiate the findings of the interview and to gather additional information. For each of the organisations, a case study was developed whereafter cross-case analysis was conducted considering similarities and differences between the cases. In addition, the feedback from the interviews was used to identify possible additional measurements.

Table 47 provides a summary of the research questions as stated in chapter one, whilst Table 48 provides a summary of all the collective benefits and value drivers identified during the study and described in all the relevant sections. The summary items are also studied for the relevance they have to the identified research questions.

Research question #	**Research question**
PRQ	How does BI add value to organisations?
SRQ1	What is the perceived value of the BI implementation amongst senior management?
SRQ2	What was the impact of BI on the organisation?
SRQ3	What was the relationship between BI implementations and organisational performance?
SRQ4	In which organisational functional areas was the perceived value the result of a BI implementation?

Table 47 - Summary of research questions

Balanced scorecard perspective	**Benefit / impact / value**	**Research question**
Business value perspective	Where applicable an increase in organisational sales was experienced.	PRQ, SRQ2
	Compliance to regulatory requirements from a risk management perspective.	PRQ

Balanced scorecard perspective	Benefit / impact / value	Research question
	The increase in the quality of operational and strategic decisions (although this indirect impact was difficult to measure).	PRQ, SRQ2
	BI was perceived as an invaluable asset to the organisation.	SRQ1
	BI was perceived as the key to organisational sustainability as a result of positive regulatory and audit outcomes and good decision-making.	SRQ1, SRQ2
	Positive regulatory and audit outcomes.	SRQ2
	Compliance or risk area.	SRQ3, SRQ4
	Sales function.	SRQ3, SRQ4
User orientation perspective	Fulfilment of the user expectation in terms of the provisioning of information.	PRQ
	Quality of decision-making and subsequent financial position of the organisation supported by: • A BI system actively used by both internal and external BI users; • Satisfied end-user with regard to the information provided by BI systems; • Provisioning of trustworthy, quality data confirmed by means of various data related audits; • Timely availability of information when required.	PRQ
	Focused on the quality of information and the extensive utilisation thereof by users.	SRQ1
	Increase in the number of sales.	SRQ2, SRQ3
	Substantial increase in the number of clients.	SRQ2, SRQ3

Balanced scorecard perspective	Benefit / impact / value	Research question
Operational excellence perspective	Anticipated BI project benefits should be realized because of on-time and within budget implementations.	PRQ
	Pre-developed data artefacts (for example reports) were available timely on request.	PRQ
	Data artefacts available within a familiar toolset contribute to user-friendliness.	PRQ
	Easy to obtain and interpret data from uncluttered visually appealing display.	PRQ
	Data artefacts contained reliable, accurate, consistent and high quality data. Decisions could therefore be made with confidence.	PRQ
	Data used in up-sell and cross-sell activities positively impacts financial indicators.	PRQ
	System support available when needed.	PRQ
	A positive management perception evident through: • Continuous implementation of new BI projects; • Timely availability of information to make operational and strategic decisions; • Ability to improve revenue through product up-sell and cross-sell activities; • Positive customer and end-user system experience.	SRQ1
	Improved decision-making in particular on operational and strategic level.	SRQ2
	Improved up-sell and cross-sell activities.	SRQ2
	Availability of relevant information when required.	SRQ2

Balanced scorecard perspective	Benefit / impact / value	Research question
	Improved sales figures due to the utilisation of timely, accurate data in up-sell and cross-sell activities.	SRQ3
	Positive sales figures will have a positive impact on financial indicators.	SRQ3
	Increase in the performance of operational processes due to the availability of information for decision-making purposes.	SRQ3
	Financial business function.	SRQ4
	Various operational process level areas.	SRQ4
	Sales function.	SRQ4
Future orientation perspective	The current human resource ability to retrieve and use data from the BI system using a familiar tool such as Microsoft Excel ensures that data is readily available and shared amongst users. Unfortunately no additional human resource training was provisioned for in the budget.	PRQ
	Human resources are experienced and familiar with the business environment to interpret data in the context of the business scenarios. However, the risk exists that a skills transfer should be planned to ensure continuity.	PRQ
	User satisfaction is an indication that users will utilise the system. The utilisation of the system will contribute to well-informed decision-making.	PRQ
	Adequate system response time and limited system downtime ensure that information is available when needed.	PRQ
	Satisfied BI end users utilise BI system	SRQ1

Balanced scorecard perspective	Benefit / impact / value	Research question
	extensively.	
	Timely information is available from 'stable' systems with limited downtime.	SRQ1
	Employees are skilled in the retrieval and utilisation of data from the BI system.	SRQ1
	BI end-users are equipped with knowledge and skills to provide the organisation with the applicable information when required.	SRQ2
	The majority of the BI employees have the necessary knowledge and skill with regard to emerging BI technologies. The impact of this will only be visible when the latest BI technologies are implemented. If implemented successfully the impact will be substantial on the competitive advantage of the organisation.	SRQ2
	Mature employees (when the number of service years in the organisation is evaluated) have the contextual background to interpret data in the organisation.	SRQ2
	The ability of employees to make informed decisions will lead to improved organisational performance although the indirect benefits are difficult to identify and communicate.	SRQ3
	The ability of mature employees to make contextual data interpretations is evident across all functional areas.	SRQ4

Table 48 - Summary of value items identified as a result of BI implementations

The relationship between the BI implementations and organisational performance (SRQ3) as well as the functional areas where the perceived value was the result of a

BI implementation (SRQ4) might be more visible in the graphical representation of the proposed intermediate version of the BI balanced scorecard presented in chapter seven.

The following items have been identified as barriers to achieving the value offered by BI organisations:

- No formal, scientific method (for example surveys) is used to establish the true management perception towards BI implementations.
- Except for the one organisation utilising their BI system for risk management purposes, no other risk related calculations were conducted during projects.
- BI end user satisfaction is, in general, not established scientifically. The measure is derived from the amount of times the users actively use the system. However, they might have no other option to use the system, despite their disapproval of the system.
- In general, organisations are not using traditional financial calculations (with the exception of one organisation) to establish the potential value of BI investments.
- No project related controls focusing on project schedules and financial calculations are used to establish if the project will be delivered on time and within the restricted budget.
- No BI related methodologies are followed when implementing for example using a data warehouse. This can lead to ‘short-cuts’ and impact on the quality of the deliverable.
- Organisations did not know to what extent the BI solution catered for the various business functions and business performance measurements within their organisations. It will therefore be challenging to cater for potential gaps in the information if these are not identified.
- The number of training days allocated to BI end user training was lacking.
- The financial provisioning of formal training for BI end users were not included as part of the budget.
- No provisioning was made for research into emerging BI technologies. This should be considered to adopt the latest applicable technologies that can contribute to the organisational competitive advantage.

- The age of applications, BI tools and BI systems were not monitored closely. This might contribute to an increase in the number of unplanned downtime events and system failure.
- Although a mature workforce might contribute to the efficient interpretation of data due to their contextual understanding of the business, the risk exists that the knowledge might leave the organisation when the senior employees retire.

Data gathering process challenges

The data gathering process was not without challenges and the following must be disclosed in order to put the results into perspective:

- The interview template was extremely long (twenty-two pages) and although there is ample space on the template for notes, there were a lot of questions in five sections. Due to the limited time available it was difficult to discuss all the questions in detail. As a result, transcribed interview templates were communicated back to interviewees to add more detail in instances where gaps were identified.
- The first option was to record interviews for the purpose of transcribing. Unfortunately participants did not feel comfortable with recordings for two main reasons:
    - Participants opted to remain anonymous and feared that recordings might be used to identify participants.
    - Information was highly sensitive and classified due to the fact that BI systems and the implementation and utilisation thereof often contribute to the organisation's competitive advantage.

  For this reason, data was transcribed directly after the interview process and thorough notes were taken during the interview process.

The next chapter (chapter seven) proposes an intermediate version of the BI balanced scorecard based on the findings of this chapter. This research output was used to diagrammatically display the following items:

(1) the various value items identified and confirmed in this study;

(2) the relationships between the various components of a BI implementation when compared to organisational performance (SRQ3)[35].
(3) identify the organisational functional areas where the perceived value was the direct result of the BI implementation (SRQ4); and
(4) the relationship amongst the various objectives and four perspectives.

For this reason, the BI balanced scorecard was merely a method used to investigate the value of BI in organisations and subsequently gather data and display the findings on the same framework.

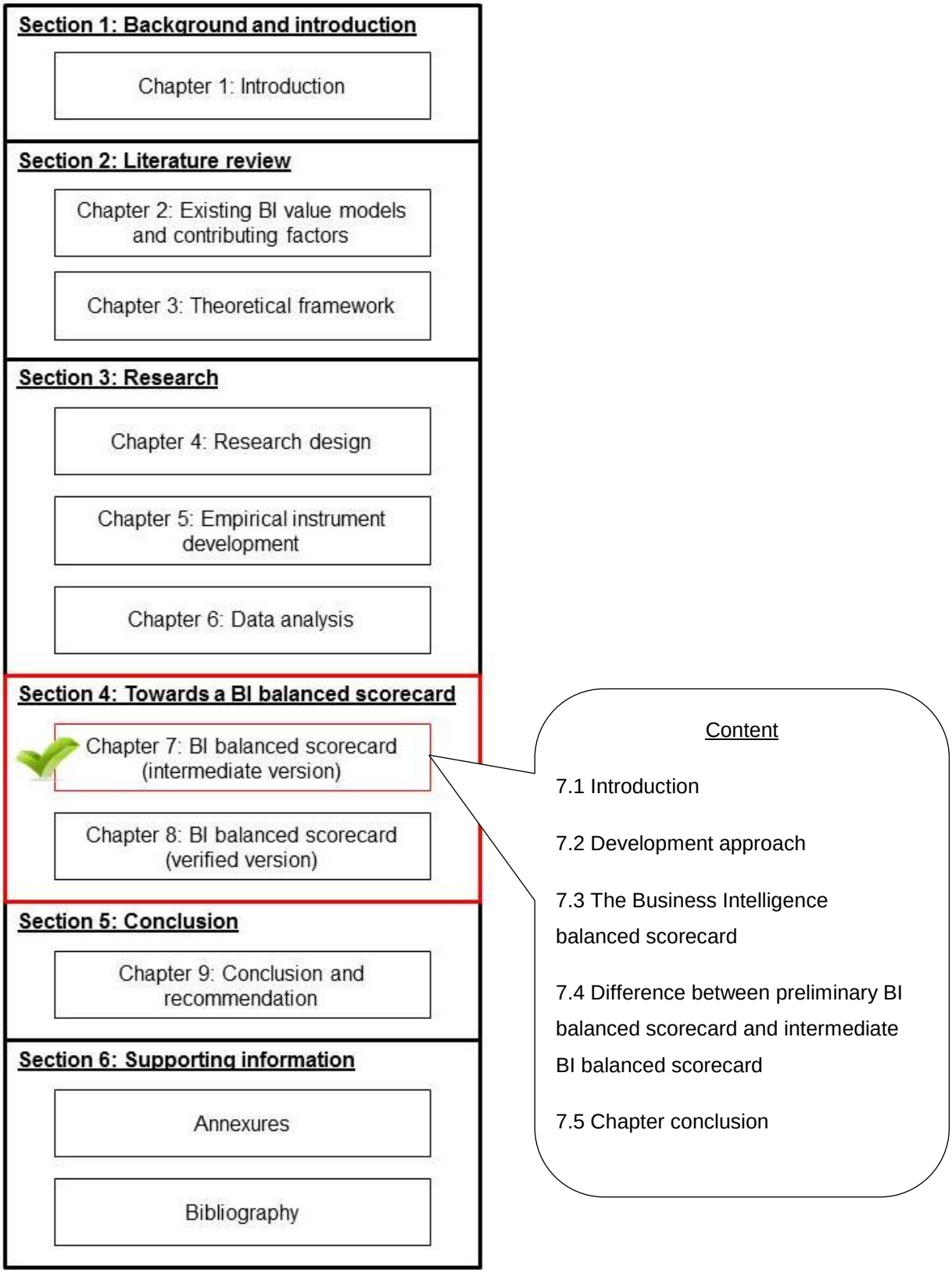
[35] The diagram presented in section7.3.5 was also used in the thematic analysis phase.

Section 4

Towards a Business Intelligence balanced scorecard

Chapter 7

Intermediate Business Intelligence balanced scorecard


Section 1: Background and introduction
Chapter 1: Introduction
Section 2: Literature review
Chapter 2: Existing BI value models and contributing factors
Chapter 3: Theoretical framework
Section 3: Research
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7.1 Introduction
7.2 Development approach
7.3 The Business Intelligence balanced scorecard
7.4 Difference between preliminary BI balanced scorecard and intermediate BI balanced scorecard
7.5 Chapter conclusion

7.1 Introduction

The objective of this chapter is to propose a balanced scorecard for BI after the findings of the data analysis. Due to the fact that a balanced scorecard strategy map was used as theoretical framework, the development of a scorecard was a logical step in the investigative process to present the findings. However, the scorecard is a subordinate artefact as a result of the investigation into the value of BI implementations in organisations.

Figure 22 comprises a diagrammatical representation of the outline of the chapter. The first section of the chapter briefly describes additional items considered in the development of the BI balanced scorecard whereafter the intermediate version of the BI balanced scorecard is displayed diagrammatically. The diagram is supported by a lengthy discussion of the various items of the proposed scorecard. The relationship between the various objectives in the proposed four perspectives is also considered to identify the relationships between BI implementations and organisational performance (SRQ3) and to identify the organisational functional areas where the perceived value was the direct result of the BI implementation (SRQ4). Both research questions are addressed in section 7.3.5 describing the interrelationship amongst perspectives and objectives.

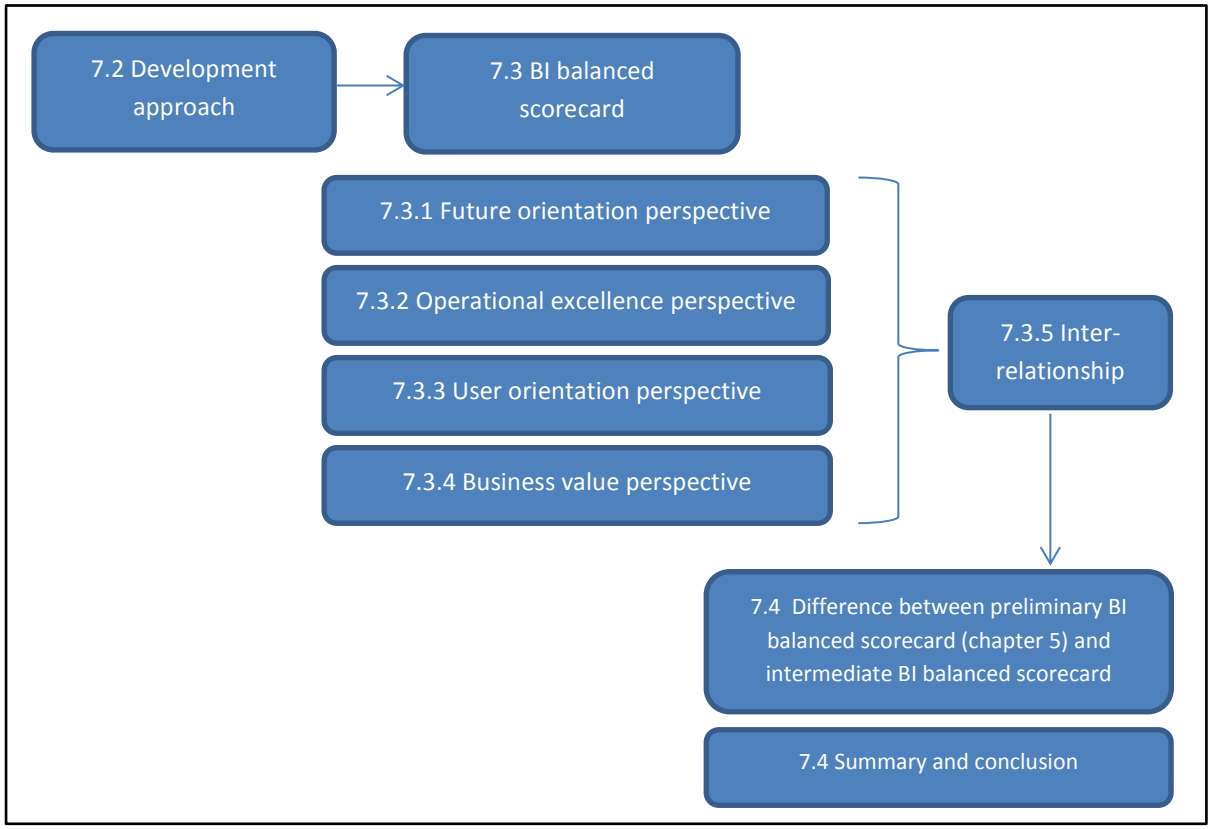

Figure 22 - Chapter seven outline

Although the sections describing the various perspectives and objectives are similar to the ones presented in chapter five during the conceptualisation process on which the semi-structured interview template is based, this section describes the sections *after* the data analysis process.

The version of the BI balanced scorecard presented in this chapter is based on the preliminary version of the BI balanced scorecard and BI balanced scorecard strategy map presented in chapter five. These two versions of the BI balanced scorecard are compared and the deviations discussed in the final section of this chapter.

The BI balanced scorecard in this chapter is also referred to as the intermediary version of the scorecard. This is to indicate that this version has not been verified by study participants. Once the verification process has been concluded, the final version of the scorecard is confirmed. The various versions of the BI scorecard are presented diagrammatically in figure 23.

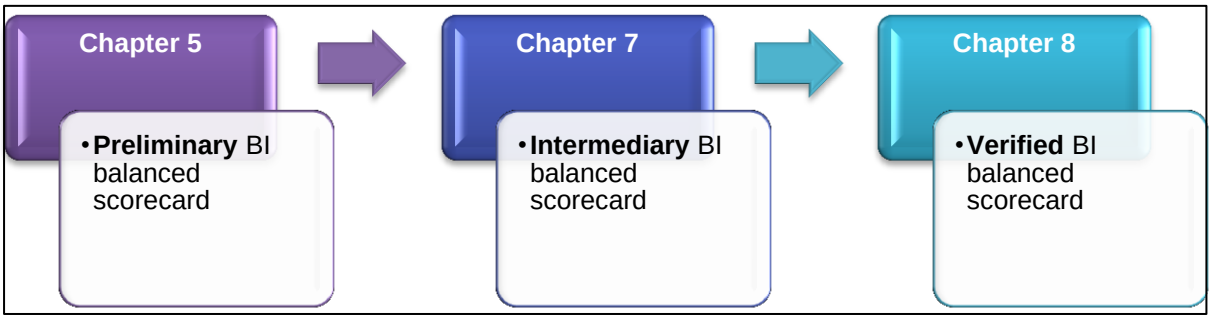

Figure 23 - Evolution of the BI balanced scorecard

7.2 Development approach

A preliminary version of BI balanced scorecard was proposed in chapter five after a thorough literature search process. The outline of this BI balanced scorecard, including the perspectives, objectives, measurements and subsequent metrics were used as a starting point (by means of a semi-structured interview template) for collecting data to investigate the value of BI to organisations.

The collected data set, in the form of transcribed interviews, was evaluated, analysed and presented in chapter six. Based on the findings of the semi-structured interviews and evaluation of the other sources of evidence (technical documentation and physical BI artefacts), an intermediate version of the BI balanced scorecard can now be constructed and discussed.

The following items were considered to propose the intermediary version of the BI balanced scorecard:

- Any additional objectives, measurements, metrics and relationships between these items not included in the original concept of the BI balanced scorecard used as template to collect semi-structured interview data (identified during the data collection process);
- The importance of the metrics (in the semi-structured interview) to the individual organisation. The assumption was that the items measured the most have a higher level of importance to the organisation. The importance is linked to the value and subsequent impact on the organisation, i.e. the more an item is measured, the higher its importance and the bigger the organisational impact. If the item was not measured it was assumed that the item was either not important and the subsequent value not substantial *or* the item was not relevant to the industry sector in which the organisation operates[36].

