Masters in Information Management

Information Technology Architecture and Related Strategic Factors Supporting Business Advantage

by

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A thesis submitted in fulfilment of the requirements for the Degree of Magister Commercii (Information Management)
in the Department of Information Systems
at the
University of the Western Cape

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August 2007

Declaration

I declare that ***Information Technology Architecture and Related Strategic Factors Supporting Business Advantage*** is my own work, that it has not been submitted for any degree or examination at any other university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

The fieldwork of this study followed the University of the Western Cape guidelines in regards to research ethics. Especially in light of the view that the project involved people as its research subjects, the researcher was fully aware of the necessary ethical considerations attached to such a study. All fieldwork was conducted in accordance with such guidelines. Specifically for this research, the ethical considerations included ensuring that the researcher had the appropriate training and preparation for the work; that the rights and welfare of the human subjects were protected; that the identities and interests of those involved have not been, and will not be, disclosed; that the information imparted has been obtained anonymously and treated confidentially; and that the research was conducted in accordance with the ethical and professional practices of the IT industry as a whole.

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Key words

Architecture

Infrastructure

Alignment

Information technology

Reliability

Agility

Flexibility

Enablers

Inhibitors

Business advantage

Abstract

Information Technology (IT) architecture is not restricted to technology, but may also address the views of business activities; their processes, data sets and information flows; applications and software; and technology. Business is driven by the quest for sustainable competitive advantage and one strategic factor such as the alignment between IT and business strategy may support organizational success. The objective of this study is to understand the role of IT architecture and related factors that support competitive business advantage. This study investigates the null hypothesis: ***IT architecture enhances the competitive advantage of business****.*

The literature study provided a grounded knowledge of the topic. Three dimensions were identified namely, IT Architecture, Strategic Factors and Business Advantage. A research instrument based on the literature was developed to gather quantitative data. Following a piloted study, the instrument was administered. A qualitative survey gathered more in-depth information from interviewees relevant to the study. The target population were corporations and institutions based in Cape Town, South Africa. 160 invitations were sent out, to which 55 responses were received.

Dimension one identified that 90% of respondents agreed or strongly agreed that business advantage is supported by a sound IT architecture. Dimension two, 85.4% of the respondents reflected a positive attitude that alignment, minimising inhibitors and maximizing enablers are factors supporting business advantage. Dimension three, 81% of respondents agreed or strongly agreed that business advantage is supported through proactive decision-making and the availability information of value. The qualitative data identified that staff should be regarded as assets, with ongoing

training to improve the skill level. The advancement of technology happens fast and IT strategies should be carefully planned.

In conclusion, this study set out to explore IT architecture and strategic factors that support business advantage. The findings indicated that business advantage is supported by a sound architecture, by IT and business alignment and by the enablers of organisations. IT and business should, therefore, complement each other and function as one cohesive unit in order to achieve such objectives. This study also showed that effective architecture provided customers with improved service delivery.

The study findings recommend that further research in this field could broaden the geographical area. Further research could investigate collaboration between organisations.

Acknowledgements

My sincere appreciation and thanks to those who helped and supported me, including:

- Dr Glen Martin Mansfield, for his supervision, guidance and encouragement;
- Mr Mohammed Elmalik, for his assistance, patience, and guidance in converting numerical data into verbal descriptions;
- Jacqueline Adriaans, for her generous time and assistance;
- Ms Ayesha Ismail and Ms Chantell Lyner, for their kind and generous assistance when I was most in need of software support;
- Daneen Sissing, for her undying faith, support and patience; and
- the many anonymous respondents who gave of their time to complete the survey.

My special thanks must be given to God, in whom I trust, for providing me with the strength and guidance to follow the correct path in completing this study.

Explanation of abbreviations and acronyms

ADL	architectural description language
BP	business plan
BSR	Bureau for Social Research
B2B	business–to–business
DW	data warehouse
EA	enterprise architecture
EAF	enterprise architecture framework
ECA	event–condition–action
EDI	electronic data interchange
EIT	emerging information technology
IA	information architecture
IEEE	Institute of Electrical and Electronics Engineers
IOS	inter-organisational system
ISO	International Standards Organisation
ISP	IS plan
IT	information technology
LAN	local area network
OASIS	Organisation for the Advancement of Structured Information Standards
OED	Oxford English Dictionary
PC	personal computer
PI	process improvement
QA	quality assurance
R&D	research and development
RAS	reliability, availability and serviceability
RE	requirement engineering
ROI	return on investment
ROV	return on value
RTDW	real-time data warehousing
SOA	service-oriented architecture
SPSS	Statistical Package for Social Sciences
TCO	total cost of ownership
TQM	total quality management
UML	unified modeling language
WAN	wide area network
WFMS	work flow management system

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CHAPTER ONE

1.1 Introduction

IT architecture is not restricted to technology, but may also address the views of business activities; their processes, data sets and information flows; applications and software; and technology. A possible component of information technology (IT) architecture is a plan for an organisation to progress from its inherited processes to meeting current and immediate business requirements. Such an architecture has to be agile and flexible enough to sustain the organisation and to lead it towards the future. In practice, IT architecture is a blueprint not necessarily limited to hardware or software issues.

Before 1980, IT was in a very manageable position (Melling, 1994:493). However, after 1990 the quality of IT architectural practices deteriorated significantly. Local area networks (LANs) experienced a major growth as servers and desktops of all sizes, such as clones and unspecified operating system versions, appeared overnight. Melling (1994:493) found that multiple vendors, hardware architectures, operating systems and “islands of automation”, which had once been the exception, now became the “rule” in almost all organisations. Without a sound architectural plan to guide them, IT standards at such organisations eroded, while pressure to reduce spending in IT departments became widespread.

IT appeared to become a continual drain on financial resources with little readily measurable return on investment (ROI) and a high total cost of ownership (TCO). There was a general feeling that resources could have been better spent on designing and building a better infrastructure aimed at obtaining reliability, availability and serviceability (RAS) to ensure efficient IT service delivery. IT and business departments became increasingly unable to communicate effectively and efficiently and to understand each other as the complexity of demand increased.

This misalignment of IT and business strategy generally resulted from specific factors, as identified by Luftman, Papp and Brier (1999). Lindahl and Beyers (1999) identified the following factors as inhibitors and enablers: quality; price; creativity and innovation; timely delivery; and scope of service offered.

1.2 Rationale for study

The key focus of the current research is to identify architectural factors that support business competitive advantage. Melling (1994:493) states that “Information Technology (IT) is changing eras…” As such, IT has been identified as the leader of business into the future. However, management did not realise the seriousness of the impact that it could ultimately have on business, should it lose sight of the vision and goals of the organisation. Rather than remaining a passive facility, IT became a key strategic competitive tool. Business and IT, when aligned, can work towards achieving an organisation’s vision and goals. The survey conducted by Brancheau, Janz and Wetherbe (1995) ranks the need for an architectural infrastructure at the top of a list of key issues for determining the most critical issues in an information systems management survey, and more recently, The Commerce Department's Office

of the Chief Information Officer of the USA (2004), states that “The best reasons for having an IT Architecture are the benefits it brings to your organization”.