The intermediate BI balanced scorecard is diagrammatically displayed in Figure 24.

[36] An example of a measure not applicable to the organisation is the *'increase in sales as a result of a BI implementation'*. One of the participants was a governmental organisation trading in the public administration sector. The main focus of their business was on service delivery and not on product sales.

7.3 The Business Intelligence balanced scorecard (intermediate version)

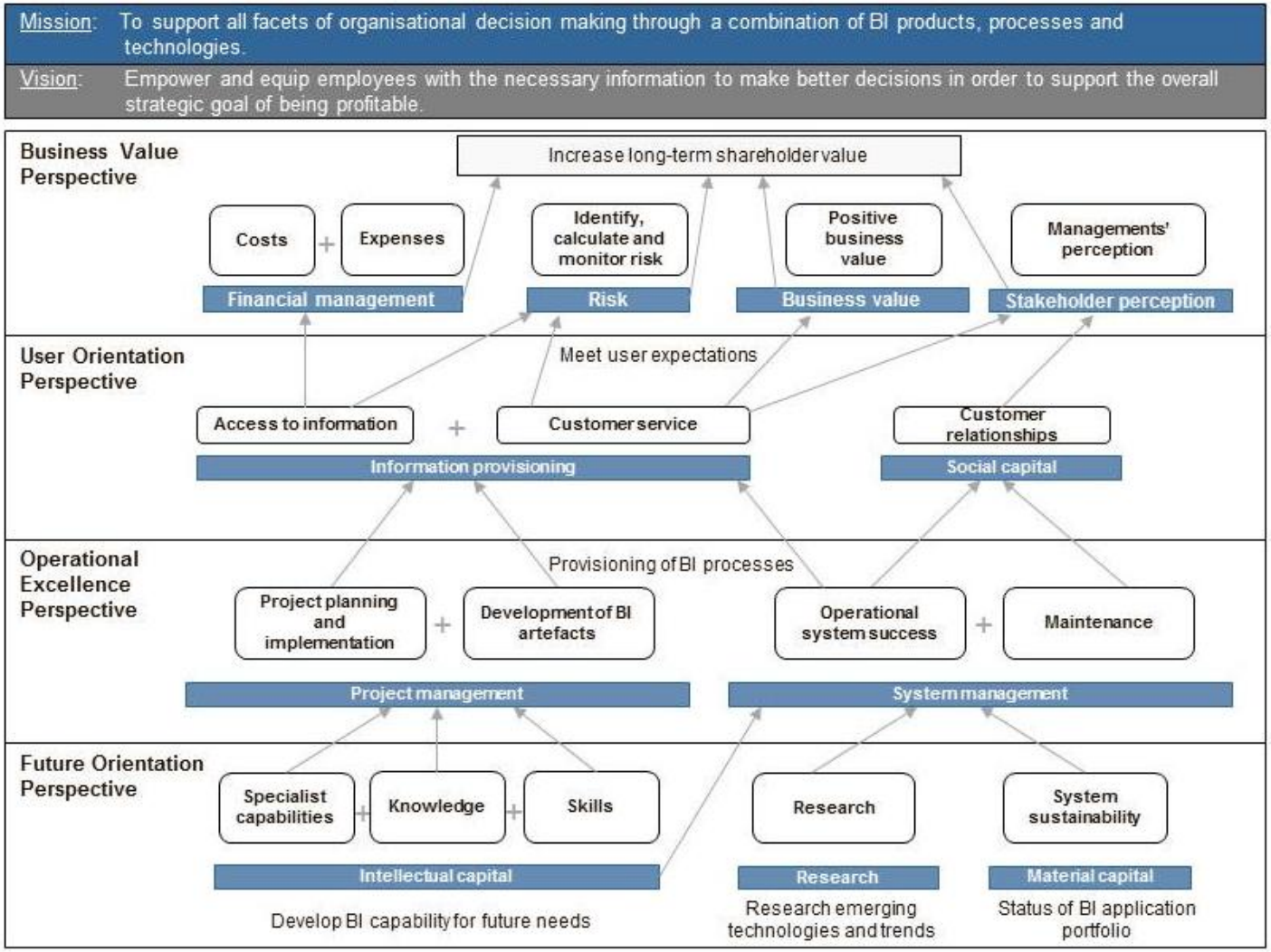

Figure 24 - Proposed intermediate version of the BI balanced scorecard

The BI balanced scorecard is based on the achievement of a particular organisational mission and vision for BI within the organisation. In the instance of BI, the mission is to support all facets of organisational decision-making through a combination of BI products, processes and technologies. All the objectives and perspectives are directed at achieving this mission. A longer term BI vision is to empower and equip employees with the necessary information to make better decisions in order to support the overall strategic goal of being profitable. The balanced scorecard is therefore merely a tool that can be used to assist in the identification and monitoring of business value through the achievement of this overall strategic goal.

The discussion of the intermediary version of the BI balanced scorecard (displayed in Figure 24) follows a bottom up approach. This approach starts with a discussion of the lowest level perspective displayed on the figure, in this instance the future orientation perspective, followed by the operational excellence perspective, user orientation perspective and business value perspective. The main reason for this approach is that this might be a more logical method for explaining the detail of the scorecard. For example, the status of objectives in the future orientation perspective directly influences objectives in the operational excellence perspective. The objectives from the operational excellence perspective directly influence the perspectives in the user orientation perspective and ultimately also the business value perspective.

Perspectives are grouped together with rectangle boxes and labelled accordingly in the top left hand corner. Objectives pertaining to a particular perspective is grouped together in the perspective boxes and indicated with a rounded edge rectangle. In instances where objectives could be logically grouped together, it is indicated using a collective label, in this case a blue shaded box. The arrows on the balanced scorecard indicate that a particular objective influences higher level objectives.

7.3.1 Future orientation perspective

The main vision identified for the future orientation perspective is:

To retain current employees and ensure that the employees are equipped with the right mix of capabilities and skills to meet the current and future needs of the

organisation. Also, this perspective must ensure that the latest, best technologies are introduced in the organisation.

In order to achieve this vision, three objectives have been identified, namely:

(a) to develop a specialist BI human resource capability with the knowledge and skills that will address the future needs of the organisation (intellectual capital label);
(b) to research emerging BI technologies and trends to cater for the future BI needs in the organisation (research label); and
(c) to monitor the current status as well as identify the future requirements of the BI applications portfolio (labelled as material capital).

Intellectual capital

The development of a BI human resource capability focused both on the profile of the current BI workforce as well as the current knowledge and skills set of BI employees. The collection of BI specialist capabilities combined with the necessary knowledge and skills are referred to as the intellectual capital of the organisation.

It is important to identify the number of employees with applicable knowledge and skills to work with BI technologies and artefacts as well as cater for the possible requirement of skills pertaining to emerging technologies. An organisation can implement the best technologies, but without the necessary skills to utilise these technologies, the implementation will remain fruitless expenditure. Surprisingly the majority of the respondents in the study neglected the provisioning of a formal training budget to cater for the training needs of BI specialists. The lack of focus on this objective was indicated on the BI balanced scorecard in Figure 25.

Another important consideration was the profile of the current BI workforce in terms of age, experience (measured in years), as well as the employee turnover statistics. The necessary provision should be made for younger employees to join the workforce before the retirement of senior employees. This will allow for a proper knowledge transfer between the various generations. The ideal workforce will consist of a blend of younger employees with a limited number of years' experience in the BI environment and extensive experience in senior employees. On the other hand, if the employee turnover rate with regard to BI employees is too high, skilled

employees might leave the organisation before a proper skills transfer to replacement employees can be conducted, missing out on the value skilled employees might add to the contextual interpretation of data. It was also assumed that the higher the skill of employees, the higher the productivity. Knowledgeable human resources will be capable of performing more tasks than unskilled resources. The extent to which the organisation utilises external consultants to perform tasks might also be an indication of a workforce not equipped with knowledge and skills to perform BI related tasks.

Research

Organisations should focus some of their resources on research into emerging technologies. This becomes more vital in organisations where BI is providing them with a competitive advantage over rivals. There should therefore be adequate financial provisioning for research into these emerging technologies and the future role of these in the sustainability of the organisation. In instances where the number of new business ventures is introduced as a direct result of the application of new BI technological trends, management might have a positive perception and favourable attitude towards spending financial resources on the research effort. Surprisingly, participants of the study indicated that this objective received very little attention and monetary support. However, the objective was included in the scorecard to cater for a complete, balanced scorecard view. The lack of focus on this objective was indicated on the BI balanced scorecard in Figure 25 (using yellow shading in the appropriate boxes).

Material capital

Material capital, in this environment, refers to the current BI application portfolio, including all related technologies such as BI artefacts, databases and infrastructure (to name a few). The importance of the status of this portfolio is its role in the future sustainability of the organisation. Items such as the age of current applications, downtime of the current system (planned and unplanned), the availability of systems, system response times and user satisfaction rate when interacting with these systems might all be indicators of potential future (preventative) catastrophic events.

7.3.2 Operational excellence perspective

The operational excellence perspective focused on the mission of supporting the organisation in achieving its goals by providing effective BI processes. These BI processes should provide for all the information needs in the organisation.

In order to achieve the mission of providing effective BI processes four main objectives have been identified, namely:

(a) project management and implementation strategies;
(b) the development approach followed when developing BI solutions (the project management, implementation strategies as well as development approach is collectively labelled as project management);
(c) operational success of the BI system; and
(d) system maintenance (the operational system success and system maintenance are collectively labelled as system management).

Project management

In order to realize the full benefits of projects and to work towards implementing successful projects, it is advisable to follow strict project management guidelines. These include the adherence to project management methodological prescriptions and the utilisation of project related calculations to scientifically establish the progress made (when compared to the project schedule and project budget). Two other items of vital importance to achieving this objective is the extent to which the BI solution covers the business processes and business performance measurements and the business involvement in the project. The extent of business process coverage will influence the ability of the BI system to provide information across the various functional areas in the organisation. Business involvement is important in the development process for two main reasons. Firstly the solution will cater for the business requirements as communicated by users to ensure that the needs are addressed. Secondly, business involvement will foster a sense of system ownership.

Systems management

From a systems management perspective, operational system success and system maintenance is of importance. The system should perform in line with the user expectation (in terms of performance, quality, user friendliness, availability) as well

as meeting standards with regard to data accuracy, availability, consistency and quality. All these items contribute to user satisfaction and will, in some instances, dictate the extent to which the system is utilised. Systems maintenance includes the implementation of regular maintenance tasks that will ensure that an uninterrupted BI service to the organisation is assured. As a result, the number of unplanned system downtime and operational failures will be minimized or eliminated.

Proper project planning and implementation, the development of BI artefacts following governance procedures, the monitoring of operational system success indicators and adequate maintenance procedures will contribute to the ability of providing end-users with the required BI information when and as needed.

When the results of the study were considered, it became evident that participants in general did not diligently consider and implement measurements in the project planning objective. This included the absence of project management monitoring tools such as schedule and financial variance calculations. From a development perspective, it was not clear to which extent the current business process and business performance measurements were covered in the solution. This might result in gaps in terms of the coverage of the current BI solution. Also, the absence of development methodologies in the development process had even a bigger impact. All these items are graphically displayed in Figure 25 and the impact explained in the *'interrelationships between perspectives'* section.

7.3.3 User orientation perspective

The user orientation perspective focuses on the mission to meet the internal and external user expectations by providing exceptional service through the fulfilment of the organisational information requirements.

This perspective focuses on three objectives, namely:

(a) access to information
(b) customer service (labelled as information provisioning together with the access to information objective); and
(c) customer relationships (labelled as social capital).

Information provisioning

Information provisioning refers to the availability and access to the required information when needed. For example, information availability and usefulness of information play a vital role in this objective. Another BI system objective is to provide both internal and external customers with exceptional customer service. Internal customers refer to users within the organisation whilst external users refer to users outside the organisation, for example suppliers (although participants indicated that they do not often expose them to information). It should be remembered that BI is a service provider with the purpose of satisfying the end-user need by providing exceptional customer service.

Social capital

The term social capital was introduced as a labelling item. It refers to the social interaction between parties. In this instance it is concerned with customer relationships. It focuses on the ability of the BI system to foster and enhance customer relationships measured in the growth in the internal and external customer base (as a result of the BI implementation) as well as user enthusiasm. It is assumed that satisfied customers will display positive user enthusiasm through a substantial number of active BI system users and the number of times these users utilise the system.

In general, the user orientation objectives in the study were measured by the majority of the respondents. It also seems as if the biggest organisational impact is displayed in this perspective. This might be attributed to the fact that this perspective contains tangible, measureable items that are easy identifiable and communicated to the business (for example the availability of useful and relevant information when required). However, some elements evaluated as part of the customer relationship objective might not be applicable to all industries. For example, the growth in the number of internal and external client base might not be applicable to service delivery organisations.

7.3.4 Business value perspective

The business value perspective focuses on the main objective of implementing and maintaining a BI capability that will increase long-term stakeholder value. In order to achieve this, four objectives have been identified:

(a) adequate financial management measurements should be implemented and monitored for both costs and expenses (labelled as financial management);
(b) risk should be managed;
(c) business value should be measured (using traditional financial calculation methods such as ROI); and
(d) the stakeholder's perception of the BI competency should be managed and fostered.

Financial management

The financial management objective mainly focuses on tracking and monitoring BI costs and expenses. Costs, in this instance, refer to monetary expenditures pertaining to any organisational asset whilst expenses, on the other hand, are an ongoing monetary expenditure such as BI software licensing costs.

Risk

Although one of the organisations in the study strongly focused on risk management as part of their business, no risk management measurements (such as risk severity and occurrence) pertaining to the implementation of the BI solution was considered or implemented.

Business value

The mechanism identified to foster positive business value with regard to BI projects and the BI department includes the utilisation of traditional financial calculation methods as well as sales related indicators such as an increase in sales. Due to the nature of their business, sales related indicators are not applicable to all the participants.

Stakeholder perception

The status of stakeholders' perception of the BI department and BI implementation within the organisation is established using management surveys. Although no formal management surveys were implemented by respondents in the study the climate was established indirectly through informal feedback mechanisms. For example, stakeholders continue to make monetary provision for BI implementations indicating a favourable perception of BI.

When one considers the substantial amount organisations spend on implementing BI solutions, including software related costs (such as annual licensing fees), it is surprising to note that the respondents in this study did not diligently keep track of costs and expenses. The reason for this was unknown and could not even be established as no link between subsequent objectives (from the user orientation perspective) could be established. For example, one could assume that the lack of financial management can be attributed to a lack of access to information, but this was not indicated by the study. The same scenario could be applied to the lack of risk management.

All these objectives contributed to the overall objective of long-term stakeholder value.

7.3.5 Interrelationship amongst perspectives and objectives – A practical example

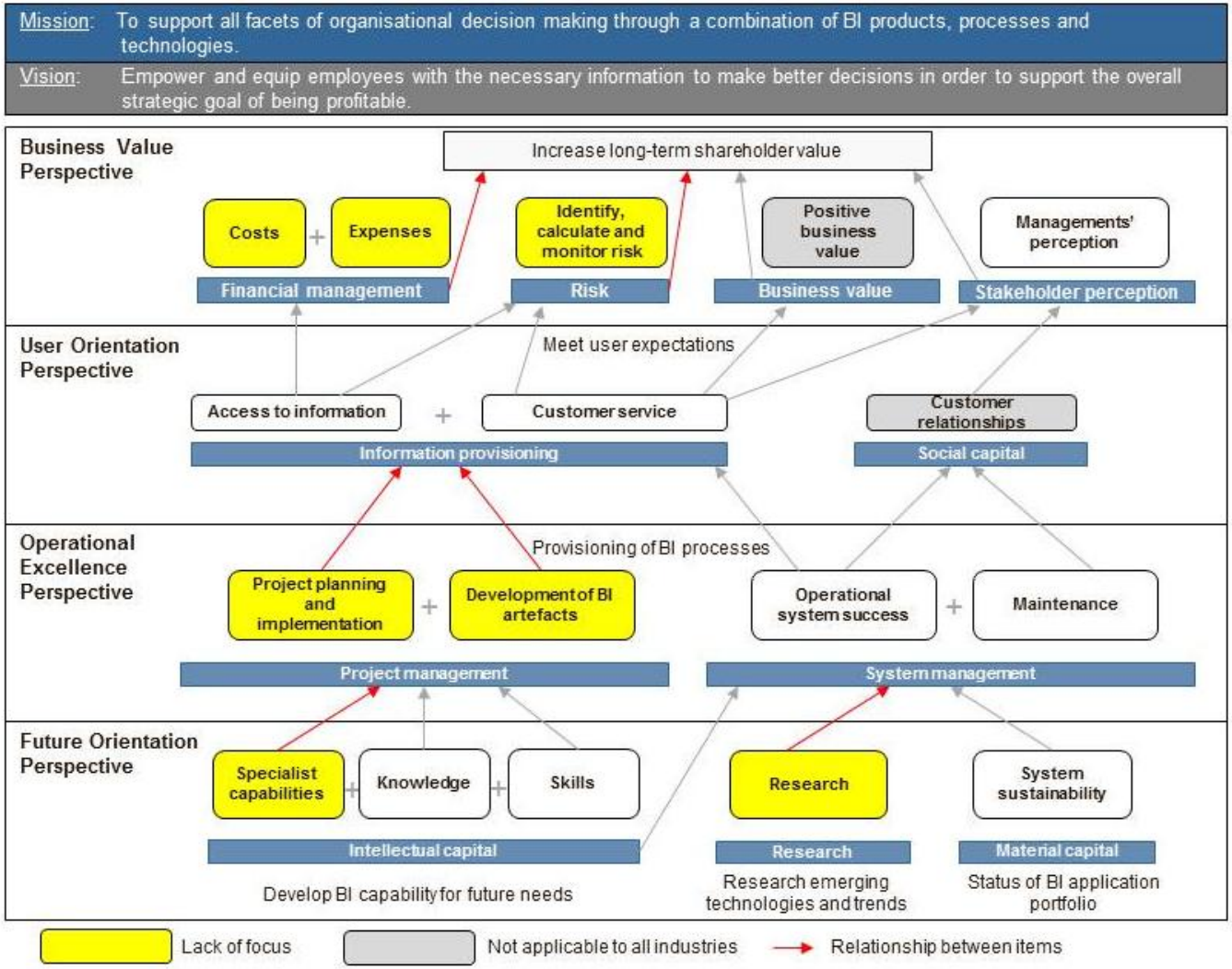

Figure 25 - Interrelationship between perspectives and objectives

Figure 25 highlights the interrelationships amongst objectives identified in the various perspectives. The lack of focus on particular objectives was highlighted in the figure using yellow highlighted boxes. The perceived relationships and ripple effect between objectives are indicated with arrow lines.

The study confirmed the anticipated interrelationships between the objectives. However, an interesting finding was the relationship path indicated by the yellow highlighted boxes and red arrows. The relationship path indicated the ripple of effect caused by a lack of or even absence of certain measurements across various perspectives:

Organisations did not make provision for a formal training budget to cater for the training needs of BI specialists. The lack of the necessary specialist capability became evident in the project planning and implementation of the BI solution and the development of the solution. This can be attributed to the fact that BI human resources did not have the know-how to follow development methodologies in a BI environment or were educated in the utilisation of generally accepted project management approaches. The assumption could further be made that the lack of following strict guidelines will influence the information provisioning capability as the risk of project failure might increase. However, this could not be confirmed.

The lack of implementation of formal business value objectives were identified with no clear link identified between the user orientation perspective and the business value perspective. On a logical level, a link between the inability to gain access to information will impair the ability of the organisation to implement financial management measurements. For example, proper cost and expense management procedures could not be followed due to lack of access to information.