The Institute of Electrical and Electronics Engineers (IEEE, 2005) authoritatively defines architecture: “The structure of the components of a program/system, their interrelationships, and principles and guidelines governing their design and evolution over time.” Allen and Garlan (1996:6) maintain that “a critical aspect of any complex software system is its architecture. At an architectural level of design, a system is typically described as a composition of high-level, interacting components.” An architectural construct must survive both the current and future advances of IT and business. According to Umar and Francesco (2004:10), “Sound architectures are needed so that the applications can survive rapid business as well as technical changes.” Failure to manage such change most probably will result in the low ROI of IT resources and a high TCO.

Competitive advantage strengthens as the relationship of trust between business and its IT resources grows. As IT is not immune to change, similar change will also be required in its infrastructure. Maintenance of RAS demands reworking by the infrastructure to keep continually abreast of change. A good architect will enable both a business and its IT component to build up and maintain a reliable and agile competitive advantage that is able to respond to service delivery expectations. Such advantage is only possible in an organisation that is alert to the need for IT to remain in a constantly proactive state, allowing it to respond swiftly and positively to business requirements in order to secure a competitive advantage. Bhatt (2000:141) states: “The main purpose of IT infrastructure is to provide consistent and quick

information support throughout the organization to respond to dynamic challenges in the markets.".

1.3 Research title

The title of the current research study is: "*Information Technology Architecture and Related Strategic Factors Supporting Business Advantage*".

Business in the 21st century encompasses the presence of IT, with most businesses largely depending on IT (dimension 1) to automate their processes in an ongoing effort to improve and function more effectively and efficiently. The employment of human resources inevitably means the presence of factors that will either inhibit or enable progress towards the strategic achievement of organisational visions and goals (dimension 2). Organisational business advantages (dimension 3) consist of a number of factors that organisations can employ to facilitate their competitive drive. The three dimensions identified so far are of key interest, as they, in essence, sum up the research topic. A core problem for commercial enterprises is to retain their business advantage, supported by their IT and these strategic factors. The title of this thesis therefore reflects these primary three dimensions, which are all aimed at supporting business advantage.

1.4 Research problem

A key challenge for commercial enterprises is their own survival. The architectural factors that support entrepreneurial survival are identified by Varghese and Kurien (2004) as:

- enterprise architectural flexibility; and
- IT delivery efficiency.

The study will, therefore, focus on the relationship between business and its IT architecture in light of the components of its enterprise architecture (EA). Kim and Lee (1996:19) stress the importance of regarding IT as a strategic tool. In terms of such a perspective, this study will also identify factors that either enable or inhibit business and IT alignment, as suggested by Luftman *et al.* (1999).

Consideration of the architectural components that support business advantage leads to the raising of questions such as: Has management learnt how to balance the use of technology with business advantage, or does it regard IT as only being concerned with its own progress? How can business and IT motives best be aligned to benefit an organisation? In this regard, the research of Varghese and Kurien (2004) into the necessity for a sound flexible architecture is of particular note. A further question to which attention must be given is: As business processes and requirements change, what impact may such change have on the IT architecture involved? These same researchers suggest that IT can proactively prepare itself to meet new business requirements by making use of the latest technologies available in terms of what the business requires, and not by making use of what IT feels needed to be implemented because it is the latest technology available.

The Oxford English Dictionary (OED) defines the concept of 'business' as "a matter that concerns or relates to a particular person or thing; constituent of". Princeton University online dictionary defines 'business' as "a commercial or industrial enterprise and the people who constitute it and the activity of providing goods and services involving financial and commercial and industrial aspects".

The OED defines the concept of 'advantage' as "To further, promote, advance, contribute to the progress of (anything). To put in a better position, prove beneficial to, benefit, profit." Princeton University online dictionary defines 'advantage' as "the quality of having a superior or more favorable position".

The meaning of 'business advantage' therefore combines the meaning of the above two concepts and, within the context of the current study, means a form of progress that accelerates business processes and solutions, enabling knowledge to be acquired sooner and decisions to be made more soundly, in such a way that proactive insights into existing threats and opportunities can be gained more rapidly. In fast-paced environments, the heightened utilisation of assets, such as people, finance, information and other fixed assets, by management requires the raising of customer, profit and market share volumes.

The identification of current limitations and the creation of forthcoming opportunities demands ongoing research. Many authors, such as Reich and Benbasat (1996) and Ferratt *et al.* (1995), suggest further research into the topic.

In summary, sustainable competitive advantage relies on an effective IT infrastructure, based on its architecture and the components of an EA. The associated strategic factors enable and inhibit business and IT alignment that supports business advantage.

1.5 Research question

The current study endeavours to identify the IT architectural factors that enhance business advantage. An EA not only has to be adopted, but also has to be practised in order to maintain the competitive business advantage capable of improving the ROI of IT.

The study will address three related questions:

1. What roles does IT Architecture play in achieving business objectives?
2. What are the strategic factors that contribute to the alignment between a business and its IT?
3. What are the business advantages achieved by such alignment?

1.6 Hypothesis

A hypothesis is formulated without knowing whether there is any empirical warrant to accept it as reasonably valid or even true (Mouton, 1996). By means of data collection, the hypothesis is tested to establish whether there is a plausible explanation, on which a conclusion can be drawn as to whether sufficient evidence exists either to support or reject the aforesaid hypothesis. This study makes the following hypothesis:

H1: IT architecture enhances the competitive advantage of business.

H0: IT architecture has no effect on the competitive advantage of business.

1.7 Assumptions

The current study is based on the premise that architecture has an effect on how IT can support business. Technology is in place to support organisations in obtaining their goals and objectives. The assumption is made that the respondents, who all have both computer and internet access, should be sufficiently computer literate to be able to complete an online survey.

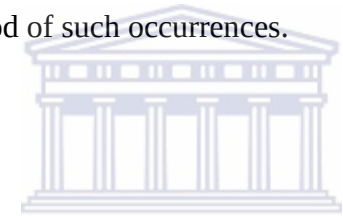
1.8 Limitations

The data gathered from the survey used in this study will be obtained anonymously, since some participating organisations may be reluctant to allow their results to be published. The sample population will have IT and/or business-related experience. The data gathered and the findings that are made will be based upon a limited sample of organisations, studied over a limited period of time. As the web-based survey questionnaire is not limited to any specific corporate or organisational type, some of the data gathered may be generic in nature. Due to the high cost of travel, the interviews will be limited to corporations and institutions based in Cape Town, South Africa, so that the study will largely present the views of respondents working within this specific geographical business area.

Although web surveys are becoming increasingly popular, the Bureau for Social Research (BSR) indicates that an average response rate of only between 20 and 30 percent can be expected. The current study has not attempted to investigate whether there were other competing processes or control variables that could have contributed to, or limited, the impact of the processes examined. Powell and Dent-Micallef (1997)

reported a response rate of 26 percent as being acceptable. A user name and password will be provided to access the survey in order to reduce uninvited responses. Despite the taking of such precautions, a respondent could potentially complete the survey a second time.

The demographic details in the questionnaire were not mandatory. Certain individuals might have chosen not to complete the survey. Though telephonic contact was made with all participants, not all potential respondents were contactable. Some e-mail invitations might not have reached the invitees if their mail servers were not functional or might have been blocked by a spam filter. However, every effort was made to prevent the likelihood of such occurrences.



1.9 Research methodology

1.9.1 Introduction

This study will examine the role of architecture in an effort to identify the key architectural factors that drive business performance. The literature review and survey will be based on peer-reviewed academic literature and interviews with key people. The following research methodology (see Diagram 1) will be followed.

Diagram 1: Methodology of the study

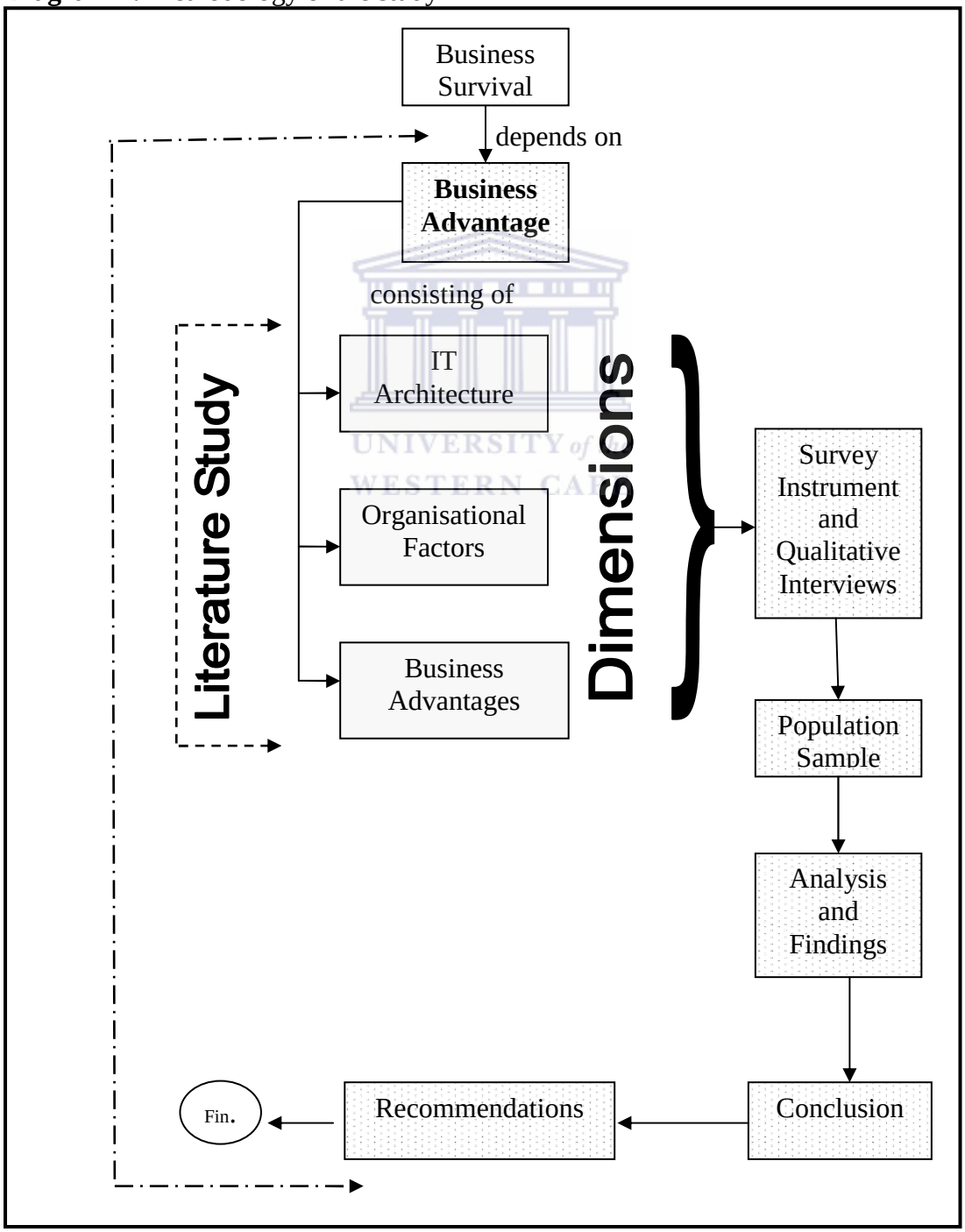


Diagram 1, which presents the logical thread of this research, focuses on the phenomenon of business advantage. A literature study will then be conducted that identifies the three dimensions that will be discussed. The understanding of these dimensions and of their innate components, as informed by the literature, will enable the current researcher to compile an appropriate instrument of measurement. Qualitative interviews will complement the instrument to enable an in-depth understanding of the topic to be obtained. A sample population will be selected for both the quantitative and qualitative surveys. An analysis will be performed on the data gathered, after which the findings will be presented and discussed. Conclusions will be drawn from the literature reviewed and the empirical research conducted. Finally, possible recommendations will be made to conclude this study.

1.9.2 Literature study

The literature study will use a variety of secondary resources, ranging from electronic databases of peer-reviewed academic journals, articles, and books, as well as other relevant sources, such as newspapers, trade periodicals and selected electronic sources. The literature study will form the basis for the survey, providing an overview of both past and current research and a survey of grounded knowledge of the topic.

1.9.3 Survey questionnaire

In order to obtain the necessary quantitative data, a web-based instrument will be compiled. Use of such an instrument is a relatively cost-effective way of gathering data from a sample population of respondents, enabling the selected sample population, who are all contactable online, to be reached. The selected sample population will range from junior to executive management.

1.9.4 Interviews

The interview process will gather qualitative data and more in-depth information concerning the topic of the study. Open-ended questions will allow the interviewees to express their attitudes and beliefs relevant to the study. Specific questions relating to architecture, strategic factors, and business advantage will also be asked.

1.10 Research outline

This document is categorised into five chapters. The chapter outline for the study is as follows:

CHAPTER ONE: This chapter introduces the nature of the research. The research concept provides the framework of the research design, as well as the research aims, methodology and outline.