Another item that lacked implementation was the inability of organisations to make adequate financial provisioning for research into emerging technologies and the future role of these in the sustainability of the organisation. If careful consideration is not given to these technologies, organisations might sacrifice their competitive advantage. On the other hand, emerging technologies might have an influence on the operational success of the BI solution. It can either enhance the current solution or new, unstable, immature solutions might have a negative effect. Unstable systems will influence customer relationships due to the inability of the organisation to deliver

timely information when required. Poor customer relationships as a result of BI systems will (negatively) influence management's perception of the BI solution and department. This will negatively influence the objective of increasing long-term stakeholder value.

Starting at the future orientation perspective working upwards through the various perspectives, it therefore became evident that all aspects proposed in the various perspectives contribute to realizing the value of BI in organisations. All these items have an impact (although the impact is indirect in some instances) on achieving the overall goal of BI in organisations. The relationship between aspects to be considered in the BI implementation (as proposed by the scorecard) is often complex to identify but once identified, logical. Should the mission and vision of the BI scorecard be achieved, the BI competency will contribute to the overall organisational performance.

7.4 Difference between preliminary BI balanced scorecard and intermediate BI balanced scorecard

A preliminary version of the BI balanced scorecard was developed in chapter five with the objective of constructing a semi-structured interview template for the purpose of data gathering. This was the main tool used to investigate the value Business Intelligence adds to organisations.

The preliminary version of the BI balanced scorecard is presented in Figure 26[37] below, whilst the intermediary BI balanced scorecard is displayed in Figure 24 in this chapter.

It is important to remember that the preliminary version of the BI balanced scorecard was based on literature and subsequent KPIs identified either in the various versions of the traditional and departmental specific scorecards available or academic literature focusing on this subject. Since the development, this version of the BI balanced scorecard has matured after the data generation process. It is therefore important to compare the two versions of the balanced scorecard to highlight deviations from the preliminary version of the scorecard.

[37] This figure is a copy of the BI balanced scorecard developed in chapter 5.

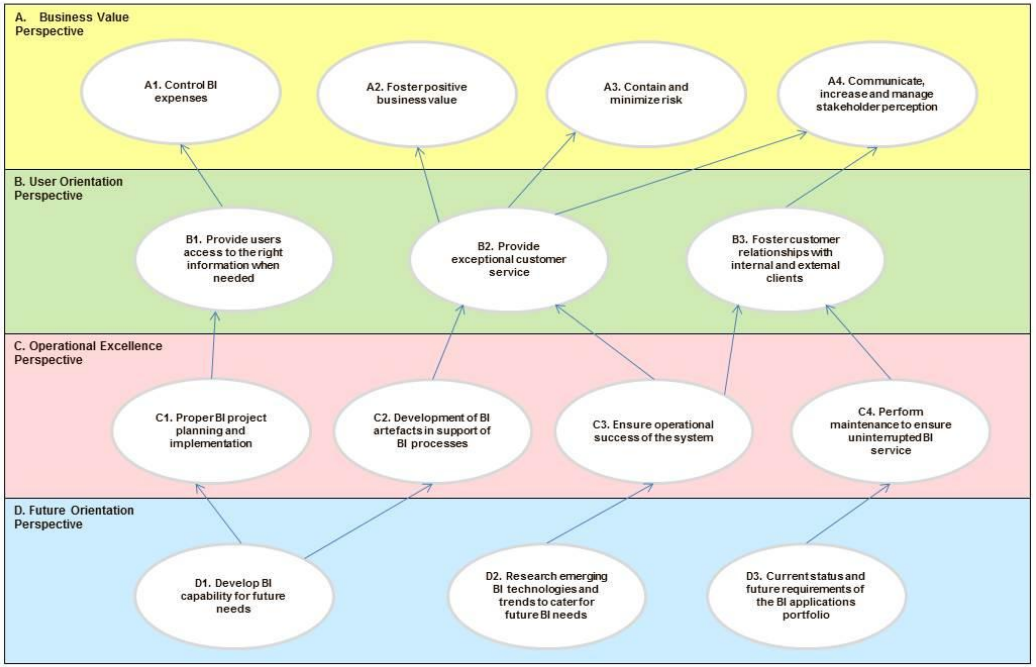

Figure 26 - Preliminary BI balanced scorecard (a copy of figure 16)

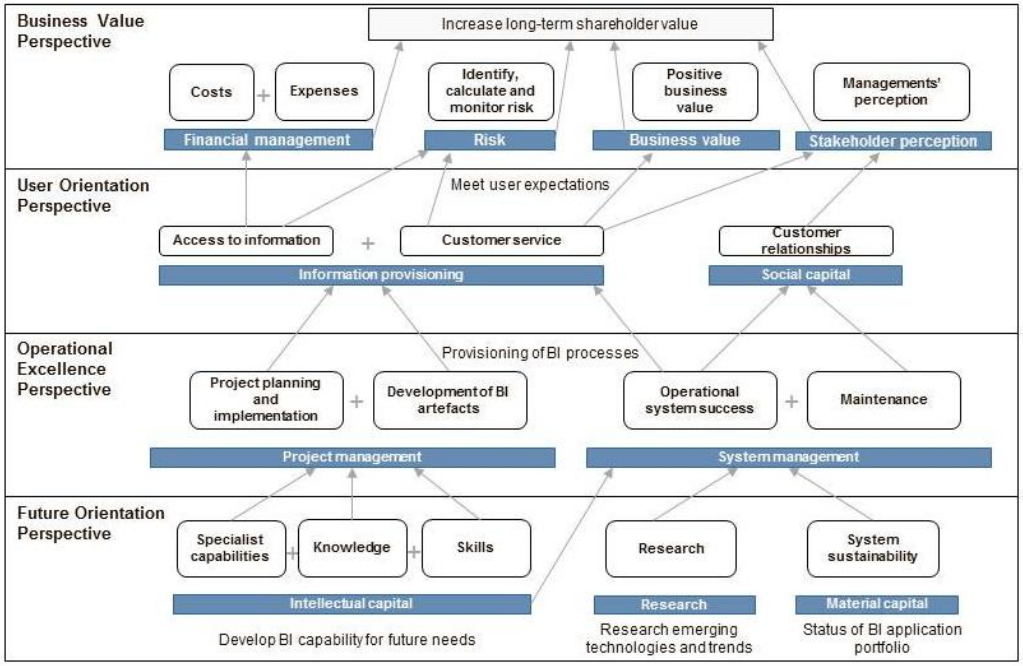

Figure 27 - Intermediate BI balanced scorecard (a copy of figure 24)

7.4.1 Perspectives

Both scorecards contained four perspectives, namely the business value, user orientation, operational excellence and future orientation perspective. The focus of each of the perspectives remained the same.

7.4.2 Objectives

Although the same objectives were used in both versions of the BI balanced scorecard, the objectives in the intermediate version of the BI balanced scorecard were slightly renamed to be more descriptive. Also, labels were used to collectively refer to related objectives. A bottom up approach (i.e. starting at the lowest level perspective, namely the future orientation perspective) was followed to highlight deviations between the objectives from the preliminary version (figure 26) and the intermediate version (figure 27) of the scorecards.

Objectives in the future orientation perspective (labelled with the prefix 'D' on the preliminary version of the BI balanced scorecard, figure 26):

- Objective D1 (develop a BI capability for future needs) were split into three objectives, namely specialist BI capabilities, BI related knowledge and BI related skills. These three objectives were collectively referred to as 'intellectual capital'.
- Objective D2 (research emerging BI technologies and trends to cater for future BI needs) were labelled as research.
- Objective D3 (current status and future requirements of the BI applications portfolio) were labelled as system sustainability which includes current and future requirements. This objective is also collectively referred to as 'material capital'.

Objectives in the operational excellence perspective (labelled with the prefix 'C' on the preliminary version of the BI balanced scorecard, figure 26):

- The four objectives (labelled as C1 to C4) proposed in the operational excellence perspective of the preliminary version of the BI balanced scorecard remained unchanged in the intermediate version of the BI balanced scorecard. Two grouping labels were added to collectively group the project planning and implementation as well as the development of the BI artefacts objectively together under the label of 'project management'. The same applied to the

operational system success and maintenance objectives. Both these objectives were grouped together under the label of 'system management'.

Objectives in the user orientation perspective (labelled with the prefix 'B' on the preliminary version of the BI balanced scorecard, figure 26):

- The objectives contained in the intermediate version of the BI balanced scorecard (B1 to B3) remained similar to the objectives proposed in the preliminary version. However, a grouping label was added to collectively group the 'access to information' and 'customer service' objectives (labelled B1 and B2 on the preliminary version) together, namely 'information provisioning'.
- The customer relationships objective (B3) was labelled as 'social capital'.

Objectives in the business value perspective (labelled with the prefix 'A' on the preliminary version of the BI balanced scorecard, figure 26):

- The cost objective (A1) in the preliminary BI balanced scorecard was split into two objectives namely cost and expenses. As described in section 7.3.4 the term cost and expenses are monitored as two different items.
- Finally the managements' perception objective (A4) has been labelled as 'stakeholder perception' on the intermediate version of the BI balanced scorecard to include a much broader definition of managements' perception of the BI artefacts.

7.4.3 Relationships between objectives

The biggest deviation from the preliminary version of the BI balanced scorecard and the intermediate version of the scorecard was the addition of a text label stating the main goal of the top level perspective (business value perspective labelled with an 'A' prefix on diagram 26) namely to implement a BI capability that will increase the long-term stakeholder value. As a result, lines indicating the relationship between the objectives in the business value perspectives and this goal were added to the intermediate version of the BI balanced scorecard.

One additional relationship was added to the intermediate version of the BI balanced scorecard. This relationship exists between the 'access to information' objective (in the user orientation perspective) and the risk objective in the business value

perspective (labelled as ‘identify, calculate and monitor risk). This relationship was not indicated on the preliminary version of the BI balanced scorecard for unknown reasons. This important relationship indicates that access to adequate information can mitigate risk in instances where it can be identified, calculated and monitored.

7.5 Chapter conclusion

The chapter proposed an ‘improved’ version of the preliminary BI balanced scorecard based on the findings of the data analysis chapter. The new improved version of the BI balanced scorecard, namely an intermediate version was presented graphically. This graphical representation was used to describe the various objectives and perspectives in detail, whereafter the interrelationships between objectives and perspectives were explained using the results from the various case studies presented as part of the data analysis chapter (chapter six).

No additional perspectives, objectives and measurements were identified during the study. However, the study did highlight interesting interrelationships between objectives and confirmed that the majority of the assumed causal relationships amongst items were indeed valid. The majority of the relationships and impact on the various objectives could be logically explained. There were instances, however, where no explanation could be identified for the impact or the lack of measurement of objectives. Despite this it was confirmed through the case study analysis (in chapter six) that the BI balanced scorecard presented here can provide valuable insight into the value BI adds to organisations as well as the intangible causal relationships amongst objectives often overlooked by stakeholders.

The next chapter (chapter eight) focuses on the verification process used to obtain feedback from study participants in terms of completeness and validity of the intermediate version of the BI balanced scorecard.

Chapter 8

Business Intelligence balanced scorecard

(verified version)

Section 1: Background and introduction

- Chapter 1: Introduction

Section 2: Literature review

- Chapter 2: Existing BI value models and contributing factors
- Chapter 3: Theoretical framework

Section 3: Research

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- Chapter 6: Data analysis

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Content

8.1 Introduction

The objective of this chapter is to describe the verification process of the intermediary version of the BI balanced scorecard presented in chapter seven. The feedback received during the verification process was evaluated. Each input item was considered and a response statement formulated to substantiate the decisions to implement or disregard the proposed input item. A final version of the proposed solution to establish the value of Business Intelligence in organisations is presented. A conclusion and recommendations section conclude this chapter.

8.2 Verification process

The intermediary version of the BI balanced scorecard was distributed to all the participants in the study as the final step in the research process (also referred to as phase two of the data generation phase). The main objective of this final step was to verify the intermediary version of the BI balanced scorecard. The verification process was included for two main reasons. Firstly, the intermediate BI balanced scorecard was constructed based on the preliminary version of the balanced scorecard and revised using data received from study participants during the interview process. By evaluating the content of the proposed scorecard, participants can indirectly confirm that their input is correctly reflected on the scorecard. Secondly, the study participants can give valuable input with regard to the completeness, overall accuracy and usability of the scorecard for the purpose of establishing the value of BI implementations in their organisations. This will contribute towards addressing the gap between theory (the theoretical BI balanced scorecard presented) and practice (the usability according to industry experts).

8.3 Results of the verification process

In general respondents were satisfied that their input was truly reflected on the proposed BI balanced scorecard. No additional perspectives, objectives and relationships between proposed items were identified. However, valuable feedback was received pertaining to the overall artefact. These items are summarized and described in the points below:

- Respondents pointed out that the theoretical concept of a BI balanced scorecard is a valuable contribution to the BI discipline, in particular to identify, measure and

monitor the value of such implementations to their organisations. However, respondents indicated that they could not envisage how one would implement the BI balanced scorecard in an organisation. The theoretical foundations were therefore sound but lacked practical implementation ability.

- No lower level measurement values were indicated on the balanced scorecard. Respondents posited that the effectiveness of this tool is dependent on the selection of measurements, the types of data as well as availability of these data items. In addition, this can only be used as an effective tool where target values are set and monitored for achievement against actual values. This is imperative to implementing corrective action to ensure that these measurements function in such a manner to achieve the overall organisation strategic objectives.

8.4 Response to feedback and considerations

The practical implementation of balanced scorecards in general is often a challenge for organisations (Pujas 2010; Chavan 2009). In the majority of instances human resources lack the knowledge and experience required to implement strategic performance management tools. In this instance the same challenge was identified. Highly skilled, specialised BI managerial staff did not have the knowledge to implement a BI balanced scorecard in their environments (Rompho 2011).

The need for a practical implementation guide has been identified by many researchers prior to the study (for example Abdullah *et al.* 2013), and was subsequently identified in this study as well. Although it was never the intention of this study to produce practical implementation guidelines it can add tremendous supporting value to the scorecard proposed. It might therefore be valuable to explore the implementation pathways to guide and support the implementation of the proposed balanced scorecard. An intervention of this scale would be suitable for post-doctoral research or an ideal opportunity for future researchers to build on this research study.

The proposed BI balanced scorecard was based on underlying data measurements and subsequently used during the interview process to gather relevant data. This set of measurements was not published with the BI balanced scorecard. The decision not to disclose the KPIs was influenced primarily by one reason. The author initially

had a suspicion that KPIs might be specific to a particular industry. By dictating actual measurements, the usability of the BI balanced scorecard will be restricted. However, the contrary became evident during the study. The majority of the measurements, with the exception of a couple (for example the measurement of product sales), was applicable and usable across all four industries represented by the participants. Therefore, to contribute to the usability of the balanced scorecard a set of Key Performance Indicators (or KPIs) were published with the balanced scorecard for implementation consideration (as displayed in figure 28 – '*A complete BI value solution*'.

8.5 BI balanced scorecard (verified version)

The verified version of the BI balanced scorecard is the final version of the BI balanced scorecard. Although some of the objectives were not measured by organisations in the study (as indicated by yellow highlighted boxes in figure 25) these objectives were not entirely removed from the proposed scorecard. The main reason is that although not measured, all the organisations agreed that these objectives were important and perceived as valuable to their organisations but supporting data was lacking to implement actual measurements.

No further adjustments were made to the intermediate version of the BI balanced scorecard (presented in chapter seven). However, based on the feedback, it is recommended that the BI balanced scorecard should be supported by a full set of KPIs identified as part of this study (in the form of a tabular version of the BI balanced scorecard strategy map) to enhance the usability of the instrument. Both items should be used towards achieving the objective of the scorecard, namely to assist in the identification of the value of Business Intelligence to organisations. For this reason, the final proposed solution contains a summary of the KPIs used for the various objectives and perspectives as contained in the tabular version of the balanced scorecard strategy map (see Annexure B). This solution can be used by both practitioners and scholars to identify and monitor the potential or current value of Business Intelligence to organisations. This instrument was considered as the main contribution towards establishing the value of BI (primary research question). Figure 28 graphically displays the proposed solution.

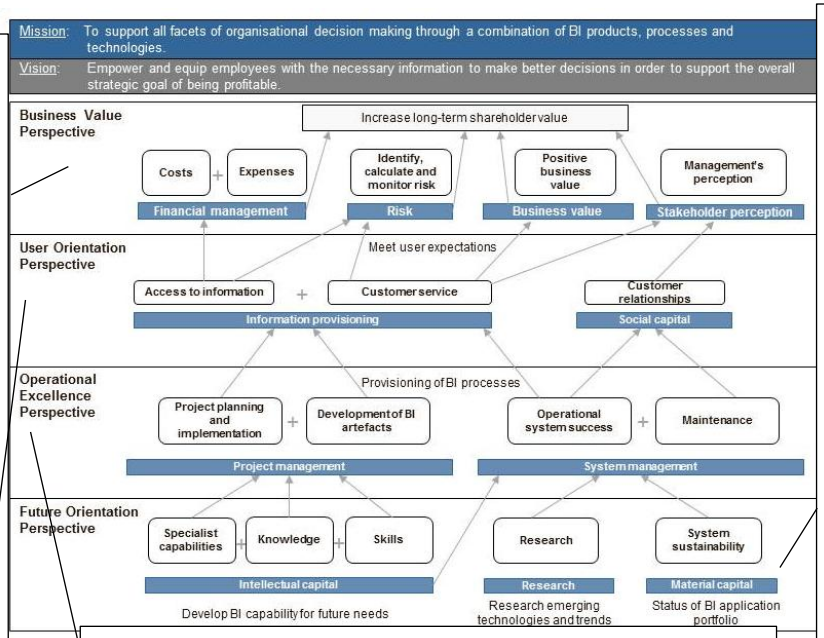
A. Business Value Perspective: KPIs

A1. Objective: Control BI expenses
Measure: Track and monitor expenses
1.1 Total actual BI expenses compared to allowable BI budget
1.2 BI expenses per user per annum
1.3 Total BI budget as a percentage of IT budget
1.4 Total BI budget as a percentage of overall turnover
1.5 Project cost variance
1.6 Cost Performance Index

A2. Objective: Foster positive business value
Measure: Establish business value
2.1 Traditional calculation methods
2.2 Perceived increase in sales

A3. Objective: Contain and minimize risk
Measure: Identify, calculate and monitor risk
3.1 Risk severity
3.2 Risk occurrence

A4. Objective: Communicate, increase and manage stakeholder perception
Measure: Management's perception of the BI department
4.1 Management survey



B. User Orientation Perspective: KPIs

B1. Objective: Access to information
Measure: Actual system utilisation
1.1 Number of times logged on to the BI system
Measure: Usefulness of information
2.1 Perceived usefulness of information survey
Measure: Intention to use the system
3.1 Intention to use the system
Measure: Availability of information
4.1 Time measured in minutes to obtain information

B2. Objective: Provide exceptional customer service
Measure: Customer satisfaction rate
5.1 BI user satisfaction rate

B3. Objective: Foster customer relationships
Measure: Growth of internal and external client base
6.1 Number of clients compared to previous selected period
Measure: User enthusiasm
7.1 Number of times logged on to the BI system
7.2 Number of active BI users

C. Operational Excellence Perspective: KPIs

C1. Objective: Proper project planning and implementation
Measure: Successful and efficient BI tool implementation
1.1 Number of projects on time and within budget
1.2 Project Performance Indicators

C2. Objective: Development of BI artefacts in support of BI processes
Measure: Structured methodology followed
2.1 Adherence to methodological prescriptions
Measure: Coverage of business processes
3.1 Percentage coverage of business processes and measures in BI systems
Measure: Business involvement
4.1 Number of users involved in the development process

C3. Objective: Ensure operational success of the system
Measure: System performance and quality
5.1 Time in minutes to obtain an existing report
5.2 Time in minutes to obtain a new report
5.3 System quality rating
5.4 User friendliness rating
5.5 Number of times when information is not available
Measure: Data reliability, consistency and high quality
6.1 Data accuracy rate
6.2 Data availability rate
6.3 Data consistency rate
6.4 Data quality rate
6.5 Number of queries related to data quality
6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems

Measure: System support provided within an acceptable standard
7.1 Response time in minutes after a call was logged

Measure: Customer / user experience
8.1 Customer / user satisfaction survey

C4. Objective: Perform maintenance to ensure uninterrupted BI service
Measure: System availability and reliability
9.1 Time in minutes for unplanned system downtime
9.2 Number of unplanned BI system interruptions
9.3 Number of planned BI system interruptions
9.4 Number of operational failures

D. Future Orientation Perspective: KPIs

D1. Objective: Develop a BI capability for future needs
Measure: BI specialist capabilities
1.1 Number of employees with BI technology skills
1.2 Number of employees with BI technology skills for emerging technologies
1.3 Age distribution of BI staff
1.4 Number of years of BI experience per staff member
1.5 Perceived satisfaction of BI employees (employee satisfaction rate)
1.6 Turnover rate of BI employees
1.7 Retention rate of BI employees
1.8 Productivity of BI employees (number of queries per employee per day)
Measure: Level of training and education of BI personnel
2.1 Number of educational days per person
2.2 BI training and resource development budget as a % of the overall IT budget
2.3 BI training and development budget as a % of the overall BI budget
2.4 Number of times an external consultant is contracted to perform internal BI tasks

D2. Objective: Research emerging BI technologies and trends
Measure: Research effort
3.1 BI research budget as a percentage of the overall IT budget
3.2 BI research budget as a percentage of the overall BI budget
3.3 Management perceived satisfaction rate on emerging technologies
3.4 Number of new business ventures as a result of BI technological trends

D3. Current status and future requirements of the BI applications portfolio
Measure: Age of current applications and number of BI technologies used
4.1 Age distribution of applications
4.2 Number of BI technologies utilised
Measure: Performance of BI systems
5.1 Downtime of BI systems
5.2 Availability of systems
5.3 Database query response time
5.4 User satisfaction rate

Figure 28 - Complete BI value solution

8.6 Relevance of BI balanced scorecard to current literature

The proposed BI balanced scorecard contributes to existing literature on BI value research whereby an existing approach is reused and adapted for the purpose of a BI environment. When the proposed framework for BI value research (as proposed in chapter two as part of the literature review chapter) is evaluated, the BI balanced scorecard presented in this study contributes to both the organisational and process level. Subsequently, a list of CSFs considered in this study can contribute to the area of CSFs as well as project success or failure areas (figure 29).