CHAPTER TWO: The literature review described in this chapter provides critical insights into the published work that is relevant to the study. A theoretical background is provided in order to build a conceptual foundation for the questionnaire.

CHAPTER THREE: The statistical research methodology is presented and the research techniques employed, consisting of both quantitative and qualitative methods, are discussed. This chapter gives a detailed explanation of the steps followed in data collection.

CHAPTER FOUR: The results and an interpretation of the results are discussed in this chapter. The results are then related to the architectural factors, such as enablers and inhibitors, that support business advantage, and the effects of the methods used on the data obtained are assessed.

CHAPTER FIVE: Conclusions and recommendations are drawn from the research. Possible measures that could be used by different stakeholders are suggested, which may promote the effective alignment of IT with business in order to take advantage of opportunities that provide organisations with a competitive edge.

CHAPTER TWO

2. Literature review

The literature review is based on secondary resources and provides the framework for this study.

2.1 Architecture

2.1.1 Introduction

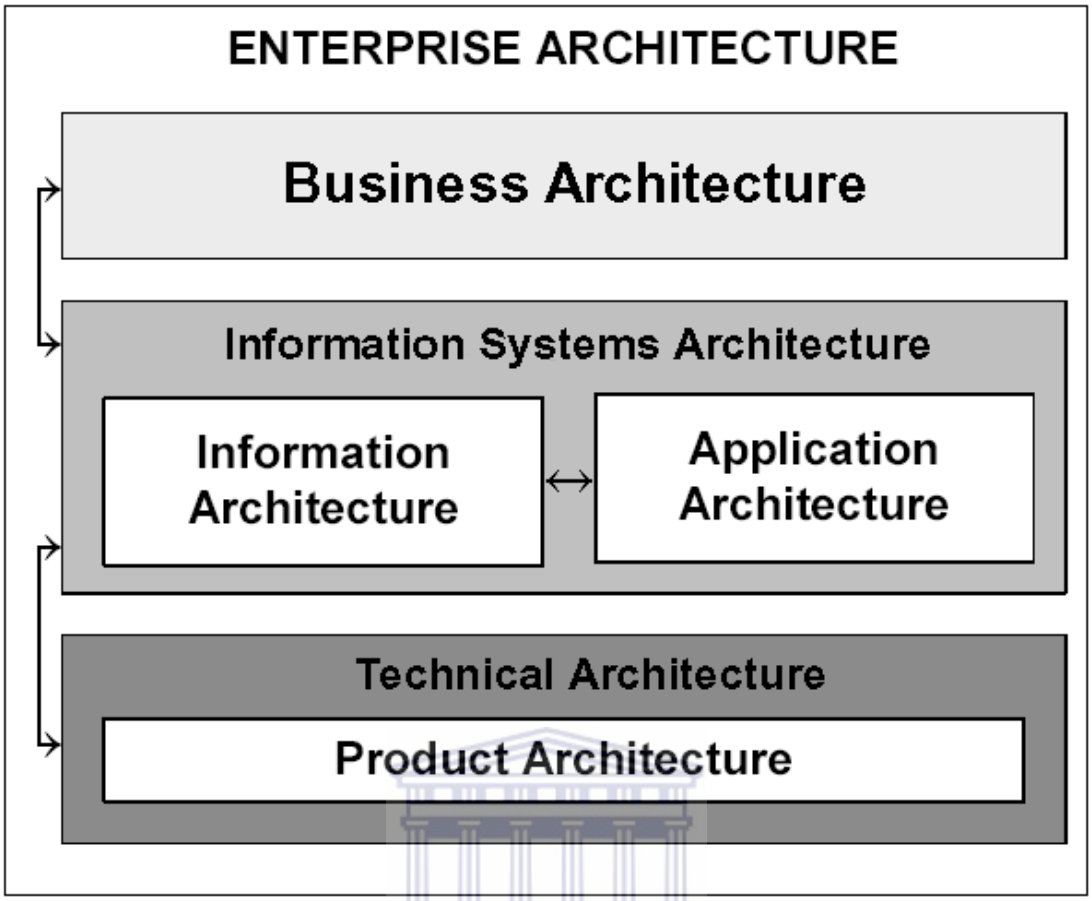
The first section of this chapter discusses the concept of architecture and reviews architectures within organisations. It defines the components and the processes of architectures, as well as how they impact upon the development and delivery of solutions. It also discusses how IT supports business in achieving its organisational objective and goals.

2.1.2 Discussion

IT architecture is designed to develop, implement and maintain an organisation's technology, information and business management components, which must work together efficiently in order to accomplish the mission of the organisation effectively. Carter (1999) discusses how architecture can be used to design and build an information system supportive of business strategy. Such an approach to architecture provides an opportunity to harness business creativity and IT innovation in order to produce and maintain the competitive advantage of the business. Any solution achieved should add value to the profitability of the business by lowering the cost of ownership and improving efficiencies (Koushik & Joodi, 2000; Porter, 1998). Well-engineered architecture is grounded in a clear understanding of the current environment and a clear vision of the intended future of an organisation. Open

standards development focuses on encouraging the use of standards-based technology to improve efficiency and interoperability between users. Such standards may support common agreements that open up communication to all. Open standards may, therefore, enable more flexible development, with businesses being able to adapt more easily to changing technologies that support business needs and requirements. Such open standards are also more reliable and stable in the release versions, with their stability being maintained in the release versions by way of corrective quality assurance (QA) processes.

The integration of existing systems and databases is enhanced in such a way as to provide the basic architectural components with the ability to deliver the services needed to support set business requirements. Pereira and Sousa (2004) suggest that various architectures form an EA. The various components or models that constitute an EA consist of a business, technical, and information system architecture, with the latter consisting of an information and applications architecture (see Figure 1).



Architecture Relationships

Figure 1: Architecture relationships (adapted from Pereira & Sousa, 2004:1367)

Figure 1 shows that an EA consists of inter-related architectures that are not necessarily directly related with all of each other's components. However, information system architecture supports the business architecture, with which it, therefore, has a direct relationship. The information system architecture consists of an information and application architecture which, although consisting of two separate architectures, yet functions as one. No direct relation exists between the business architecture and the technical architecture, as business is not concerned with what technology is used, apart from its supportive processes and functional requirements. The relationship between the information system architecture and the technical

architecture reflects the services required to support the information systems architecture. In summary, the technical architecture supports the information systems that, in turn, support the business architecture in line with the EA.

Business architecture embraces business strategies, processes and functional requirements, providing the basis for requirements for the information system architecture that, in turn, support the business processes.

Application architecture is focused on the software that is developed and implemented. Applications support the business requirements aimed at achieving the operational goals and objectives of the business.

Information architecture (IA) represents the logical and physical data view, as well as the management of such data resources. Such architecture also embraces the modeling of the information that is needed to support the business processes and functional requirements of the organisation.

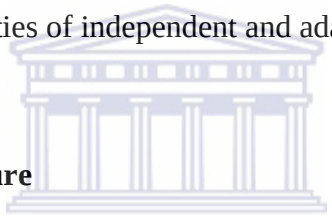
Technical architecture has a direct relation to the applications and data architectures, supporting such architectures. By forming the infrastructure or foundation, it enables the identifying and planning of the computing services, which, in turn, support the organisational processes.

Product architecture relates to the technical architecture, serving to identify the configuration and standards that enable the other technologies, such as software products and services.

2.1.2.1.1 Enterprise Architecture

This EA is the basis for architectures which, together, should integrate as one cohesive unit and provide a common view of the resources of the enterprise (its people, processes and technology).

The enablers that have been identified as assisting with the successful implementation of an EA, as well as the existing inhibitors, such as miscommunication, lack of planning and unsuccessful leadership, will be discussed later. Hasselbring, Reussner, Jaekel, Schlegelmilch, Teschke and Krieghoff (2004) suggest that an EA approach can produce beneficial properties of independent and adaptable components.



2.1.2.1.2 Business Architecture

In the above figure, the business architecture, as defined by Levi and Arsanjani (2002:45), is regarded as "using a business-driven approach for component identification and specification within a highly reconfigurable component-based architecture. This approach centers on the initial stages of the analysis of a software system within which a goal-oriented model of a business is created and developed into the business architecture." The performance of such processes is critical to the delivery of managerial decision-making activities, such as work scheduling and capacity planning, which result in the improvement of the overall performance of business processes.

The aforementioned researchers suggest that performance can be evaluated in terms of timelines, stability, cost effectiveness and resource utilisation. Business activities

can be measured in terms of cycle and delay time that affect the overall output of activities. Business rules must be supported by the different components and the varying composition of components results in certain systems being developed. As rules often change rapidly and arbitrarily, business modelers and architects may often be out of synchronisation with executive management. The constant verification of the goals and objectives of management, therefore, amounts to sound practice.

As the design rules of architecture are applied, a change in the environment will result in a system change. Such change, in turn, affects the coded base of the system, with such modifications having to be reflected and maintained at an architectural level. The business rules must be supported by the components and the composition of the components that reflect the system being developed (Nistor, Erenkraantz, Hendrickson & Van der Hoek, 2005).

Business architecture is driven by the understanding and knowledge of business processes, as well as the building of key business concepts, while, IA is defined as "the structural design of the information space to facilitate intuitive access to content" (Garret, 2000, cited by Busch-Geertsema, Balbo, Murphy & Davey, 2005). The IA, which must support the needs of the organisation in order to be able to provide information directed towards planning, must take precedence over other technological considerations. The IA maps the relevant information items, as well as the links and groupings among them. Metadata describes other data or information, the data structures and the reason for specific structures. Sinha and Boutelle (2004) suggest that the techniques used to understand what information users require are card-sorting, free-listing, and stakeholder analysis. As information requirements change and evolve

over time, such mapping has to be dynamic and agile enough to allow for the meeting of new business information requirements.

2.1.2.1.3 Application Architecture

Application architecture (as shown in Figure 1) aims to support business goals and objectives, which must be achieved in order to justify the existence of a software development project. Such application architecture is determined on the basis of specific business requirements, involving the definition of the interaction between application packages and databases in terms of functional coverage. Such definition could result in the identification of many integration problems, gaps in functional coverage, or the necessity for various media. A migration plan could be drawn up for systems which are at the end of their software life cycle or which offer inherent technological risks.

Terekhov (2004) suggests that improvement in software architecture is needed. The absence of formal architecture has been replaced by informal structural agreements between developers and software architects. The architects involved thus have to maintain agility and flexibility in order to provide a service aimed at attaining organisational vision and goals.

The acknowledgment of the fundamental role played by IT in supporting business is also noted by Henkel, Zdravkovic and Johannesson (2004). Software must be designed correctly in order to enable the integrating of new business processes into existing software services. When migrating to a new system, legacy systems cannot be ignored since business must continue to perform. Yan, Garlan, Schmerl, Aldrich

and Kazman (2004:1) say, “One of the challenging problems for software developers is guaranteeing that a system being built is consistent with its architectural design”. A key aspect of the design of any software system is the architecture that it involves and the way in which it provides a formal model of the components, connectors and behaviours, their composition and inter-relationships.

2.1.2.1.4 Software Architecture

The software architecture of a program or computing system is defined by Bass, Clements and Kazman (1997) as “the structure or structures of the system, which comprise of software components, the externally visible properties of those components and the relationships among them”.

Oquendo (2006) and Bredemeyer (2001) suggest that software architecture can be considered from two viewpoints, namely structural and behavioural. The structural viewpoint refers to components, connectors, and their configuration. The behavioural viewpoint refers to the actors or actions executed, together with the inter-relations between the different actions, and the way in which the components and connectors interact between themselves. The formal modeling of this software architecture is described by Oquendo (2006) in a structured architectural description language (ADL). Most ADLs essentially provide the constructs for a component and connector description from a structural viewpoint. In such terms, structure is considered to be the most understandable and visible part of the architecture. However, behavioural viewpoints are neither forgotten nor neglected. The major drive behind developing a formal language for architecture, namely ADL, is that the visual notation must be user-friendly and that its formality must render it suitable for manipulation by the

available software, which may consist of a number of different versions (Nistor *et al*., 2005).

As systems evolve over time, version control can be used to maintain the synchronisation of the architectural and developmental code base. When change dictates the need for applying new design rules of architecture, the resulting system changes, affecting the code base of the system involved. Such modifications have to be maintained in ongoing synchronisation with the architecture. All the activities involved can either be manual or automated by workflow engines, also referred to as work flow management systems (WFMSs). As soon as the conceptual architecture has been defined, an iterative process can be used for combining the problem domain and the system itself in order to develop the design rules.

The design rules maintain the architecture in the event that re-architecture is required. The design rules reflect key design decisions of server and user-interface. Design rules also allow for the automation of checking the code base for possible design violations. The structural and behavioural viewpoint, together with the manually managed or automated design rules, should be maintained by version control, with the design rules all residing within the software architecture space.