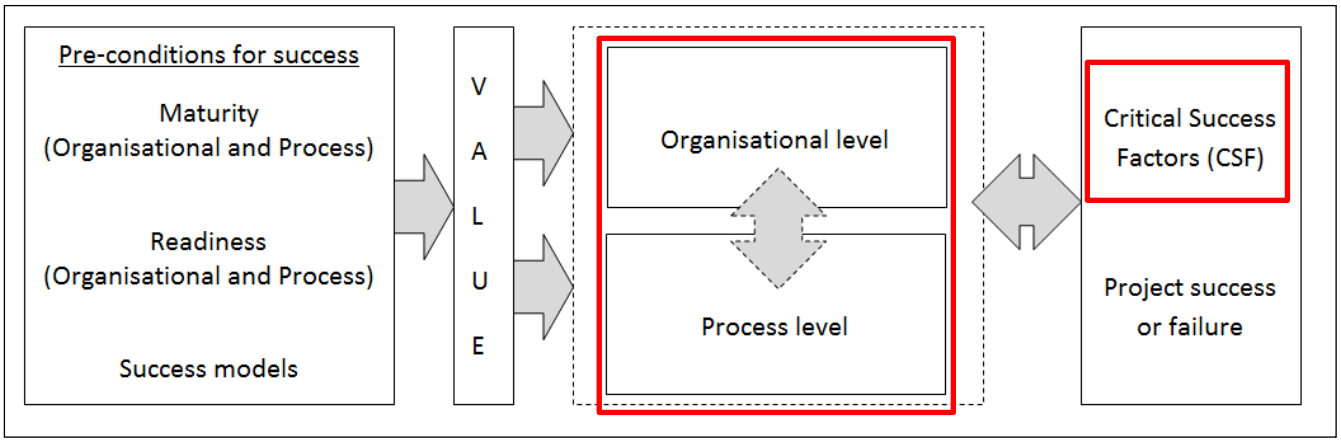


Figure 29 – BI balanced scorecard contribution compared to the proposed BI value research framework

8.7 Chapter conclusion and recommendations

Based on the feedback received, no structural changes were made to the proposed BI balanced scorecard. Therefore, no additional objectives, perspectives or relationships amongst items were implemented or adjustments made to these items. It can therefore be concluded that, from a theoretical perspective, the final version of the proposed BI balanced scorecard is complete. However, to provide the intended user with a usable solution towards establishing the value of BI in organisations, the BI balanced scorecard was supported by KPIs as utilised in the study.

The next chapter focuses on the limitations, challenges and future research opportunities identified as a result of the study. This chapter (chapter nine) concludes the study.

Section 5

Conclusion

Chapter 9

Conclusion and recommendations

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9.1 Introduction

The last chapter in this thesis focuses on the assumptions, limitations, challenges and future research opportunities identified on concluding this study. The limitations and challenges are key elements in the contextualisation of the proposed contribution of this study and should be considered where applicable.

The reason for the inclusion of assumptions, limitations and challenges in the final chapter of this thesis is that these transpired towards the end of the study. Whilst some of the items are documented as part of specific chapters where appropriate, this section focuses on the overall limitations of the entire study.

9.2 Research contribution

Various research contributions have been produced as part of the empirical study. The table below provides a summary of all the items and the contribution on both a theoretical and practical levels:

Research outcome	**Contribution**
Extensive academic literature review focusing on BI value models depicted using a framework	Theoretical
Extensive academic literature review focusing on balanced scorecards and the approach of strategy mapping	Theoretical
Preliminary BI balanced scorecard	Theoretical and practical
Primary research instrument (semi-structured interview template)	Theoretical and practical
Intermediate (unverified) BI balanced scorecard	Theoretical and practical
Verified BI balanced scorecard	Theoretical and practical

Table 49 - Theoretical and practical research contribution

The research output items as a result of the literature review process (namely the framework depicting various BI value models as well as the literature review focusing on balanced scorecards) contribute to the broader body of knowledge on theoretical level. The output of these items were purely based on academic literature and therefore not a practical implementable framework or tool. However, the contribution of the various versions of the BI balanced scorecard as well as primary research

instrument contributes both on theoretical and practical level. On the theoretical level, scholars can test existing theoretical balanced scorecard versions against the proposed BI balanced scorecard. On a practical level, the proposed BI balanced scorecard provides the user with a practical implementable toolset (although it was not the objective of the study to do such an implementation).

9.3 Assumptions

The primary assumption in this study is that BI implementations add (realized) value to organisations. The objective of the study was therefore to investigate the extent of this (assumed) value.

A literature review was based on current academic material pertaining to the subject. The assumption was made that worldwide academic research is applicable to a developing country like South Africa.

Numerous new approaches in the BI industry have recently seen the light. Some examples of these approaches include the introduction of BI as a service as part of cloud computing, mobile BI solutions, the utilisation of BI in virtual reality environments such as 'Second Life' as well as the inclusion of analytics as part of business intelligence, referring to BI as BI&A. The objective of this study was not to focus on these individual BI items. However, it was assumed that some of these items might have been included as part of an organisational BI solution and they were therefore included when applicable and appropriate.

The concept of 'perceived' value varies, depending on the context in which the value is investigated (Rutner & Langley 2000), the type of value investigated (Davern & Kauffman 2000) as well as the party or stakeholder investigating the value (Barua *et al*. 2010). Value is generally evaluated in the context of 'economic value' or the value contributed to the stakeholders of an organisation (Rutner & Langley 2000). According to Rutner and Langley (2000), this refers to the macro contribution of value to the overall economic environment. For the purpose of this study, business value is investigated. Business value refers to both tangible, monetary measurable items of value to the organisation, as well as 'intangible' items (Rutner & Langley 2000). The value type refers to the time when the value is determined. Potential value refers to the estimated value prior to the project (Davern & Kauffman 2000).

Realized value, on the other hand, refers to the actual value after project implementation. For the purpose of this study, realized value was assumed to be the perception of middle and upper management.

9.4 Limitations

As indicated in the introduction section of this chapter some limitations of the study were documented as part of specific chapters, for example the limitations as part of the literature review section (section 2.10). The limitations in this section focus on the overall limitations of the entire study.

One of the limitations of the study is the type of the artefact produced as part of this study, namely a *theoretical* BI balanced scorecard (or model). A theoretical model is a model constructed using the underlying theory (the balanced scorecard second generation approach) as foundation. It was never the intention to produce a physical artefact. In theory the model can be converted to a computerized prototype. The gap (if any) between the theoretical BI balanced scorecard presented here and the physical implementable version of the scorecard is not known. Unfortunately, the physical implementation of the model does not fall into the scope of the purpose of this study.

The balanced scorecard is driven by a clear strategic mission and vision statement. Without clear articulation and communication of these, the balanced scorecard, as a tool, will fail dismally.

The original Kaplan and Norton balanced scorecard has been in circulation for approximately two decades. During this period, the original version of the scorecard has matured into a strategic management tool. It is therefore believed that the first version of the BI balanced scorecard presented here should also be allowed to mature and will be refined into a usable strategic management tool for the organisational BI competency. This is not achieved overnight, so that opportunities open up for future research into the topic of BI and performance management.

Finally, the study did not consider departmental processes in the various organisations. Such an analysis will take years to complete. However, the selected

interviewees had sufficient knowledge about these processes to contribute to the study.

9.5 Challenges

As mentioned above the proposed BI balanced scorecard is based on a strong theoretical foundation. Although the end product went through a process of verification, it was never the intention to physically implement the balanced scorecard. However, the scorecard should be implementable in any organisation using some sort of software toolset (freely available) and in instances where management can set a clear BI mission and vision. It is foreseen that the main challenge will be to provide the scorecard with real data values and comparing these values to actual acceptable target values. It should be noted that the balanced scorecard is not a technical tool but a strategic management tool. The technical implementation of the balanced scorecard is therefore a secondary objective.

One of the challenges highlighted in current subject related academic literature was the challenge to quantify the 'intangible' positive or negative impact of BI implementations (Elbashir *et al*. 2008). This highlighted the possibility of identifying and communicating intangible items during interviews. Although one of the advantages of the balanced scorecard strategy map approach (second generation) was to focus on areas typically characterized by intangible measurements or benefits (such as the internal process perspective, Lawrie & Cobbold 2004; Kaplan & Norton 1997, 2000). The interviewee had to take cognisance of the challenge of identifying intangible benefits and had to be prepared to explore possible hidden benefits.

One of the biggest challenges was to conduct interviews in a limited time period. The level of the selected target population (managerial level) made it difficult for participants to spend a considerable amount of time away from business activities. The interview template was extremely long adding to the challenge. The researcher had to rely on short hand interview notes as participants did not feel comfortable with the utilisation of transcription aids (such as voice recorders).

In some instances, a bottom up approach is used to discuss the proposed BI balanced scorecard. This approach was adopted for discussion purposes and should not be confused with the overall implementation approach. The bottom up versus

top down discussion has been a much debated topic. The argument from the original authors of the balanced scorecard (Kaplan & Norton 1992, 1996), and the argument adopted for the purpose of the study, labels the balanced scorecard approach as both bottoms up and top down. The top down approach is visible through the formulation of strategy on the strategic management level and is communicated to the various management levels in the organisation (middle and operational level). The objectives and measurements are then used by these levels to improve performance (for example) that will influence the achievement of the vision and mission (bottom up).

9.6 Future research opportunities

A consolidated framework and table describing current research pertaining to BI value research is presented in chapter two. This proposed framework offers researchers a good starting point for classifying and categorizing future BI value research studies. The framework should also be re-evaluated to identify the applicability to the latest trend in the business intelligence research field, namely the inclusion of a strong analytical component (also referred to as BI&A).

The theoretical version of the BI balanced scorecard should be implemented and tested on a practical level. It would be interesting to test the usability and applicability of the theoretical version and the workable, practical version of the scorecard to establish the value of BI in organisations.

The concept of Business Intelligence has lately evolved to include the concept of analytics, hence the introduction of BI&A. With the extension of the concept to include analytics, a new set of characteristics evolved adding to additional dimensionality not previously evident in BI. It was not sure what the effect (if any) of this additional dimensionality was on the proposed BI balanced scorecard. This might be a topic worth exploring.

9.7 Summary

The thesis commenced with a clear identification of a research problem and a subsequent set of research questions. The main research question was how does BI add value to organisations? The main objective of the question was to focus on

establishing a measuring mechanism and metrics that can be used to identify how the benefits and value as a result of a BI implementation can be measured in an organisation.

Chapter two focused on the clarification of terminology in particular the meaning of Business Intelligence and business value. The current literature is classified according to the main elements identified in the various definitions presented by many authors. These include BI as an application, technology, process, analytical tool as well as product predominantly used in decision support activities. The decision support element is identified by almost all the authors as a key element of their understanding of BI. In addition, various viewpoints are taken by authors, including that BI is a diverse term, BI is an umbrella or collective term, a technological broad term, applicable to various contexts and that BI is a young, evolving discipline. Lastly, authors postulate that BI as discipline covers different aspects (for example technological aspects). The main conclusion is that BI, in the context of this study, can be labelled as a diverse term referring to *"a product, process and technology or a combination of the three concepts in support of organisational decision making"* (Shollo & Kautz 2010).

In addition, the meaning of business value was contextualized using BI, and confirmed as the perceived (positive) contribution of BI technologies, products and processes to the overall positive status of the organisation. The last section of the chapter focused on the identification of current BI value literature. As a result, a classification framework is synthesized as a consolidated view of the current published academic literature. The classification framework contain sections focusing on the pre-conditions for successful BI implementations and considers elements such as organisational and process maturity, organisational and process readiness as well as success models. The majority of literatures identified are classified in this area. The second segment of the classification framework focuses on organisational and process level investigations into the value offered by BI implementations, as well as the interrelationships between these two components. Finally, critical success factors as well as studies focusing on project success or failure were identified and categorized in this section.

Chapter three discussed and substantiated the selection of the theoretical framework, the balanced scorecard strategy map approach used as basis for the study. The different variations of the balanced scorecard approach is discussed, from the original concept of the balanced scorecard by Kaplan and Norton (1992, 1996) to the IT balanced scorecard (Van Grembergen & Van Bruggen 1997; Van Grembergen & Timmerman 1998; Martinsons, Davison & Tse 1999; Van Grembergen 2000). Two instances of a BI balanced scorecard are identified although limited information is published describing these concepts (Vinciguerra 2004; Hawking 2011). No further consideration is given to these two versions of the BI balanced scorecard.

Chapter four was the first of three chapters focusing on the research process. The adoption of the interpretive, constructivist approach is described in detail based on the main objective of the research, namely to perform an in-depth analysis of the value of BI implementations in organisations. For this reason a multiple-case study research design strategy seemed appropriate. The strategy is supported by additional data generation methods also referred to as sources of evidence. These include semi-structured interviews (as main data generation method), physical artefacts, technical architecture documents as well as company websites.

The data analysis approach was disclosed, namely a thematic data (content) analysis approach. The process is described in detail by listing the five phases followed in the actual data analysis process. The last section of the chapter discloses the ethical principles adopted in the study.

The main objective of chapter five was to develop and verify the semi-structured interview template for data gathering purposes. The template is based on a BI balanced scorecard strategy map approach.

A pragmatic approach was used to identify KPIs supporting the various areas within the four balanced scorecard perspectives and various objectives within the perspectives. A process of verification was used whereby a preliminary set of KPIs (obtained from the proposed IT balanced scorecard) was compared to a list of KPIs identified in BI specific literature. A final list of KPIs was compiled.

For each of the KPIs, an interview question was formulated for the purpose of the semi-structured interviews. A final interview template was confirmed after considering validation and reliability constructs.

Chapter six analysed the data obtained from the semi-structured interviews as well as multiple sources of evidence using four individual organisational case studies. The findings for each of the perspectives are described in detail whereafter a conclusion section summarise the findings. The last section in each of the individual case studies map the findings back to the research questions as contained in chapter one.

A cross-case analysis, where the results from all the individual case studies are compared, is summarized in table format in line with the various research questions. In addition, numerous barriers have been identified in achieving value of BI implementations. One of the central themes that was identified is the lack of scientific measurement methods implemented in actual measuring value (for example no formal financial calculation methods were used).

Chapter seven described the preliminary version of the BI balanced scorecard based on the findings of the data analysis process (chapter six). The scorecard contains four perspectives namely business value, user orientation, operational excellence and future orientation. Various objectives were identified within the perspectives. No major deviations from the initial version of the scorecard were identified. However, descriptive labels were added to the preliminary version to group relevant objectives together. Finally, arrows were used to indicate the potential influence of objectives on one another.

Chapter eight presented the findings after a verification process involving all study participants. The results of the verification process focused on potential practical challenges should the scorecard be implemented. Although it was never the intention to produce a prototype of the BI balanced scorecard, a practical implementation guide might be worth exploring. In addition, respondents indicated that the publication of KPIs pertaining to individual objectives will add value to using the balanced scorecard.

Chapter nine disclosed assumptions made during the study as well as limitations and challenges. Although these were disclosed in individual chapters where appropriate, the items described in this chapter transpired during the study. The chapter is concluded with the identification of future research opportunities.

9.8 Conclusion of the study

The main objective and primary research question of this study was to investigate how Business Intelligence interventions add value to organisations. The study was conducted using a balanced scorecard second generation approach. As a result, a BI balanced scorecard was constructed as an instrument to identify, measure and monitor value items across the organisation.

Business Intelligence adds value to organisations (primary research question) through a number of benefits namely an increase in sales, compliance to regulatory requirements to manage risk, fulfilment of user expectation with regard to provisioning of information and the availability of information presented by user-friendly systems that contributed to improving the quality of decision-making.

The perceived value of BI implementations amongst senior management (secondary research question one) was positive. Respondents indicated that they perceive BI as an invaluable asset to their organisations and key to their organisation's sustainability through the influence on positive regulatory and audit outcomes as well as the impact on decision-making. The value was furthermore visible through the availability of quality information that was found to have been extensively used. The positive perception was evident through the continuous implementation of new BI projects, the high satisfaction rate with regard to the quality of data, the organisation's ability to improve revenue through additional sales opportunities as well as an overall positive customer and end-user experience.

The impact of BI on the organisation (secondary research question two) was evident in five main areas, namely sales (and subsequent increase in customers), operational and strategic decision-making, organisational sustainability, availability of information as well as mature and educated employees equipped with appropriate skills to provide in the information needs.

The relationship between business intelligence implementations and organisational performance (secondary research question three) was evident through the linkage between the various lower level objectives (in the future orientation perspective) to the higher level perspective in the operational excellence, user orientation and business value perspective. Some of the more important prevalent items impacting organisational issues included an increase in the number of clients, subsequent improvement in sales due to improved decision-making and the positive effect on the revenue value (and therefore financial business value) of the organisation; improved sustainability of the organisation due to adequate compliance audit outcomes increasing long-term stakeholder prospects; as well as the increase in the ability of employees to make informed decisions (due to timely availability of data) that led to improved organisational performance.

Secondary research question four focused on the identification of the organisational functional areas where the perceived value experienced was the result of a BI implementation. The most obvious functional area where the biggest benefit was achieved was the sales function. In addition, the function focusing on risk and compliance management as well as operational management (in particular on process level) was identified.

In closure - the outcome of the study confirms that BI adds value to organisations. However, in order to establish the value of BI and the implementation thereof a multi-level, multi-faceted approach is required. This is evident through the various perspectives and objectives identified in the balanced scorecard and the various levels (from operational to strategic level) of the measurements used in the objectives. The complex interrelationship between objectives often contributes to the complexity of not just managing the potential value but identifying the value. The value of BI is merely the result of proper management approach of all items somehow related to BI and its implementation. A holistic approach should therefore be followed and the exercise to establish the value in the organisation should be much wider than just a one dimensional view (for example financial calculations). Hopefully the balanced scorecard addresses the challenge of identifying and communicating benefits often perceived as indirect and intangible. It should be noted that the items perceived as having the biggest impact on business, often represent a

manifestation of underlying items. This is evident in the sales environment where the number of products sold can be positively influenced by proper sales training.