2.1.2.1.5 Technical Architecture

The technical architecture (see Figure 1) of a software system provides the broad infrastructure necessary to support the functional software architecture described in the preceding paragraph. Schwarz, Farris and Sommera (2003) suggest that, from a technical architecture perspective, there are two separate types of concerns: the

domain-specific functional concerns, and the technical concerns that arise from the computing environment in which the problems of operations, data acquisition, and data analysis are to be solved. Pace and Campo (2005) indicate that architectural models are good for extracting implementation details, serving as inputs to the primary design decisions that involve quality assurance of the system design. Care needs to be taken that not too much effort goes into the design and building of frameworks as opposed to actually providing the required solution to the specific problem. The approach suggested by Pace and Campo (2005) is firstly to design the architecture independently from the technology, and then to proceed to obtain an object-orientated version of the design. The quality aspect addressed here refers to attributes such as modifiability, reusability, scalability and performance.

2.1.2.2 Service-Oriented Architecture

Van Thanh and Jorstad (2005) suggest that service-oriented architecture (SOA) is a 'new' school of thought, based on older and established architectural structures. SOA consists of a collection of self-contained services that communicate with one another. Services, although working together, should not cease to function if one of them fails. SOA is defined by OASIS (Organization for the Advancement of Structured Information Standards) as "a design for linking computational resources (principally, applications and data) on demand to achieve the desired results for service consumers (which can be end users or other services)". Brauer and Kline (2005) suggest that there are four key elements to SOA, namely the service provider, the service registry, the service consumer and the contract that binds the consumer and provider, as shown in Figure 2.

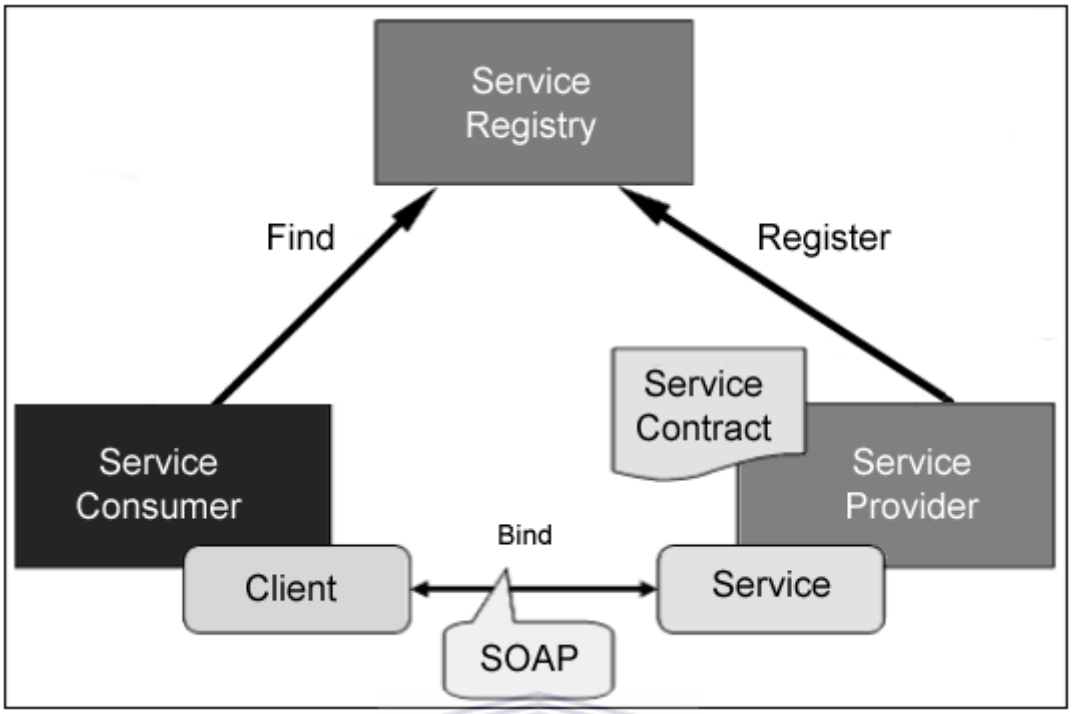


Figure 2: SOA model (Brauer & Kline, 2005:4)

The service provider publishes its service contract in the service registry in order to promote its services to potential consumers. The consumer can then access the registry to find a contract for service that meets its requirements, implementing the elements from the contract that are necessary for invoking the service. The agreement for that service, existing at that point in time between the service provider and service consumer, is expressed through the contract itself. Critical to SOA is to have a strategy of how and when services are built. Such a strategy can ensure that the services meet basic technical criteria for interoperability, thereby identifying and avoiding unnecessary duplication of services. The re-use of services by way of eliminating redundancy is an important business benefit of SOA. A result of the re-use of services directly relates to the ROI for SOA.

The importance of architecture is the way in which interoperability requirements are identified. EA offers a common view of the primary resources of an organisation, namely people, processes and technology. The EA also offers a view of how they integrate with each other as the primary drivers of the organisation. The relationships of the architectures need to align to each other in order to best support the organisation.

Table 1: Various architectures

Architecture	Concern	Key outputs
Enterprise	Defining the various architectures to meet the business requirements that together should integrate as one cohesive unit.	A common view of the resources of the enterprise: people, processes and technology.
Business	Understanding the business processes and the building of key business concepts.	Information for decision-making activities, such as work scheduling, capacity planning and eventually process refining to improve the overall performance of business processes.
Information	Supporting the needs for organisational information requirements and data flows.	The design of the information to facilitate timely and accurate intuitive access to data and the prevention of data redundancy.
Application	Setting of different elements connected or related in such a way as to perform a unique function not performable by the elements alone.	A definition of the interaction between the application packages and databases in terms of the functional coverage of processes.
Software	Identifying architectural components and connectors, and required system behaviour, designed to meet the system requirements, by specifying how components and connectors are intended to interact.	The structural configuration of components and connectors; the behavioural actions, relationship and interactions of the components and connectors.
Technical	Providing a broad infrastructure necessary to support the functional software architecture. It serves as input to the primary design decisions.	A set of principles, guidelines and rules that guide an organisation through acquiring, building, modifying and interfacing IT resources throughout the enterprise.
SOA	Defines a collection of services that communicate with each other. The services are self-contained and depend on neither the context nor the state of the other service. They work within distributed systems architectures.	A collective environment that allows services to be defined, developed and used by other services, and to be assembled into solutions by adding process, interaction mechanisms, user interface, and/or rules.

Table 1 and Figure 1 are similar with the exception of SOA. The EA architecture focus on a macro level, the SOA architecture focuses on a micro level. These specific differences are:

EA focuses on defining business components, deals with frameworks and enterprise applications. EA would deal with enterprise-level infrastructure including servers and databases. EA addresses enterprise integration matter regards patterns and when they should be used, file transfer and application integration approaches.

SOA would focus on services that business would consume and the scope of service modeling only. SOA focuses on the infrastructure that supports services. and provides an integration approach based on using services. Though the SOA approach to integration may prove to be the most flexible and recommended approach, you should consider it as one of the approaches EA needs to define and support.

2.1.2.3 Planning

As architectural concepts evolve, the ability to share resources and information to foster a decentralised sharing of functionality can be adopted as a style of architecture. Giesecke, Warns and Hasselbring (2005) discuss a peer-to-peer architectural style. Giesecke *et al.* suggest that distributed systems are realised using peer-to-peer architectures in order to avoid bottlenecks when utilising resources, and that the development of a specific architecture style lies within the structure of a generic style. Different levels of abstraction or requirements can be distinguished as part of the implementation of technology. The levels are described by Giesecke *et al.* (2005) as architectural requirements, problem domain, and solution domain requirements. Distributed computing systems can be viewed as software intensive when viewed

from a software-centric point of view. However, distributed software can also be viewed either from a hardware-centric or a network-centric point of view. Decisions have to be made as to whether the architecture is driven from a design-time or a run-time perspective, as the taking of such decisions affects the governing rule of run-time structures. The peer-to-peer architectural style is complex and has a direct effect on the delivery of services to the real world. Therefore, architects can identify the use of this architectural style within IT, as well as the effect it has on business in respect of the goals and objects of IT in regard to supporting a business advantage.

2.1.2.4 Version Control

Versioning is one of the components that links the architecture to the solution (Nistor *et al.*, 2005). Maintaining various versions of a solution may prove useful when there is a need to support older versions still in use within the customer base. Version control involves the management of source code, documents, or related files in a large storage facility. Version-control software provides a database that keeps track of the revisions made to software by programmers and developers. Versioning may also be conceptualised in another form, of which an example is that of a motor vehicle, a base model with limited features, versus the same model type, with additional features, proving advantageous to business. The different model versions, which result in an expanded customer base, cater independently for the various income expenditure and financial buying power classes. Such a form of versioning could, by supporting a unique approach marking a product, support the development of business advantage. However, such may only hold true until competitors replicate this strategy.

The process of software version control within the software life cycle relates more to the task of tracking the various versions of the solution as opposed to the actual solution itself in support of the business. Software developers need to consider the following components of the solution during software development: computational parts; how they interact (connectors); and the configurations and tracking of changes. The tracking of changes in the solution implemented by business, which may occur as a result of maintenance and system enhancements, may not synchronise with the architecture initially designed. Nistor *et al.* (2005:100) cite the need to "map between the architectural descriptions and component implementations using a versioning infrastructure and address the evolution of the relationship between the versions of the architecture and the versions of the implementation".

If developers intend to maintain the different versions of components or artifacts, a back-up can be made of the solution. However, version control of the relationship between them also needs to be maintained as part of the software architecture. In light of the uniqueness of each solution, Nistor *et al.* (2005) suggest that software developers need to adopt the right tool available for each task of version control, consisting of architectural development, source code development, and the configuration management of systems.

Consistency should be maintained between architecture and implementation versions, which should also constantly be synchronised with the architecture to allow for the management of changes within the code base and vice versa. From a software architectural perspective, the benefit of maintaining version control is that, when new smaller components of a system are rolled out, only the newest subcomponent of the

system has to be checked and tested. Nistor *et al.* (2005:108) state that doing so "allows a developer to instantiate an entire system without needing to check out every component within it". The use of such a methodology can shorten the rollout time of new or additional features of a system that is already functioning in a production environment, as well as allowing for the parallel development of architecture and components. As stated earlier, in this way testing and QA are both promoted, with the entire system not having to be retested every time a subcomponent rollout occurs. However, testing, including regression testing, does need to be carried out in order to ensure that a defect-free system is deployed, and that no new defects are introduced in the previously tested code during the deployment of new or modified components.

2.1.2.5 Quality Assurance

The evaluation and confirmation of system readiness ensures that the intended implemented system is deployed. Dustin (2003:1) states, "The most effective testing programs start at the beginning of a project, long before any program code has been written." From a QA perspective, an entire project can be divided into five leverage points, namely: inspection; requirements management; test planning; testing technique; and defect management. The general purpose for each of these leverage points is to ensure that as many defects as possible are removed from the work product before being used as input for the next phase of the project. Defect prevention during the early stages of a project can lead to the avoidance of errors pertaining to the next phase of the project. During the development of the code base, a test harness can be developed and later re-used, if and when changes are made to the system after it is deployed into production. The re-use of the test pack can be deployed for regression testing, as earlier stated. The business advantage of this is clear, in that the

time to market can hereby be shortened with an almost perfect and defect-free system being deployed.

The slightest modification to the implemented solution requires re-testing, known as regression testing. Muccini, Dias and Richardson (2005:1) claim that "assessing both 'top-down' and 'bottom-up' evolution, i.e., whether a slightly modified implementation conforms to the initial architecture, and whether the (modified) implementation conforms to the evolved architecture". Further, the modifications made still need to satisfy business needs and requirements. Such a process, aimed at maintaining and achieving the following architectural benefits, among others, can be costly: early system deadlock detection; performance analysis; component validation; predictable behaviour requirements; and guided system integration. Maintaining the intended architecture is especially important when considering the possible changes to be made to the already implemented system, a phenomenon which is referred to by Muccini *et al.* (2005) as 'architectural drift'. Regression testing is the key solution to the problem of retesting the solution post evaluation and implementation. Regression testing can also lower the cost of retesting the entire system, as only the modified components are fully tested, while the rest are tested by means of the existing test package. Muccini *et al.* (2005), citing Harrold (1998), state that "regression testing can account for as much as one-third of the total cost of a software system … the use of software architecture for regression testing activities has the potential for a bigger impact on the cost of software". The cost of such testing is reduced through re-using the previous tests and the amount of information involved, thereby reducing the total number of selected test cases requiring retesting. As illustrated, regression testing not only shortens the time taken to re-evaluate the system and to improve deliverable

timelines (especially in the case where a new version of an already implemented system is in place), but also improves the degree of trust which the business places in its IT and, finally, in its bottom line, the TCO. As suggested by Dustin (2003:1), QA needs to be involved from the start of designing and planning systems.

Although dated, Teufel and Teufel (1995) suggest that business strategies are influenced by changes in their environment, including: business markets; new technologies; and the quest to improve customer service. Two fundamental dimensions are mentioned: a strategic fit – the company's position relative to the external market; and a functional integration – the capability of IT to support a specific business strategy. Organisations need to minimise the effort and to maximise the usefulness of solutions to achieve strategic goals within the competitive business climate in which they operate.

Authors such as Erl (2005), Van Thanh and Jorstad (2005) and Nistor *et al.* (2005), among many others, share a common view, in that a structure and an organised architectural approach within IT is required to support the business. However, IT also needs to align to business strategic objectives. The next section discusses such alignment.

2.1.3 Architecture in summary

The key concepts covered in this section were:

- architecture;
- SOA;
- planning;
- version control; and
- Quality Assurance.