The proposed BI balanced scorecard used as tool in this study supports the approach of managing the majority of the various dimensions contributing to reach the full value BI can add to organisations.

Section 6

Supporting information

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Annexure A: Critical Success Factors (CSFs) identified in literature

The tables below present a list of BI Critical Success Factors (CSFs) for BI implementations identified during a process of academic literature review. Related CSFs were grouped together into three categories namely organisational factors, project related factors and technical factors (and listed in chronological order). Each of the categories is presented in a separate table. This classification scheme is similar to studies conducted by Olszak & Ziemba (2012), hypothesized by Yeoh & Koronios (2010) and utilised by Xu & Kim (2014) and Naderinejad, Tarokh & Poorebrahimi (2014) (although the project related factors were omitted in the adoption in this study). Once identified, each of the CSFs was linked to the relevant BI balanced scorecard perspective and a KPI measurement derived based on the CSF.

Item #	1. Organisational factors			
	Critical Success Factor/s	**Author/s**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
1.1	Management support	Sammon & Finnegan (2000)		Implied in the business balanced scorecard
		Wixom & Watson (2001)		
		Little & Gibson (2003)		
		Mukherjee & D'Souza (2003)		
		Chenoweth, Corral & Demirkan (2006)		
		McMurchy (2008)		
		Hobek, Ariyachandra & Frolick (2009)		
		Yeoh & Koronios (2010)		
		Dinter, Schieder & Gluchowski (2011)		
		Adamala & Cidrin (2011)		
		Olszak & Ziemba (2012)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
		Fedouaki, Okar & Alami (2013)		
1.2	Management sponsorship	Adamala & Cidrin (2011)		Implied in the business balanced scorecard

Item #	1. Organisational factors			
	Critical Success Factor/s	**Author/s**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
		Alshboul (2012)		
		Sangar & Iahad (2013)		
1.3	Strategic alignment	Williams & Williams (2007)		Implied in the business balanced scorecard
		Arnott (2008)		
		Hobek, Ariyachandra & Frolick (2009)		
		Anjariny & Zeki (2011)		
		Dinter, Schieder & Gluchowski (2011)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
1.4	Business involvement	Sammon & Finnegan (2000)		Implied in the business balanced scorecard through the creation of a clear strategic mission and vision
		Ko & Abullaev (2007)		
		Adamala & Cidrin (2011)		
		Dinter, Schieder & Gluchowski (2011)		
		Sangar & Iahad (2013)		
	Organisational culture:			
1.5	Change management	Mukherjee & D'Souza (2003)		Implied in the business balanced scorecard
		Chasalow (2009)		
		Hobek, Ariyachandra & Frolick (2009)		
		Yeoh & Koronios (2010)		
		Adamala & Cidrin (2011)		
		Dinter, Schieder & Gluchowski (2011)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
1.6	Organisational resistance	Chasalow (2009)		
1.7	Decision-making based on data	Popovič *et al.* 2010		This is implied by the business and IT scorecard(s)
		Alshboul (2012)		
1.8	Politics	Alshboul (2012)		

Item #	1. Organisational factors			
	Critical Success Factor/s	**Author/s**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
	Culture	Sangar & Iahad (2013)		
1.9		Naderinejad, Tarokh & Poorebrahimi (2014)		
	Research:			
1.10	New ventures based on BI system	Hawking (2011)	Number of new business ventures introduced as a result of new BI technological trends	Future orientation
	Environmental factors (external):			
1.11	Business competition	Alshboul (2012)		
1.12	Selection of vendors	Alshboul (2012)		
1.13	Adherence to industry standards and regulations	Alshboul (2012)		
1.14	Partner compatibility	Alshboul (2012)		

Table 1 - Organisational critical success factors (CSFs)

Item #	2. Project related factors			
	Critical Success Factor/s	**Author**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
2.1	Clear vision, business case and goals	Rainer & Watson (1995)		Implied in the business balanced scorecard
		Poon & Wagner (2001)		
		Williams & Williams (2007)		
		Yeoh, Gao & Koronios (2007)		
		Arnott (2008)		
		Chasalow (2009)		
		Yeoh & Koronios (2010)		
		Adamala & Cidrin (2011)		
		Anjariny & Zeki (2012)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar & Iahad (2013)		
2.2	Data stewardship	Sammon & Finnegan (2000)		Implied in the business balanced scorecard
2.3	Business and system champion	Chenoweth, Corral & Demirkan (2006)		Implied in the business balanced scorecard
		Alshboul (2012)		
		Sangar & Iahad (2013)		
2.4	Committed and informed executive	Poon & Wagner (2001)		Implied in the business balanced scorecard

Item #	2. Project related factors			
	Critical Success Factor/s	**Author**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
	sponsor			
	BI system deployment:			
2.5	Utilisation and usage	Adelman (2003)	Number of queries per period, number of logons per period and number of users per period	User orientation
		Hobek, Ariyachandra & Frolick (2009)		
		Adamala & Cidrin (2011)		
		Hawking (2011)		
		Dinter, Schieder & Gluchowski (2011)	Percentage of employees as active BI users	
2.6	Perceived usefulness of information	Clark, Jones & Armstrong (2007)		User orientation
		Sangar & Iahad (2013)		
2.7	User satisfaction	Chen *et al*. (2000)		User orientation
		Lonnqvist & Pirttimaki (2006)		
		Adamala & Cidrin (2011)		
		Dinter, Schieder & Gluchowski (2011)		
2.8	Intention to use	Dinter, Schieder & Gluchowski (2011)		User orientation
2.9	User acceptance	Chenoweth, Corral & Demirkan (2006)		User orientation
2.10	User access	Nelson, Todd & Wixom (2005)		User orientation
		Isik (2010)		
2.11	User enthusiasm	McMurchy (2008)		User orientation
2.12	User trust	Anjariny & Zeki (2012)		User orientation
2.13	Project scoping, priorities and goals	Alshboul (2012)		
		Rainer & Watson (1995)		
		Olszak & Ziemba (2012)		
	BI System development:			
2.14	Structured methodology followed during development	Little & Gibson (2003)		Operational excellence
		Ko & Abullaev (2007)		
		Arnott (2008)		
		Adamala & Cidrin (2011)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
2.15	iterative approach	Poon & Wagner (2001)		Operational excellence
		Salmeron & Herrero (2005)		

Item #	2. Project related factors			
	Critical Success Factor/s	**Author**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
2.16	Metadata management	Little & Gibson (2003)		Operational excellence
		Ko & Abullaev (2007)		
2.17	Single source of information across business units	Hawking (2011)	Percentage of data contained in BI structure across business processes	Operational excellence
2.18	Data integration (with other systems)	Sammon & Finnegan (2000)		Operational excellence
		Wixom & Watson (2001)		
		Nelson, Todd & Wixom (2005)		
		Isik (2010)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
2.19	Enterprise approach	Little & Gibson (2003)		Operational excellence
2.20	Technology fit	Poon & Wagner (2001)		Operational excellence
		Wixom & Watson (2001)		
		Mukherjee & D'Souza (2003)		
		Salmeron & Herrero (2005)		
		Chenoweth, Corral & Demirkan (2006)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
	Resources (internal and external):			
2.21	Balanced team composition	Yeoh & Koronios (2010)		Future orientation
		Adamala & Cidrin (2011)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
2.22	Resource profile	Chasalow (2009)	Number of new employees per competency resource retention rate	Future orientation
2.23	BI end user knowledge and skills	Dinter, Schieder & Gluchowski (2011)	Employee skills profile	Future orientation
		Sammon & Finnegan (2000)		
2.24	User training	Clark, Jones & Armstrong (2007)		Future orientation
		Chasalow (2009)		
		Hobek, Ariyachandra & Frolick (2009)		

Item #	2. Project related factors			
	Critical Success Factor/s	**Author**	**KPI measurement for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
		Dinter, Schieder & Gluchowski (2011)		
		Alshboul (2012)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
2.25	Resource availability	Chasalow (2009)		Future orientation
2.26	.Resource budget	Sammon & Finnegan (2000)		
		Wixom & Watson (2001)		
		Alshboul (2012)		
		Anjariny & Zeki (2012)		
2.27	External resource support	Little & Gibson (2003)		Future orientation
		Alshboul (2012)		
		Olszak and Ziemba (2012)		
2.28	Appropriate team skills[1]	Poon & Wagner (2001)		
		Salmeron & Herrero (2005)		
		Ko & Abullaev (2007)		
		Yeoh, Gao & Koronios (2007)		
		Arnott (2008)		
		Alshboul (2012)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
2.29	Sufficient resources (funding, information, human resources, etc.)	Williams & Williams (2007)		
		Yeoh, Gao & Koronios (2007)		
		Arnott (2008)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
		Popovič *et al.* 2010		
2.30	(Including financial and human resources)	Alshboul (2012)		
		Olszak & Ziemba (2012)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		

Table 2 - Project related critical success factors (CSFs)

[1] Arnott (2008) and Yeoh, Gao & Koronios (2007) did not disclose if the team skills refer to skills for BI end-users or BI developers

Item #	3. Technical factors			
	Critical Success Factor/s	**Author/s**	**KPI measurements for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
	Quality:			
3.1	Data	Rudra & Yeo (2000)		Operational excellence
		Wixom & Watson (2001)		
		Mukherjee & D'Souza (2003)		
		Ko & Abullaev (2007)		
		Isik (2010)		
		Yeoh & Koronios (2010)		
		Adamala & Cidrin (2011)		
		Alshboul (2012)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar & Iahad (2013)		
		Naderinejad, Tarokh & Poorebrahimi (2014)		
3.2	Information	Dinter, Schieder & Gluchowski (2011)		Operational excellence
		Hawking (2011)		
		Sangar & Iahad (2013)		
3.3	System	Dinter, Schieder & Gluchowski (2011)		Operational excellence
		Wixom & Watson (2001)		
		Clark, Jones & Armstrong (2007)		
3.4	Service	Dinter, Schieder & Gluchowski (2011)		Operational excellence
3.5	Data integrity	Adamala & Cidrin (2011)		Operational excellence
		Sangar & Iahad (2013)		
3.6	Data consistency	Rudra & Yeo (2000)		Operational excellence
		Hawking (2011)		
3.7	Data consistency including standardisation	Ko & Abullaev (2007)		
3.8	Content quality	Yeoh, Gao & Koronios (2007)		
		Popovič *et al.* 2010		
	System performance (operational management):			
3.9	System response time	Hawking (2011)		Operational excellence
3.10	Report development	Hočevar & Jaklič (2010)		Operational excellence

Item #	3. Technical factors			
	Critical Success Factor/s	**Author/s**	**KPI measurements for BI balanced scorecard strategy map**	**BI balanced scorecard perspective**
3.11	Reliability (data and system)	Nelson, Todd & Wixom (2005)		Operational excellence
		Isik (2010)		
		Hawking (2011)		
		Sangar & Iahad (2013)		
3.12	Scalable	Adamala & Cidrin (2011)		Operational excellence
		Sangar & Iahad (2013)		
3.13	Flexible	Sammon & Finnegan (2000)		Operational excellence
		Arnott (2008)		
		Hočevar & Jaklič (2010)		
		Isik (2010)		
		Yeoh & Koronios (2010)		
		Adamala & Cidrin (2011)		
		Alshboul (2012)		
		Olszak & Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar and Iahad (2013)		
3.14	System user friendliness	Hawking (2011)	training cost and training time	Operational excellence
		Alshboul (2012)		
		Olszak and Ziemba (2012)		
		Fedouaki, Okar & Alami (2013)		
		Sangar and Iahad (2013)		

Table 3 - Technical Critical Success Factors (CSFs)

Annexure B: Tabular BI balanced scorecard strategy map

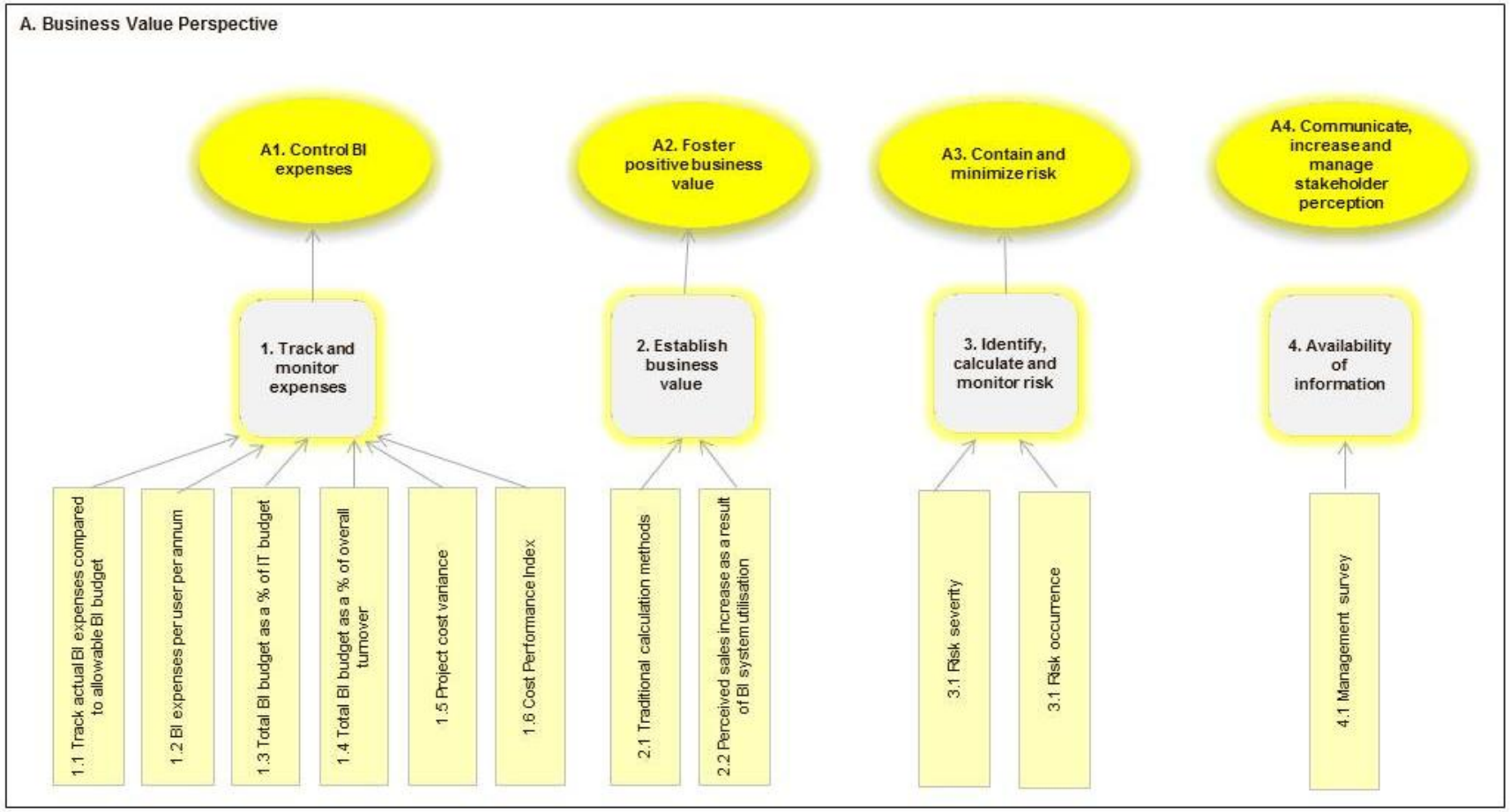
Business Intelligence: Tabular Strategy map				
Perspective	**Mission**	**Objective**	**Measurement**	**Metric**
A. Business value	Implement and maintain a BI capability that will increase long-term shareholder value	A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget 1.2 BI expenses per user per annum 1.3 Total BI budget as a % of IT budget 1.4 Total BI budget as a % of overall turnover 1.5 Project cost variance 1.6 Cost Performance Index
		A2. Forster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics) 2.2 Perceived increase in sales as a result of BI system utilisation
		A3. Contain and minimize risk	3. Identify, calculate and monitor risk	3.1 Risk severity using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk) 3.2 Risk occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional uncertainty, technical risk, IT service delivery risk, project risk)
		A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey
B. User orientation	Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.	B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system
			2. Usefulness of information	2.1 Perceived usefulness of information survey
			3. Intention to use the system	3.1 Intention to use the system (survey)
			4. Availability of information	4.1 Time measured in minutes to obtain information
		B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)
		B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period
			7. User enthusiasm	7.1 Number of times logged on to the BI system

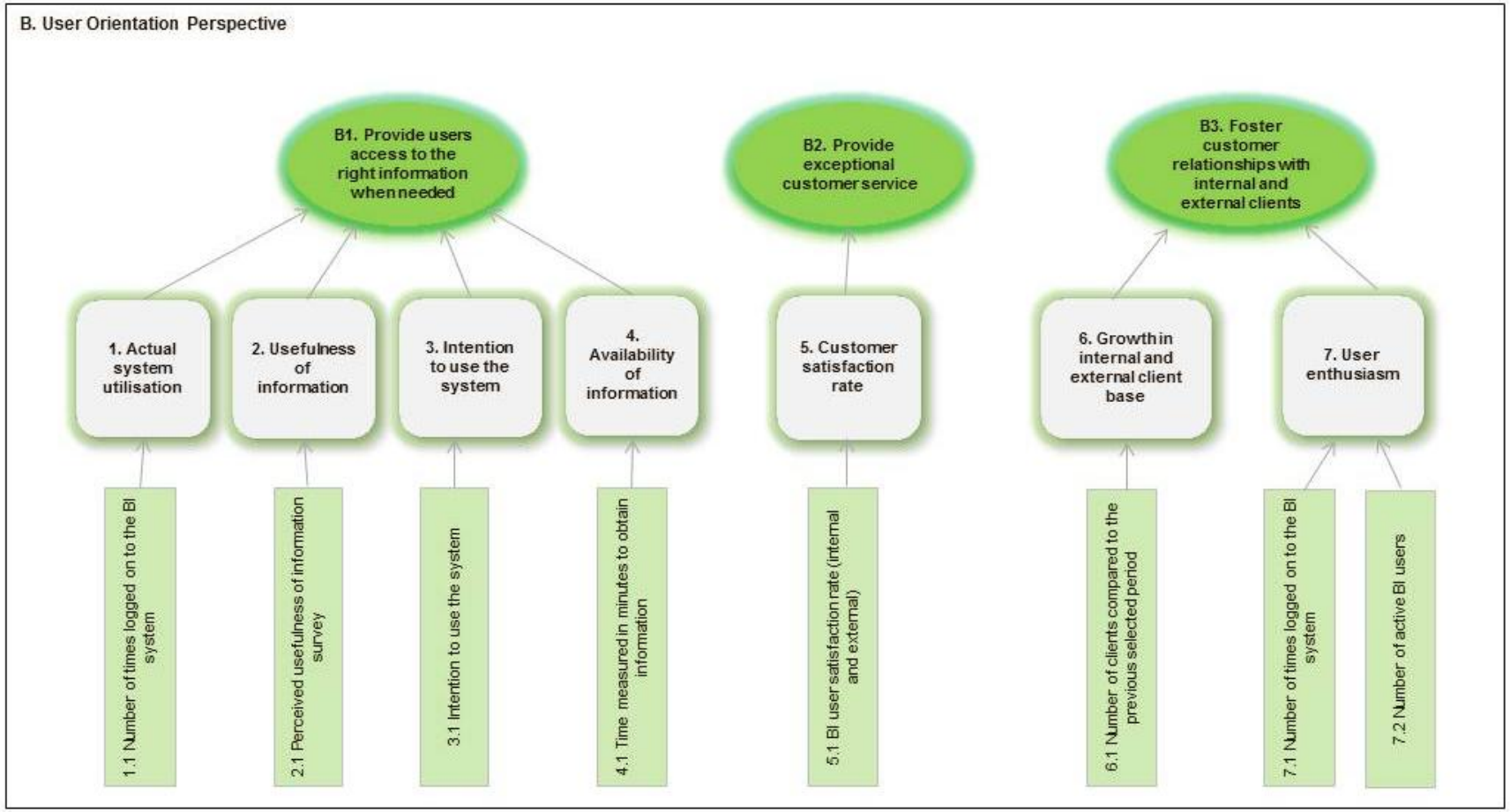
Business Intelligence: Tabular Strategy map				
Perspective	**Mission**	**Objective**	**Measurement**	**Metric**
				7.2 Number of active BI users
C. Operational excellence	Support the achievement of organisational goals through the provision of efficient and effective BI processes.	C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed 1.2 Project Performance Indicators: Project Scheduled Performance Index and Project Schedule Variance
		C2. Development of BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions
			3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements
			4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)
		C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report 5.2 Time in minutes to obtain a new report 5.3 System quality rate 5.4 User friendliness rating 5.5 Number of times when information is not available when needed
			6. Data reliability, consistency and high quality	6.1 Data accuracy rate 6.2 Data availability rate 6.3 Data consistency rate 6.4 Data quality rate 6.5 Number of queries related to data quality 6.6 Number of up-sell and cross-sell opportunities using data obtained from BI systems
			7. System support provided within an acceptable standard	7.1 Response time in minutes after call was logged
			8. Customer / user experience	8.1 Customer / user satisfaction survey
		C4. Perform maintenance to ensure uninterrupted BI service	9. System availability and reliability	9.1 Time in minutes for unplanned system downtime 9.2 Number of unplanned BI system interruptions 9.3 Number of planned BI system interruptions 9.4 Number of operational failures
D. Future orientation	Retain current employees and ensure that current employees are equipped with the right mix of capabilities	D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills 1.2 Number of employees with BI technology skills for emerging technologies 1.3 Age distribution of BI staff

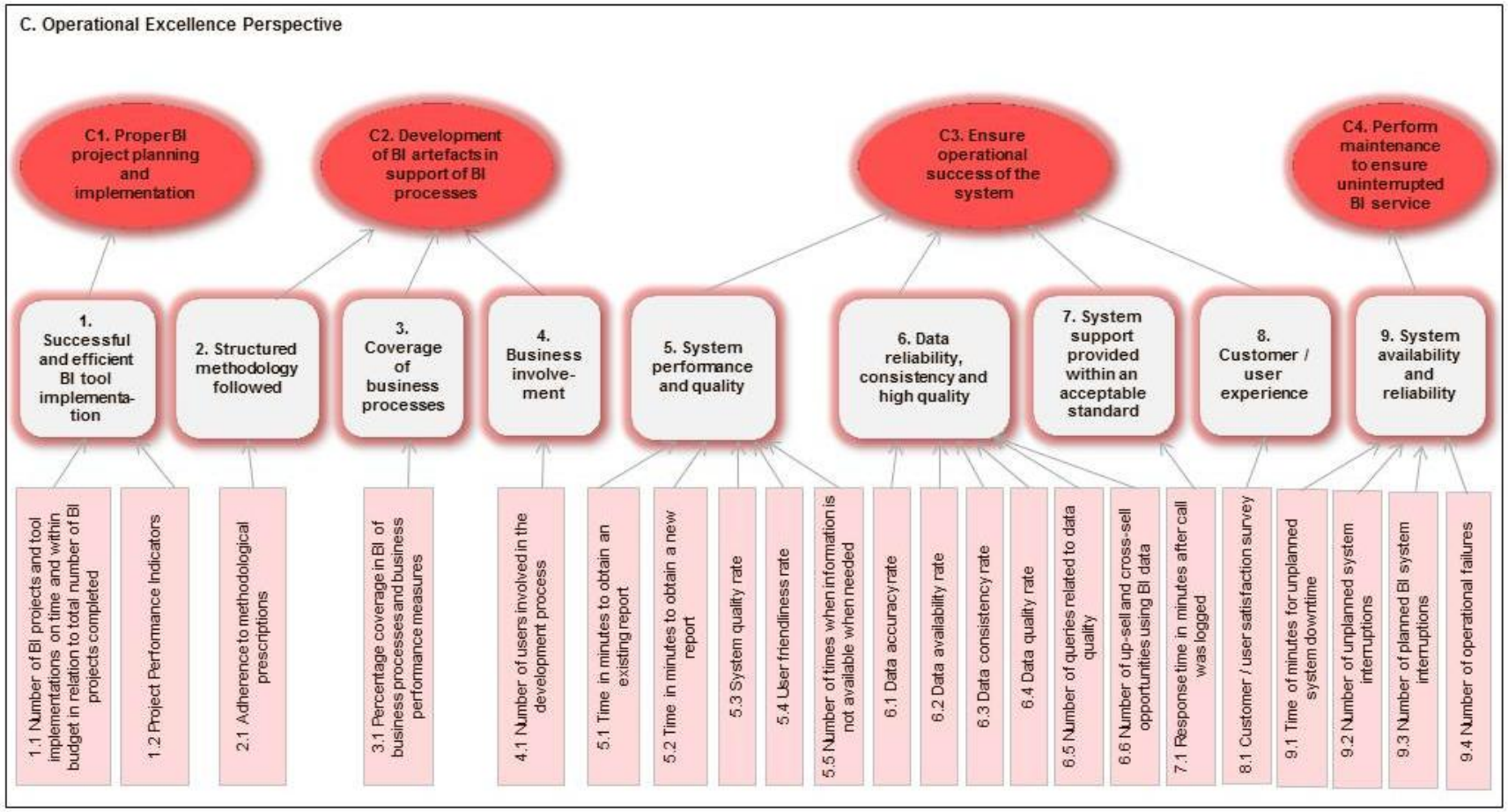
Business Intelligence: Tabular Strategy map				
Perspective	**Mission**	**Objective**	**Measurement**	**Metric**
	and skills to meet the current and future organisational needs.			1.4 Number of years of BI experience per staff member 1.5 Perceived satisfaction of BI employees (employee satisfaction rate) 1.6 Turnover rate of BI employees 1.7 Retention rate of BI employees 1.8 Productivity of BI employees (number of queries per employee per day)
			2. Level of training and education of BI personnel	2.1 Number of educational days per person 2.2 BI training and resource development budget as a percentage of the overall IT budget 2.3 BI training and development budget as a percentage of the overall BI budget 2.4 Number of times an external consultant is contracted to perform internal BI tasks
		D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget 3.2 BI research budget as a percentage of the overall BI budget 3.3 Management perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation 3.4 Number of new business ventures introduced as a result of new BI technological trends
		D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications 4.2 Number of BI technologies utilised
			5. Performance of BI systems	5.1 Downtime of BI systems 5.2 Availability of systems 5.3 Database query response time 5.4 User satisfaction rate

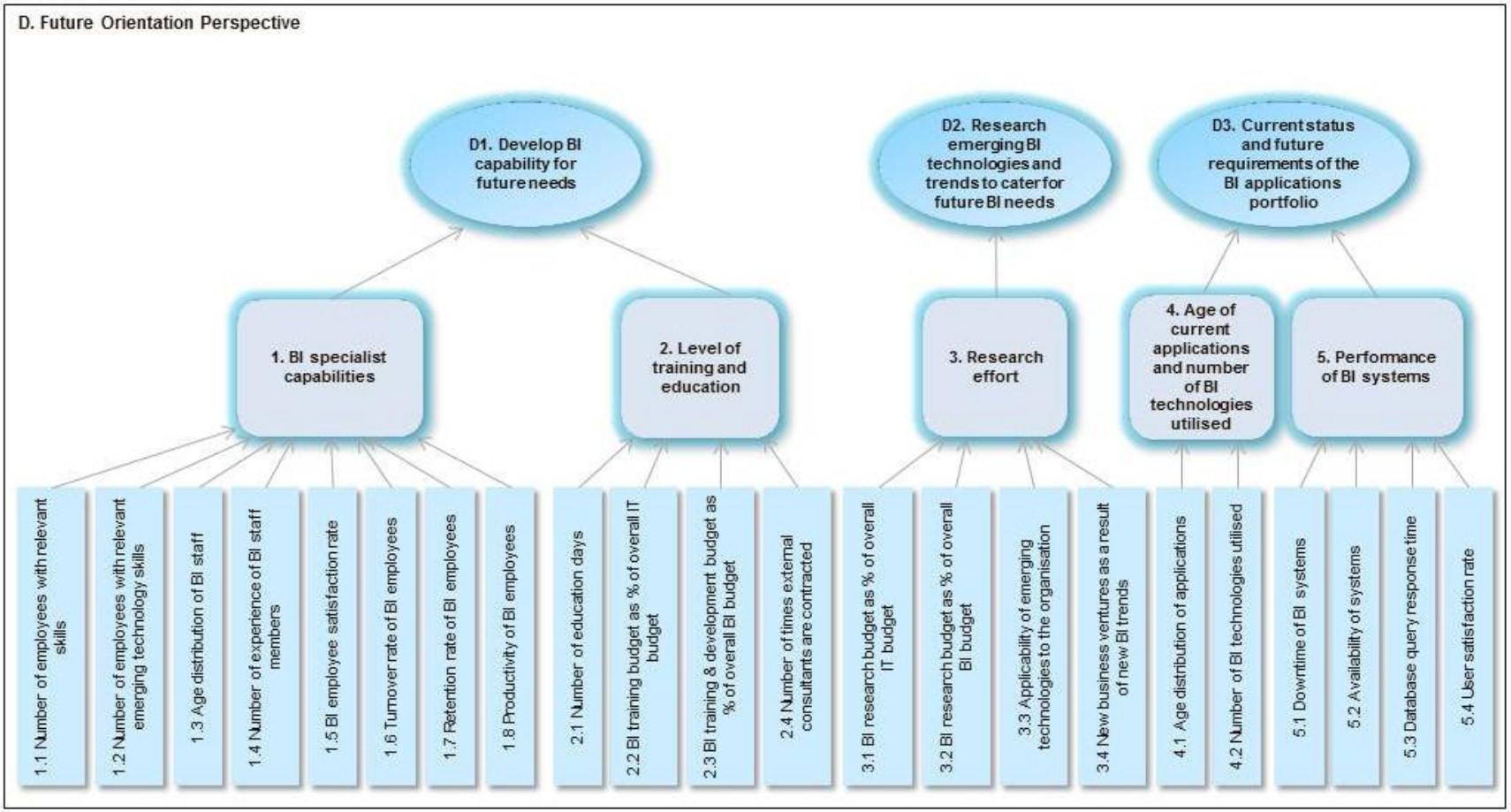
Table 4 - Tabular BI balanced scorecard strategy map

Annexure C: Graphical representation of the BI balanced scorecard strategy map (preliminary version)




B. User Orientation Perspective
B1. Provide users access to the right information when needed
B2. Provide exceptional customer service
B3. Foster customer relationships with internal and external clients
1. Actual system utilisation
2. Usefulness of information
3. Intention to use the system
4. Availability of information
5. Customer satisfaction rate
6. Growth in internal and external client base
7. User enthusiasm
1.1 Number of times logged on to the BI system
2.1 Perceived usefulness of information survey
3.1 Intention to use the system
4.1 Time measured in minutes to obtain information
5.1 BI user satisfaction rate (internal and external)
6.1 Number of clients compared to the previous selected period
7.1 Number of times logged on to the BI system
7.2 Number of active BI users


C. Operational Excellence Perspective
C1. Proper BI project planning and implementation
C2. Development of BI artefacts in support of BI processes
C3. Ensure operational success of the system
C4. Perform maintenance to ensure uninterrupted BI service
1. Successful and efficient BI tool implementa-tion
2. Structured methodology followed
3. Coverage of business processes
4. Business involve-ment
5. System performance and quality
6. Data reliability, consistency and high quality
7. System support provided within an acceptable standard
8. Customer / user experience
9. System availability and reliability
1.1 Number of BI projects and tool implementations on time and within budget in relation to total number of BI projects completed
1.2 Project Performance Indicators
2.1 Adherence to methodological prescriptions
3.1 Percentage coverage in BI of business processes and business performance measures
4.1 Number of users involved in the development process
5.1 Time in minutes to obtain an existing report
5.2 Time in minutes to obtain a new report
5.3 System quality rate
5.4 User friendliness rate
5.5 Number of times when information is not available when needed
6.1 Data accuracy rate
6.2 Data availability rate
6.3 Data consistency rate
6.4 Data quality rate
6.5 Number of queries related to data quality
6.6 Number of up-sell and cross-sell opportunities using BI data
7.1 Response time in minutes after call was logged
8.1 Customer / user satisfaction survey
9.1 Time of minutes for unplanned system downtime
9.2 Number of unplanned system interruptions
9.3 Number of planned BI system interruptions
9.4 Number of operational failures


D. Future Orientation Perspective
D1. Develop BI capability for future needs
D2. Research emerging BI technologies and trends to cater for future BI needs
D3. Current status and future requirements of the BI applications portfolio
1. BI specialist capabilities
2. Level of training and education
3. Research effort
4. Age of current applications and number of BI technologies utilised
5. Performance of BI systems
1.1 Number of employees with relevant skills
1.2 Number of employees with relevant emerging technology skills
1.3 Age distribution of BI staff
1.4 Number of experience of BI staff members
1.5 BI employee satisfaction rate
1.6 Turnover rate of BI employees
1.7 Retention rate of BI employees
1.8 Productivity of BI employees
2.1 Number of education days
2.2 BI training budget as % of overall IT budget
2.3 BI training & development budget as % of overall BI budget
2.4 Number of times external consultants are contracted
3.1 BI research budget as % of overall IT budget
3.2 BI research budget as % of overall BI budget
3.3 Applicability of emerging technologies to the organisation
3.4 New business ventures as a result of new BI trends
4.1 Age distribution of applications
4.2 Number of BI technologies utilised
5.1 Downtime of BI systems
5.2 Availability of systems
5.3 Database query response time
5.4 User satisfaction rate

Annexure D: Copy of participant permission form

Participant Permission Form

Thank you for agreeing to participate in this study. The study will take place from 15 September 2013 to 31 October 2014 and will be conducted by Sunet Eybers under the supervision of Prof Jan Kroeze.

This form details the research details such as research and study information as well as the rights of the participant. By completing this form, the participant grants his / her permission to participate in the research.

RESEARCH BACKGROUND

		RESEARCHER INFORMATION	SUPERVISOR INFORMATION
Name:		Mrs S. Eybers	Prof. J.H. Kroeze
Contact details:	**e-mail**	Sunet.eybers@yahoo.com	kroezejh@unisa.ac.za
	Contact number	(+27) 082 874 2124	(+27) 012 429 6976
Institution:		University of South Africa (UNISA)	University of South Africa (UNISA)

STUDY INFORMATION

Purpose of the study:	The purpose of the study is to investigate the value of business intelligence (BI) implementations to organisations. The BI contribution is assessed by means of establishing the impact business intelligence has on the overall organisational performance.
Research benefits and risks:	The findings of the research will contribute to the existing (limited) academic body of knowledge pertaining to the value of business intelligence implementations. No risks have been identified.
Method(s) used:	Semi-structured interview (60 minutes)

PARTICIPANT RIGHTS

The following participant rights are applicable to the study:

- Participation in this study is completely voluntarily.
- Participants may at any stage decide not to continue with their participation in the study.
- The participant's privacy and dignity will not be violated by using hidden cameras, one-way glass, microphones, sound recordings or any other research devices without the necessary permission.
- Data gathering will be treated with the necessary confidentiality and will remain completely anonymous.
- The participant's identity will not be revealed and any conclusions derived from the study will be considered anonymous.
- Participants will be provided with a copy of the participant permission form as well as the interview template. The content of both documents will be explained before the scheduled interview sessions.
- The results of the study will be used for research purposes and might be published.

PARTICIPANT PERMISSION

Declaration

I, _____ hereby voluntarily grant my permission for participation in the research project as explained to me by the researcher Sunet Eybers. The inputs derived from my participation will be interpreted and presented in a confidential and anonymous manner. The nature, objective, possible safety and health implications have been explained to me and I understand them. I understand my right to choose whether to participate in the project and that the information furnished will be handled with the necessary confidentially and anonymously. I am aware that the result of the study may be used for the purposes of publication. Upon signature of this form, you will be provided with a copy. The participant also has the right to withdraw their participation at any time.

Date: _____

Participant: _____ _____

Researcher: S.S.A. Eybers

Annexure E: Interview template

Business Intelligence (BI) value interview template

Date of interview:	
Interview conducted by:	

Note:

- Participants should complete the 'Participant Permission Form' prior to the scheduled interview.
- The interview will take approximately 60 minutes.
- This template consists of five sections (general information, business value, user orientation, operational excellence and future orientation perspective).

Objective of the study is to investigate the following research questions:

1. *What contribution does BI make towards the achievement of the overall organisational goals and objectives?*
2. *What is the perceived value of BI implementations amongst senior management in organisations?*
3. *What was the impact of BI on the organisation?*
4. *What is the relationship between BI implementations and organisational performance?*
5. *In which areas in the organization were the perceived value the result of a BI implementation?*

These questions are important for the following reasons;

- *To prove the worth of the investment to stakeholders;*
- *To track and monitor the BI investment to ensure that the required satisfaction rates (internal and external) are achieved both on process and organisational levels;*
- *To ensure that the BI investment continues to contribute to the overall IT and organisational goals;*
- *To ensure that the success of the investment is continuous.*

For office use:

The numbering system used in the template is not sequential as it corresponds to the numbering system used in the 'Business Intelligence: Tabular Strategy map'.

Acronyms used in this template:

Acronym	Meaning
BI	Business Intelligence
CPI	Cost Performance Index
CV	Cost Variance
IRR	Internal Rate of Return
IT	Information Technology
NPV	Net Present Value
OLAP	Online analytical processing
ROI	Return on Investment

Definitions:

The table below contains some of the concepts used in this interview template.

Term	Description
BI	The combination or set of processes, products and technologies used to supply the user with the required data, information or knowledge in order to make informed decisions (Shollo & Kautz 2010).
BI Centre of Excellence	A central business function providing various departments with the required BI assistance. It is a central point of contact for the confirmation and accumulation of standards and procedures relating to BI elements.
BI processes	All facets of the process of collecting and storing business data and analysing information for decision-making purposes.
BI products	The output or result of the BI process such as data, information, knowledge or decisions.
BI strategy risk	Risk of having an unsuccessful or undefined (BI) strategy (Parker, Benson & Trainor 1988). The strategy should be clearly defined.
BI technologies	Specific software utilised in the BI process, normally vendor specific, to assist in the collecting and storing of data such as data warehouse technology.
BI tools	Tools used in the analysis of collected data and information, including reports, cubes, data mining.
Data warehouse	A large database storage facility for data containing multiple sources of data used as a primary source for BI tools.
Dashboard	Summary of key performance indicators on one screen for the tracking and monitoring of actual performance against targeted performance.
Definitional uncertainty	Lack of or inadequate project specification (Parker, Benson & Trainor 1988).
Emerging BI technologies	New technologies currently being introduced and / or developed in the business environment in the short or medium term (5 – 10 years). These technologies can potentially change the entire business and social environment. Examples of these include: social media analytics, self-service BI and analytics, mobile BI and BI in a cloud computing environment (Russom 2012).
Employee retention rate	The ability of an organisation to retain a percentage of employees. For example, 80 % retention rate indicates that 80 % of employees remained part of the organisation for a particular period.
Employee turnover rate	The rate at which organisations retains or losses employees. The total number of employees who left the organisation is divided by the total number of employees actively working in the organisation expressed as a percentage. For example, if 6 employees left the organisation out of a total of 100, the turnover rate is 6/100*100 = 6%.
Earned value	A project management technique used to measure project performance and progress using project scope, project schedule and project costs in the calculation.
Information economics	A decision-making approach popularised by Parker, Benson & Trainor (1988) used in the calculation of the value of an investment. The approach includes the value of intangible measurements not normally considered in traditional financial methods.
Internal Rate of Return (IRR)	An approach used in capital budgeting. The discount rate is used to set the net present value of project cash flows equal to zero for ease of comparison.
IT strategy risk	Risk of having an unsuccessful or undefined IT strategy (Parker, Benson & Trainor 1988). The BI strategy is an extension of the IT strategy. In instances where the IT strategy is unclear or undefined, it will impact the BI strategy.
Net Present Value (NPV)	The difference between the present value of cash inflows and the present value of cash outflows.
OLAP	Multi-dimensional structure containing data usually utilised in the analysis of data trends according to multiple views.

Term	Description
Organisational risk	The risk associated with resistance to change as well as end-user difficulties such as a lack of knowledge and skills (Parker, Benson & Trainor 1988).
Payback period	An approach used in capital budgeting referring to the period of time required for the investment to settle the sum of the original capital investment amount.
Project Cost Performance Index (CPI)	The budgeted cost of work performed (BCWP) divided by the actual cost of work performed (ACWP). The result gives an indication of the efficiency of (monetary) resources utilised on the project when compared to the allocated budget.
Project Cost Variance (CV)	A calculation to establish if the project is currently over or under the allocated project budget.
Return on Investment (ROI)	The evaluation of an investment considering the benefit to the investor when compared to the investment cost.
Technological risk	Risk for using the latest, untested technology (hardware and software), also known as “bleeding edge” technology (Parker, Benson & Trainor 1988).
Traditional financial calculation methods	Methods that are generally accepted financial methods frequently used in the industry such as ROI or NPV.
IT infrastructure risk	The degree to which the organisational environment supports the (BI) implementation (Parker, Benson & Trainor 1988).

INTERVIEW QUESTIONS

DEMOGRAPHIC AND GENERAL INFORMATION

1. Industry:

2. Public or government sector:

Public	Government	NGO

3. Position of interviewee within the organisation:

4. Size of your organisation (total number of employees*):

<10 (Micro)	<50 (Small)	<250 (Medium)	>250 (Large)

*European standard used

5. Which of the following BI-related items were implemented in your organisation:

Data warehouse	Dashboards	Reports	OLAP cubes	Other:

6. In your opinion, does BI add value to your organisation?

Yes	No

6.1 Why or why not?

7. Do you have a separate BI division or Competency Centre fulfilling the BI needs within the organisation?

Yes	No

BUSINESS VALUE PERSPECTIVE

A1. BI Expenses

1.1 Does your organisation keep track of BI expenses on departmental level?

Yes	No

If '**yes**', is the total of actual BI expenses more or less than the allowable budget for the BI department?

More than budget	Less than budget	Not sure

1.2 What are the estimated BI expenses per user per year (including licensing costs)?

<R10,000	<R20,000	<R30,000	<R40,000	Not sure

1.3 What percentage of the overall IT budget is attributed to BI?

5 %	10 %	15 %	20 %	25 %	>25 %	Not sure

1.4 What percentage does the BI budget contribute to the overall turnover?

5 %	10 %	15 %	20 %	25 %	>25 %	Not sure

1.5 Do you calculate the Project Cost Variance at any stage during a BI project?

Yes	No

If **'yes'**, is the variance more or less than the acceptable standard?

More than acceptable standard	Less than acceptable standard

1.6 Do you calculate the Project Cost Performance Index at any stage during a BI project?

Yes	No

If **'yes'**, is the index more or less than the acceptable standard?

More than acceptable standard	Less than acceptable standard

A2. Business value

2.1 Does your organisation make use of any 'traditional' financial calculation methods to calculate the potential value of BI projects prior, during or after the project?

Yes	No

If **'yes'**, what method do you use?

Earned value	ROI	NPV	IRR	Payback period
Information economics	Other:			

2.2 In your opinion, did your organisation experience an increase in sales as a direct or indirect result of BI implemented in your organisation?

Yes	No

If **'yes'**, what was the estimate value?

A3. Risk

3.1 Do you identify, calculate or monitor any of the following risks pertaining to BI either on organisational or project level?

Type of risk (Parker, Benson & Trainor 1988)	**Yes/No**		**Method**
	Yes	**No**	
BI strategy risk			
IT strategy risk			
Definitional uncertainty			
Technological risk			
Organisational risk			
IT infrastructure risk			

A4. Shareholder perception

5.1 (a) In your opinion, what is your management's perception of the delivered BI products?

(b) In your opinion, what is your management's perception of the BI department?

(c) Do you scientifically establish the management perception towards BI in your organisation by means of surveys?

Yes	No

If '**yes'**, what was the outcome?

B. USER ORIENTATION PERSPECTIVE

B1. Access to information

1.1 (a) How many times (on average) do internal BI users log on to the BI system (per day)?

<10	11 to 20	21 - 29	>30

(b) How many times (on average) do external BI users log on to the BI system (per day)?

<10	11 to 20	21 - 29	>30

2.1 In your opinion, is the information obtained from the BI system useful and trustworthy?

Yes	No

Why or why not?

3.1 Are there any other users (internal or external) who intend to use the system in the near future?

Yes	No

4.1 How long does it take for internal and external BI users to obtain information from the BI system?

Is the length of time taken acceptable?

Yes	No

B2. Customer service

5.1 (a) In general, are the BI internal users satisfied with the current BI system they interact with?

Yes	No

(b) In general, are the BI external users satisfied with the current BI system they interact with?

Yes	No

Why or not?

B3. Customer relationships

6.1 Did you experience an increase in the number of clients since the implementation of a BI system?

Yes	No	Not sure

If 'yes', was the increase substantial?

Yes	No	Not sure

7.1 Same as point B1 (1.1) above.

7.2 How many users actively utilise the current BI system?

Internal	
External	

C. OPERATIONAL EXCELLENCE PERSPECTIVE

C1. Plan and implement

1.1 How many BI projects and / or tools have been implemented in your organisation in the past five years?

1	2	3	>3	Not sure

How many BI projects and / or tools have been implemented on time and within budget in the past five years?

1	2	3	>3	Not sure

1.2 Do you make use of one of the following calculations during BI projects?

(a) Project scheduled performance index	Yes	No	Not sure
(b) Project schedule variance	Yes	No	Not sure

If '**yes**', is it within an acceptable standard?

(a) Project scheduled performance index	Yes	No	Not sure
(b) Project schedule variance	Yes	No	Not sure

C2. Develop

2.1 Do you follow a particular methodology when conducting BI projects?

Yes	No	Not sure

3.1 What percentage of business processes and business performance measurements are covered by your BI system?

	%	
(a) Business processes		Not sure
(b) Business performance measurements		Not sure

4.1 Were any users involved in the development of the BI products or during implementation of any aspects of the BI system?

Yes	No	Not sure

If 'yes', during which stage of development?

Requirements gathering	Development	Testing	Maintenance

C3. Operations (system functioning)

5.1 How long does it take to obtain an existing report from the BI solution?

1 -4 minutes	5 minutes	6 –10 minutes	> 10 minutes

Is this acceptable?

Yes	No	Not sure

5.2 How long does it take to obtain a new report from the BI solution?

1 -4 minutes	5 minutes	6 –10 minutes	> 10 minutes

Is this acceptable?

Yes	No	Not sure

5.3 Is the data contained in the outputs of the BI system (such as reports, dashboards or analytical calculations) trustworthy and of high quality?

Yes	No	Not sure

If 'no', why?

5.4 Would you describe the current BI system as user friendly?

Yes	No	Not sure

Why or why not?

5.5 How many times in a business week is the information not available from the BI system when requested by the business?

Always available	Once or twice	Three times or more	Not sure

6.1 to 6.4 'Rate' your current BI system by using the following scale:
1-Extremely satisfied; 2-Satisfied but scope for improvement; 3-Not satisfied at all

		Score		
6.1	Data accuracy	1	2	3
6.2	Data availability	1	2	3
6.3	Data consistency	1	2	3
6.4	Data quality	1	2	3

6.5 Do you often get enquiries from end-users questioning the data quality contained in reports or any other BI related output?

Yes	No	Not sure

If 'yes', how many per month?

<5	6-10	>10

6.6 Does your organisation use the data obtained from the BI system or BI toolset to up-sell and cross-sell products to customers?

Yes	No	Not sure

If 'yes', how many additional product(s) or services were sold per month as a result of this effort?

<5	6-10	>10

7.1 Is there adequate support for the end-users utilising the current BI system or toolset?

Yes	No	Not sure

If **'yes'**, what is the response time?

Satisfactory	Not satisfactory	Not sure

8.1 In general, are the following users satisfied with the BI system?
(a) BI end users; and
(b) external customers.

(a) BI end users	Yes	No	Not sure
(b) External users (customers or suppliers)	Yes	No	Not sure

C4. Maintenance

9.1 How many unplanned system downtime events occur during a month?

<5	6-10	>10

What is the acceptable standard?

9.2 How many unplanned BI system interruptions occur during a month?

<5	6-10	>10

What is the acceptable standard?

9.3 How many planned BI system interruptions occur during a month?

<5	6-10	>10

What is the acceptable standard?

9.4 How many operational failures of the BI system or toolset do you experience during a month?

<5	6-10	>10

What is the acceptable standard?

D. FUTURE ORIENTATION PERSPECTIVE

D1. BI specialist capabilities

1.1 How many employees in your organisation are competent in using the current BI system?

<5	6-10	>10

1.2 How many employees in your organisation are competent in using emerging and / or the latest BI products and BI technologies such as mobile technologies for BI, BI self-service or big data analytics?

<5	6-10	>10

1.3 What is the average age of the staff members responsible for the BI capability within the organisation?

19-29	30-39	40-49	>50	Not sure

1.4 What is the average number of years of BI experience per staff member?

<5years	6-10years	>10years	Not sure

1.5 Do you measure the BI staff satisfaction rate within your organisation?

Yes	No	Not sure

If '**yes**' please provide the outcome of the survey:

1.6 On average, how long do BI staff members work for your organisation?

<1year	2-5years	6-10years

What is the turnover rate for BI staff per year (%)?

<5%	6-10%	11-20%	>20%

1.7 What is the retention rate for BI staff per year (%)?

100%	90%	80%	70%	<70%

1.8 How many enquiries does an employee handle per month?

(a) BI support staff	
(b) BI development staff	

Is this acceptable?

(a) BI support staff	Yes	No	Not sure
(b) BI development staff	Yes	No	Not sure

D2. Training and education

2.1 How much training (in days) have BI personnel spent on formal BI related education and training programmes during the past year?

2.2 What is the BI training and resource development budget as a percentage of the overall IT budget (per year)?

<5% of IT budget	6-10% of IT budget	>10% of IT budget	Not sure

2.3 What is the BI training and resource development budget as a percentage of the overall BI budget (per year)?

<5% of BI budget	6-10% of BI budget	>10% of BI budget	Not sure

2.4 Do you make use of external BI consultants to assist in any BI related activities?

Yes	No	Not sure

If 'yes', how many times per year?

<5 times	6-10 times	>11 times	Not sure

D3. Research effort

3.1 What is the budget for BI research as a percentage of the overall IT budget (per year)?

<5% of IT budget	6-10% of IT budget	>10% of IT budget	Not sure

3.2 What is the budget for BI research as a percentage of the overall BI budget (per year)?

<5% of BI budget	6-10% of BI budget	>10% of BI budget	Not sure

3.3 In your opinion, will emerging BI technologies be applicable to the future ventures of the organisation?

Yes	No	Not sure

3.4 How many new business ventures have been introduced as a result of new BI technological trends?

<5	6-10	Not sure

D4. Age of current applications and number of BI technologies utilised

4.1 On average, what is the age of your current BI system (such as the data warehouse) and software technologies used?

	Age (months)	
(a) BI system		Not sure
(b) BI technologies		Not sure

4.2 How many different (a) BI technologies (software vendors and software platforms such as Microsoft and Oracle) and; (b) tools (cubes, dashboards, reports) do you utilise in your organisation?

	(a) Technologies	(b) Tools
Data warehouse		
Operational data store (ODS)		
OLAP		
Reports (self service)		
Reports (pre-developed)		
Dashboard(s)		
Analytical tools		

D5. BI system performance

5.1 BI system downtime (refer to C4. Maintenance, 9.1 and 9.2)

5.2 BI system availability (refer to C4. Maintenance)

5.3 How long does it take for a database query to produce a result?

<1 minute	<5minutes	>5minutes

Is this an acceptable response time?

Yes	No	Not sure

5.4 User satisfaction rate (refer to B5. Customer service, point 5)

For office use only:
D5. BI system performance question 5.1, 5.2 and 5.4

Annexure F: Summary of interview responses

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
N/A: Demographic information	Gather demographic information of study participants	The demographic information provides important information describing the environment in which respondents operate and should be considered during the data analysis of the data	**N/A**	1. Industry	Industry	Information Technology: BI consultancy	Financial services, Banking.	FMCG	Public administration
				2. Sector classification	Public or government sector (public, government, NGO)	Public	Public	Public	Government
				3. Position of interviewee	Position of the interviewee within the organisation	Owner / CEO as well as entire BI consultancy team	Chief Technology Officer (CTO) and Head of Operations (Risk)	IT Operations: Technical Manager	Senior Data Analytics Manager
				4. Organisational size	Size of your organisation (total number of employees): Micro (<10), Small (<50), Medium (<250), Large (>250)	Micro	Medium	Large	Large
				5. BI elements implemented	Which of the following BI-related items were implemented in your organisation: data warehouse, dashboards, reports, OLAP cubes, other.	Data warehouse, dashboards, reports, data modelling (other)	Data warehouse, dashboards, reports. 37 different dispersed databases containing transactional data. Some databases are contained in a data warehouse type structure (also a cube like structure using Postgress SQL). Excel is the tool of choice for connecting to data sources to create reports but it is not adequate. Also Excel is used to share spreadsheets containing aggregated data amongst users. Note: Systems are either internally or	Data warehouse, Dashboards, Reports, OLAP cubes. Using ProClarity (as analytical tool) and Cognos (for cubes).	Data warehouse, Dashboards and Reports

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
							external (a number of systems (from the 37) are outsourced). Dashboard for measuring capability maturity model (use as goals for the company).		
				6. Perception of BI value	In your opinion, does BI add value to your organisation?	Yes. Org can't survive without it and enables decision-making	Yes. BI needs driven by: regulatory requirements, risk (credit, compliance, fraud) and financial profit / income. Implementations of BI in all these areas add value to organisations. Bank compliance is split into regulated by the bank regulation act and non-regulated. They cannot do without BI due to regulatory requirements. Strong focus on King III Governance measurements.	Yes	Yes. BI provides valuable input into their decision-making process and provide valuable information to both internal and external stakeholders with regards to the Debit and Credit Book (for GDP calculations) as well as trade statistics. The quality of trade statistics improved the quality of statistics which resulted in more accurate trade deficit and GDP calculations.
				7. BI organisational capabilities	Do you have a separate BI division or Competency Centre fulfilling the BI needs within the organisation?	Yes	No	Yes	No. Each department have a unique set of BI and analytics resources looking after their respective requirements. No centralized capacity.
A. Busines s value	Implement and maintain a BI capability that will increase long-term shareholder	A1. Control BI expenses	1. Track and monitor expenses	1.1 Total actual BI expenses compared to allowable BI budget	Does your organisation keep track of BI expenses on departmental level?	No	No. No BI budget. Currently evaluating tools. CTO gives shortlisted products to the stakeholders to play with. The	No	No

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
	value						Financial Director (FD) will then give feedback in terms of preference. The tools should hide the complexity of back-end systems to the user.		
					If 'yes', is the total of actual BI expenses more or less than the allowable budget for the BI department?				
				1.2 BI expenses per user per annum	What are the estimated BI expenses per user per year (including licensing costs)?	In general total of R1mil+ per year depending on client (can be up to R20mil per client)	< R10,000. Open source software used to keep option open of purchasing proprietary software.	Not sure	Not sure
				1.3 Total BI budget as a % of IT budget	What percentage of the overall IT budget is attributed to BI?	15% on average but varies between clients	No official budget.	5%	5% (estimated)
				1.4 Total BI budget as a % of overall turnover	What percentage does the BI budget contribute to the overall turnover?	Unknown, varies between clients	No official BI budget.	Not sure	Not sure
				1.5 Project cost variance	Do you calculate the Project Cost Variance at any stage during a BI project? If **'yes'**, is the variance more or less than the acceptable standard?	No never been asked to do this for a BI project.	No. No formal BI projects. They do have 'black OPS' projects, i.e. project without a budget. They use some of the IT budget as funding. They do some retrospective analysis using an opportunity cost ('geleentheidskoste') approach. In other words, what would have been the status if the project was not implemented?	Yes. More than acceptable standard.	No

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				1.6 Cost Performance Index	Do you calculate the Project Cost Performance Index at any stage during a BI project? If **'yes'**, is the index more or less than the acceptable standard?	No never been asked to do this for a BI project.		No	No
		A2. Foster positive business value (BI projects and BI department)	2. Establish business value	2.1 Traditional calculation methods (earned value, ROI, NPV, IRR, Payback period, information economics)	Does your organisation make use of any 'traditional' financial calculation methods to calculate the potential value of BI projects prior, during or after the project? If **'yes'**, what method do you use? (earned value, ROI, NPV, IRR, payback period, Information economics, other)	No	No. The organisation use COBIT 4.1 including their value management offering. They perceive value not in profit and earnings but in the management of risk (non-compliance can force shut down and impose fines).	Yes. ROI.	No
				2.2 Perceived sales increase as a result of BI system utilisation	In your opinion, did your organisation experience an increase in sales as a direct or indirect result of BI implemented in your organisation?	Yes, value not disclosed by client	No BI.	Yes. Hard to say, in the millions though as our BI has been a very focused priority for many years.	Not applicable. Not selling a product.
		A3. Contain and minimize risk	3. Identify, calculate and monitor risk	3.1 Risk severity and occurrence using information economics (business strategy risk, business organisational risk, IT strategy risk, definitional	Do you identify, calculate or monitor any of the following risks pertaining to BI either on organisational or project level? Specify Yes / No and method used for each type of risk: BI strategy risk, IT	No to all types of risks and methods specified	Using COBIT 4.1	No not personally, so cannot answer this matrix accurately.	No.

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				uncertainty, technical risk, IT service delivery risk, project risk)	strategy risk, definitional uncertainty, technological risk, organisational risk, IT infrastructure risk (Parker, Benson & Trainor 1988)				
		A4. Communicate, increase and manage stakeholder perception	4. Management's perception of the BI department	4.1 Management survey	(a) In your opinion, what is your management's perception of the delivered BI products?	The intervention is normally initiated by management and is therefore directly involved in the development process. Management are sometimes unsure what the BI artefact should contain and what the look and feel should be like. However, the consultants will develop a sample BI artefact after a thorough analysis of the business where after an interactive approach will be followed to refine this according to the business requirement.	They only realize the value after delivery of accurate, up-to-date information. They understand the necessity but fail to grasp the effort in developing the back-end for supporting the visual representation.	It is a fundamental tool that is used by the business executives to make key decisions around sales and focus areas.	Highly positive but they label it as data analytics and not BI.
					(b) In your opinion, what is your management's perception of the BI department?	Positive	Positive perception but don't understand the investment required to have a proper system.	Invaluable.	No BI department but positive perception towards BI competency in terms of analytical capability within the various departments.

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
					(c) Do you scientifically establish the management perception towards BI in your organisation by means of surveys? If 'yes' what was the outcome?	No	No	No	No
B. User orientation	Meet internal and external user expectations by providing exceptional service through the fulfilment of information requirements.	B1. Provide users access to the right information when needed	1. Actual system utilisation	1.1 Number of times logged on to the BI system	(a) How many times (on average) do internal BI users log on to the BI system (per day)?	11 to 20. In some instances dashboard is available using mobile technology therefore not requiring a physical login	11 to 20	11 to 20.	>30
					(b) How many times (on average) do external BI users log on to the BI system (per day)?	Not sure. Not all customers allow external BI users to utilise their system although there is a tendency lately to start exposing their system externally. The majority of the time the BI system is restricted for in-house use only.	Unsure. The data from outsourced systems are re-used by external BI users. Data are shared in the form of files and reports. No physical BI system shared amongst internal and external users.	<10	>30. This is an estimation only. Although the trade statistics are published for external utilisation any member of the public can obtain this (transactional) data. They therefore define external BI users as anyone from the public.
			2. Usefulness of information	2.1 Perceived usefulness of information survey	In your opinion, is the information obtained from the BI system useful and trustworthy?	Yes. Used to make key decisions (strategic and operational).	Yes. No queries received pertaining to the data.	Yes. A lot of work has been put into making the data analysis more accurate, as there was a discrepancy between different systems. So the	Yes. All published data put through a rigorous testing process. Technical reports are attached to data during testing phase and presented to Stats SA and Treasury departments. The finance minister

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
								trustworthy part has been questioned in the past. This has mostly been addressed though.	signs off on the report and the results can be audited by the auditor general.
			3. Intention to use the system	3.1 Intention to use the system (survey)	Are there any other users (internal or external) who intend to use the system in the near future?	No	No. The Act on Sharing of information (and all related legislation) will have an impact on the sharing of BI data amongst users.	Yes	No. Except for some of the data that is publicly available, external users need to subscribe to other sets of data.
			4. Availability of information	4.1 Time measured in minutes to obtain information	How long does it take for internal and external BI users to obtain information from the BI system?	Instantaneous. Users expect instant response time due to standards set by Facebook and Google (for example).	Instantaneous.	The BI team generally uses refreshed dashboards, so it's instantly available (cached version).	Immediately. Additional data available per subscription (free of charge). In instances where customized reports are requested only one person deals with the requests - this can be a bottleneck.
					Is the length of time taken acceptable?	Yes	Yes	Yes	Yes
		B2. Provide exceptional customer service	5. Customer satisfaction rate (internal and external)	5.1 BI user satisfaction rate (internal and external)	(a) In general, are the BI internal users satisfied with the current BI system they interact with?	Yes	Yes	No	Yes
					(b) In general, are the BI external users satisfied with the current BI system they interact with?	N/A. In general, organisations do not expose their system to external customers (users).	Yes. They are happy with the deliverables from the DW. No BI system exists and therefore not shared amongst users. Also, external auditors use data from the DW (or reference data as they call it) for regulatory / compliance audit.	No. Adding new branches is problematic. Rectifying data and/or process issues are detrimental to accurate and timeous reporting	Yes in general. However, data consumers question the data all the time but this is normally due to a lack of understanding the context of the data presented.

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
		B3. Foster customer relationships with internal and external clients	6. Growth in internal and external client base	6.1 Number of clients compared to the previous selected period	Did you experience an increase in the number of clients since the implementation of a BI system?	Yes	Not sure	Yes	Not applicable to this environment.
					If 'yes', was the increase substantial?	Yes		Yes	Not applicable to this environment.
			7. User enthusiasm	7.1 Number of times logged on to the BI system	Same as point B1 (1.1) above				
				7.2 Number of active BI users	How many users (internal and external) actively utilise the current BI system?	Not sure. Various between customers	Internal: 25 and External: 4 entities	Internal: 5 and External 20	Internal: 120 (estimated) and External unknown (some data available to the public without requiring a subscription).
C. Operational excellence	Support the achievement of organisational goals through the provision of efficient and effective BI processes.	C1. Proper BI project planning and implementation	1. Successful and efficient BI tool implementation	1.1 Number of BI projects and / or tool implementations on time and within budget in relation to the total number of BI projects completed	How many BI projects and / or tools have been implemented in your organisation in the past five years?	> 3	1	>3	> 3
					How many BI projects and / or tools have been implemented on time and within budget in the past five years?	> 3. The interviewee was a service provider so they do a lot of BI projects. Also, the delivery of on time projects is according to their opinion and not the client.	1. This refers to the DW project not directly funded by the organisation (black-ops project).	Not sure	> 3. There are no strict project budget and project plan used to actively manage BI projects.
				1.2 Project Performance Indicators: Project Scheduled Performance Index and Project	Do you make use of one of the following calculations during BI projects? (a) Project Scheduled Performance Index	No	No	Not sure	No
					(b) Project Schedule Variance	No	No	Not sure	No

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				Schedule Variance	If' **yes**', is it within an acceptable standard? (a) Project Scheduled Performance Index	N/A	N/A	Not sure	N/A
					If' **yes**', is it within an acceptable standard? (b) Project Schedule Variance	N/A	N/A	Not sure	N/A
		C2. Develop BI artefacts in support of BI processes	2. Structured methodology followed	2.1 Adherence to methodological prescriptions	Do you follow a particular methodology when conducting BI projects?	Yes. Iterative approach based on SDLC. Quick turnover. Approx. 6 – 8 weeks to develop first artefact and 3 – 6 months to refine using the stakeholder's inputs. Key stakeholder involvement from the start – get inputs – design – develop – present visuals (show and tell)…. Back to design. Follow basic principles of Kimball's dimensional modelling approach. 'No time to follow Inmon approach'.	No. No formal BI project was conducted.	Not sure	No but sometimes elements of the Software Development Life Cycle (SDLC) methodology are followed.
			3. Coverage of business processes	3.1 Percentage coverage in BI of business processes and business performance measurements	What percentage of business processes and business performance measurements are covered by your BI system? (a)	Not sure	Not sure	100%	Not sure

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
					Business processes				
					(b) Business performance measurements	Not sure	Not sure	100%	Not sure
			4. Business involvement	4.1 Number of users involved in the development process (requirements gathering, testing)	Were any users involved in the development of the BI products or during implementation of any aspects of the BI system?	Yes	Yes	Yes	No
					If 'yes', during which stage of development? (requirements gathering, development, testing, maintenance)	Requirements gathering, development, testing (all stages except maintenance)	Requirements gathering. Users are involved in tool selection. A number of BI tools are shortlisted and then prototyped. The decision makers then 'play' with this prototype and recommend a toolset.	Requirements gathering, development, testing and maintenance	N/A
		C3. Ensure operational success of the system	5. System performance and quality	5.1 Time in minutes to obtain an existing report	How long does it take to obtain an existing report from the BI solution?	Instantaneous.	1-4 minutes	1-4 minutes	1-4 minutes. Based on pre-processed (batch) data.
					Is this acceptable?	Yes. Standard has been set by response times from Facebook and Google.	Yes	Yes	Yes
				5.2 Time in minutes to obtain a new report	How long does it take to obtain a new report from the BI solution?	Not sure	1 week to develop a new report. Proper version control in place.	>10 minutes	>10 minutes
					Is this acceptable?	This depends on report complexity. Super user can create new report after 2 hours of training.		No	Yes

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				5.3 System quality rate	Is the data contained in the outputs of the BI system (such as reports, dashboards or analytical calculations) trustworthy and of high quality?	Yes	Yes	Yes	Yes. Rigorous testing process.
					If 'no', why?				
				5.4 User friendliness rating	Would you describe the current BI system as user friendly?	Yes	Yes.	Yes.	Yes
					Why or why not?	"Clean", uncluttered design of dashboards that is visually appealing.	Complexity of data warehouse hidden from end-user using views.	Mostly Excel based dashboards are used, and sent out by the BI team to executives and business users.	Not entirely end-user self service oriented.
				5.5 Number of times when information is not available when needed	How many times in a business week is the information <u>not</u> available from the BI system when requested by the business?	Always available	Always available.	Once or twice.	Always available. All results based on batch process (pre-processed data) so data is always available even if it is the previous days data.
			6. Data reliability, consistency and high quality	6.1 Data accuracy rate	'Rate' your current BI system by using the following scale: 1-Extremely satisfied; 2-Satisfied but scope for improvement; 3-Not satisfied at all	1	1	2	1
				6.2 Data availability rate		1	1	2	2 (data availability here refers to accessibility of real time data).
				6.3 Data consistency rate		1	1	2	1
				6.4 Data quality rate		1. Data accuracy and consistency is more important for financial resources; data	1	2	1

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
						availability for marketing; data quality rest of the audience.			
				6.5 Number of queries related to data quality	Do you often get enquiries from end-users questioning the data quality contained in reports or any other BI related output?	No	No	Yes	Yes
					If 'yes' how many per month?			>10	>10
				6.6 Number of up-sell and cross- sell opportunities using data obtained from BI systems	Does your organisation use the data obtained from the BI system or BI toolset to up-sell and cross-sell products to customers?	Yes	No. But external users might.	Not sure	Not applicable in this environment.
					If 'yes', how many additional product(s) or services were sold per month as a result of this effort?				Not applicable in this environment.
			7. System support provided within an acceptable standard	7.1 Response time in minutes after a call was logged	Is there adequate support for the end-users utilising the current BI system or toolset?	Yes	Yes	Yes	Yes
					If **'yes'**, what is the response time?	Satisfactory	Satisfactory	Satisfactory	Satisfactory
			8. Customer / user experience	8.1 Customer / user satisfaction survey	In general, are the following users satisfied with the BI system?				
					(a) BI end users; and	Yes	Yes	Yes	Yes
					(b) external customers.	Yes	Yes	Not sure	Yes
		C4. Perform maintenance to ensure uninterrupted	9. System availability and reliability	9.1 Time in minutes for unplanned	How many <u>unplanned</u> system downtime events	< 5. Within acceptable standard.	< 5. Within acceptable standard.	6-10. Acceptable standard is less	<5. Not sure.

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
		BI service		system downtime	occur during a month?			than 5.	
				9.2 Number of unplanned BI system interruptions	How many unplanned BI system interruptions occur during a month?	< 5. Within acceptable standard.	< 5. Within acceptable standard.	>10. Acceptable standard is less than 5.	<5. Not sure
				9.3 Number of planned BI system interruptions	How many planned BI system interruptions occur during a month?	< 5. Within acceptable standard. Hardly ever planned or unplanned downtime.	< 5. Within acceptable standard.	<5. Acceptable standard is 2.	<5. Not sure but not receive any complaints.
				9.4 Number of operational failures	How many operational failures of the BI system or toolset do you experience during a month?	< 5	Not applicable. Using Excel.	>10	<5
					What is the acceptable standard?	Within acceptable standard. Hardly ever planned or unplanned downtime.		Acceptable standard is 1.	This is acceptable.
D. Future orientation	Retain current employees and ensure that current employees are equipped with the right mix of capabilities and skills to meet the current and future organisational needs.	D1. Develop BI capability for future needs	1. BI specialist capabilities	1.1 Number of employees with BI technology skills	How many employees in your organisation are competent in using the current BI system?	>10	>10. Using Excel. Back-end: 8 developers [6 contractors]. BI Users: 25 internal and 4 entities (not sure how many users in entities).	6-10.	>10
				1.2 Number of employees with BI technology skills for emerging technologies	How many employees in your organisation are competent in using emerging and / or the latest BI products and BI technologies such as mobile technologies for BI, BI self-service or big data analytics?	>10. On average a total of 150 executive users and 500 internal operational users. Approx. 5 – 10 super users	<5. Not a requirement at the moment.	<5	<5

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				1.3 Age distribution of BI staff	What is the average age of the staff members responsible for the BI capability within the organisation?	Not sure.	30-39	30-39	30-39
				1.4 Number of years of BI experience per staff member	What is the average number of years of BI experience per staff member?	Not sure.	6-10 years	<5 years	6-10 years
				1.5 Perceived satisfaction of BI employees (employee satisfaction rate)	Do you measure the BI staff satisfaction rate within your organisation?	No	Yes. Indirect method monitoring issue tracking system.	No	No. But this is indirectly measured through personal performance management system.
				1.6 Turnover rate of BI employees	On average, how long do BI staff members work for your organisation?	2-5 years	2-5 years	6-10 years	2-5 years
					What is the turnover rate for BI staff per year (%)?	<5 %	<5 %	<5%	<5%
				1.7 Retention rate of BI employees	What is the retention rate for BI staff per year (%)?	100%	100%	100%	100%
				1.8 Productivity of BI employees (number of queries per employee per day)	How many enquiries does an employee handle per month? (per BI support staff and BI development staff): (a) BI support staff	N/A	N/A	>10	Not sure
					(b) BI development staff			>10	±15. Although a lot of queries are handled per month it does not necessarily indicate errors in the data. The majority of the time the users does not understand the context of the data and therefore having difficulties interpreting

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
									the data.
					Is this acceptable? (a) BI support staff		N/A	No	Not sure
					(b) BI development staff			No	Yes
			2. Level of training and education of BI personnel	2.1 Number of educational days per person	How much training (in days) have BI personnel spent on formal BI related education and training programmes during the past year?	Super user training: 2 days. Product training varies (MicroStrategy)	No training. Using Excel as front end tool and open source for back-end development. 1 resource on learner ship (ongoing).	Unsure. I would say less than 10 days per person.	+10 days in total
				2.2 BI training and resource development budget as a percentage of the overall IT budget	What is the BI training and resource development budget as a percentage of the <u>overall IT budget</u> (per year)?	Not sure depending on client.	Not sure	<5% of IT budget.	Not sure
				2.3 BI training and development budget as a percentage of the overall BI budget	What is the BI training and resource development budget as a percentage of the <u>overall BI budget</u> (per year)?	Not sure depending on client.	<5% of BI budget	Not sure	Not sure
				2.4 Number of times an external consultant is contracted to perform internal BI tasks	Do you make use of external BI consultants to assist in any BI related activities?	Yes.	Yes	Yes	Yes
					If 'yes' how many per year?	6-10 times. Client dependent and dependent on new developments.	>11 times. External BI consultants in this instance refers to 'permanent' contractors.	6-10 times	6-10 times

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
		D2. Research emerging BI technologies and trends to cater for future BI needs	3. Research effort	3.1 BI research budget as a percentage of the overall IT budget	What is the budget for BI research as a percentage of the overall IT budget (per year)?	Not sure. Client dependent and dependent on new developments.	Not sure. Research is conducted in-house. The CTO will research particular concepts, present a short list of concepts / tools and then delegate to the appropriate resources to explore.	Not sure	Not sure
				3.2 BI research budget as a percentage of the overall BI budget	What is the budget for BI research as a percentage of the overall BI budget (per year)?	Not sure. Client dependent and dependent on new developments.	Not sure	Not sure	Not sure
				3.3 Managemen t perceived satisfaction rate on how specific emerging technologies may or may not be applicable to the organisation	In your opinion, will emerging BI technologies be applicable to the future ventures of the organisation?	Yes. Emerging BI technologies in this instance refers to the utilisation of social media analysis using tools such as whisperer.mobi (to analyse feeds from Facebook and Twitter).	Not sure	Yes	Yes but it is not considered at this stage.
				3.4 Number of new business ventures introduced as a result of new BI technological trends	How many new business ventures have been introduced as a result of new BI technological trends?	Not sure. Client dependent.	Not sure	Not sure	No business ventures introduced as a result of new BI technological trends.
		D3. Current status and future requirements of the BI applications portfolio	4. Age of current applications and number of BI technologies utilised	4.1 Age distribution of applications	On average, what is the age of your current BI system (such as the data warehouse) and software technologies used? (a) BI system	Not sure. Client dependent.	Not sure	60	12
					(b) BI technologies	Not sure. Client dependent.	Using Excel	24-60	12

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
				4.2 Number of BI technologies utilised	How many different **(a) BI technologies** (software vendors and software platforms such as Microsoft and Oracle) do you utilise in your organisation?				
					Data warehouse	MicroStrategy	PostgreSQL (open source)	MS SQL	Microsoft SQL Server 2012
					Operational data store (ODS)	MicroStrategy	Data mart: PostgreSQL (open source)	MS SQL	N/A
					OLAP	MicroStrategy		MS AS	Microsoft SQL Server 2012
					Reports (self service)	MicroStrategy	Excel		Excel
					Reports (pre-developed)	MicroStrategy	Excel / HTML	Excel	Microsoft SQL Server 2012 Reporting services
					Dashboard(s)	MicroStrategy	Excel / HTML	Excel	Microsoft SQL Server 2012 Reporting services
					Analytical tools	None	None	ProClarity	ProClarity
					How many different **(b) BI tools** (cubes, dashboards, reports) do you utilise in your organisation?				
					Data warehouse	Depending on customer.	1	1	5
					Operational data store (ODS)	Depending on customer.	1	5	N/A
					OLAP	Depending on customer.	0	2	5
					Reports (self service)	Depending on customer.	20	0	Unknown
					Reports (pre-developed)	Depending on customer.	20	50	10
					Dashboard(s)	Depending on customer.	0	3	1

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
					Analytical tools	Depending on customer.	0	1	1
			5. Perfor-mance of BI systems	5.1 Downtime of BI systems	How many unplanned system downtime events occur during a month? (refer to C4. Maintenance, 9.1 and 9.2)				
					How many planned system downtime events occur during a month? (refer to C4. Maintenance, 9.1 and 9.2)				
				5.2 Availability of systems	*BI system availability can be calculated using information obtained from questions in Section C, 9.1 to 9.4.*				
				5.3 Database query response time	How long does it take for a database query to produce a result?	<1 minute	<1minutes	<1 minute	<1 minute
					Is this an acceptable response time?	Yes	Yes	Yes	Yes
				5.4 User satisfaction rate	(a) In general, are the BI internal users satisfied with the current BI system they interact with?				
					(b) In general, are the BI external users satisfied with the current BI system they interact with?				
					(The same as section B, question 5.1)				

						Participant response			
Perspective	**Mission**	**Objective**	**Measurement/s**	**Metric / Demographic characteristic**	**Interview question**	**Interview 1**	**Interview 2**	**Interview 3**	**Interview 4**
General interview notes						There has been a strong tendency to move towards Social Intelligence. Although in its infancy, tools such as whisperer.mobi are explored. Social Intelligence proved to be a valuable method for real time analysis during real life scenarios for example the Obama election.	Although there is no 'formal' BI implementation in this organisation the key shareholders realize that the value of such implementation is not in contributing to profit generation but in managing the risk of non-compliance to regulatory prescriptions and subsequent fines imposed. Unfortunately some shareholders do not see the value of such implementation before the implementation but only after when the benefits are reaped.	This customer is facing huge challenge with the roll-out of their BI implementation at remote branches of their business. This can be due to connectivity issues, lack of resource knowledge and skills as well as lack of proper equipment.	

Annexure G: Institutional ethical clearance confirmation

UNISA college of science, engineering and technology

Sunet Eybers (31409199)
School of Computing
UNISA
Pretoria

2013-09-18

Permission to conduct research project

Ref: 088/SE/2013

The request for ethical approval for your PhD in Information Systems research project entitled "Exploring the value of business intelligence using a second generation balanced scorecard approach" refers.

The College of Science, Engineering and Technology's (CSET) Research and Ethics Committee (CREC) has considered the relevant parts of the studies relating to the abovementioned research project and research methodology and is pleased to inform you that ethical clearance is granted for your study as set out in your proposal and application for ethical clearance.

Therefore, involved parties may also consider ethics approval as granted. However, the permission granted must not be misconstrued as constituting an instruction from the CSET Executive or the CSET CREC that sampled interviewees (if applicable) are compelled to take part in the research project. All interviewees retain their individual right to decide whether to participate or not.

We trust that the research will be undertaken in a manner that is respectful of the rights and integrity of those who volunteer to participate, as stipulated in the UNISA Research Ethics policy. The policy can be found at the following URL:
http://cm.unisa.ac.za/contents/departments/res_policies/docs/ResearchEthicsPolicy_apprvCounc_21Sept07.pdf

Please note that if you subsequently do a follow-up study that requires the use of a different research instrument, you will have to submit an addendum to this application, explaining the purpose of the follow-up study and attach the new instrument along with a comprehensive information document and consent form.

Yours sincerely

Chair: School of Computing Ethics Sub-Committee

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Open Rubric

Annexure H: Certificate of language editing

Certification of Editing

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23 October 2014

I, Mariette Postma (5804180059081),

hereby certify that I have edited the thesis of

SSA Eybers

for the degree

Philosophiae Doctor (Information Systems):

Exploring the value of Business Intelligence using a second generation balanced scorecard approach

Dr Mariette Postma

PhD Educational Linguistics

Mariëtte Postma is an accredited member (Afrikaans/English)

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