The different components of architecture, which are key to improving business performance and, in turn, to the support of business advantage, present in the literature were highlighted. This section provides input into the survey instrument used.

Architecture is the planning component involved in implementing a solution from concept to deployment. To bring IT and business together, an EA has identified a number of architectures within itself, each of which can be managed separately, aimed at pulling all the elements of the architectural solution together. The architectures involved are identified as: business; information; application; software; and technical architecture. SOA is an approach that suggests that large problems be approached in smaller manageable components, which could ultimately address the final solution. A key SOA requirement is that the various services work together to make up SOA. Although not directly dependant on each other, they should be able to function within SOA. A critical success factor is ROI of service already invested in. TCO, which is minimised by reducing the duplication of services.

The next section reviews those strategic factors supporting business advantage.

2.2 Strategic factors

This section reviews the factors within organisations that could have a bearing on business advantage.

2.2.1 Introduction

For organisations to be profitable and survive in a competitive environment, decision-makers need to appreciate the various factors that accompany the technology deployed in their organisations. This chapter discusses strategic factors, such as the alignment of IT and business from a strategic perspective. It also examines the factors that enhance business advantage, including communication, strategic planning, and sharing of information and knowledge.

2.2.2 Discussion

2.2.2.1 Alignment

Recent research by Umar (2004) suggests that architecture should withstand the turbulence of IT and business change. Threats, such as technological change and redefining business processes, have been identified. Van der Raadt, Soetendal, Perdeck and Van Vliet (2004) suggest that architecture maturity and alignment within an organisation can be used to aid the harmonising of business and IT management. A truly successful architecture can only be as good as the architecture that bridges the gap, over time, between IT and the entire organisation that it supports. Governance entails the role and responsibility of the supporting teams and infrastructure. The Open Group (2007) defines governance as: “The practice and orientation by which enterprise architectures and other architectures are managed and controlled at an enterprise-wide level. Typically does not operate in isolation, but within a hierarchy

of governance structures, which, particularly in the larger enterprise, can include Corporate Governance, Technology Governance, Information Technology (IT) Governance, and Architecture Governance". IT and business alignment must be flexible and agile, and should never be a once-off task. When Chatterjee and Ravichandran (2004) evaluated the occurrence of inter-organisational relationships and inter-organisational systems (IOSs), they found an increased interdependence between business and managers, who have to understand how business and IT fit together within an organisation. Pereira and Sousa (2005) suggest that the alignment of business and IT departments can be addressed by employing business, information, application and technology architecture, known as enterprise architecture framework (EAF). Alignment could be achieved by building a relationship between these architectures, see Figure 3.

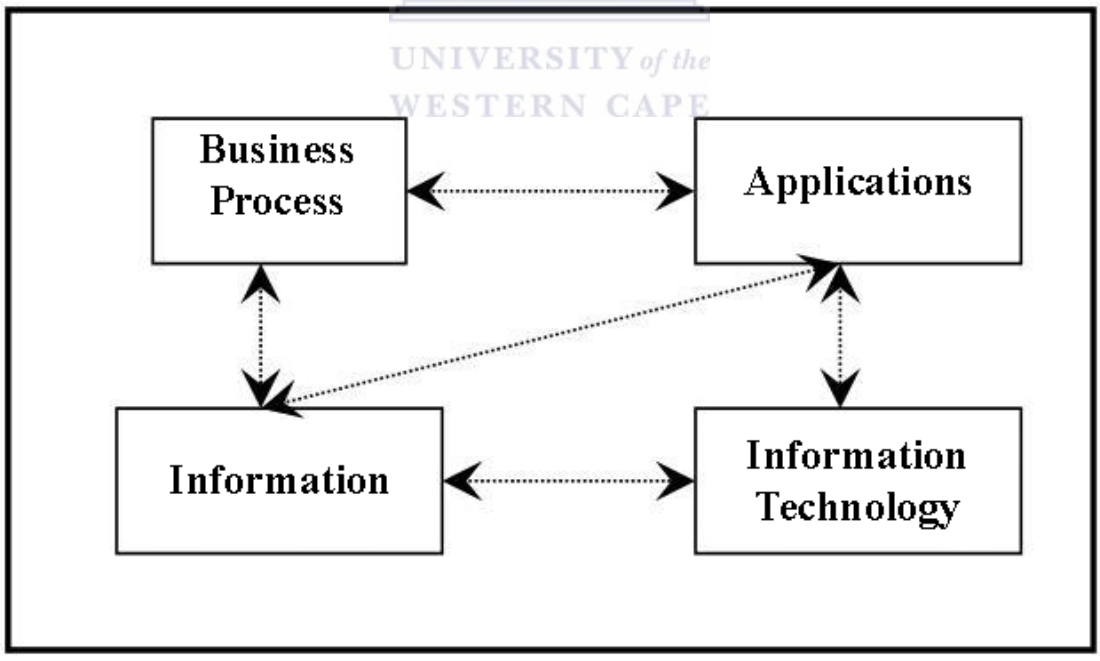


Figure 3: Relationships between architectures

Note, in Figure 3, that no relationship is shown between business process and IT, clearly indicating that business processes are independent of technology. Application architecture uses technology to build applications for supporting business processes.

2.2.2.2 Management Support

The alignment of IT with business is a management concern. Motjolopane and Brown (2004) suggest that IT implementation successes contribute to factors that are likely to support alignment. In business, customers and technologies change, with business and IT constantly having to review where and how they fit together. Pereira and Sousa (2005) suggest that architecture is a representation of the organisation aimed at enabling the planning of organisational changes. As discussed by these same authors, alignment remains a key issue dominating the relationship between business and IT. The quality of alignment that they maintain with each other can be measured by using the time and effort spent on the work required for developing the application by the developer, and by the usage of the applications concerned. The ability of non-IT managers to understand IT impacts on the alignment between IT and business. Duedahl, Andersen and Sein (2005:40) suggest that the alignment of IT with business is a top-ranking enabling factor. As business managers know best how their business functions, they need to understand how IT can affect and improve processes within the various departments within the organisation. When business managers improve their understanding and knowledge of IT, they become better able to contribute to the alignment of IT with business. They can then better identify potential improvement to processes, thereby creating advantage over their competitors.

Organisational size and industry type also has a direct impact on the role of IT and its resources. Guzman and Kaarst-Brown (2004), citing Niederman and Trower (1993), suggest that a firm's size and complexity or strategic outsourcing may similarly influence the complexity of the role that IT plays.

2.2.2.3 Strategic Planning

Pirani and Salaway (2004) suggest that IT strategic planning; IT governance; communication and measurement/assessment; and successful strategic thinking, planning, and interaction between business and IT leadership contribute towards the alignment process. These researchers suggest that strategic planning is required to enable understanding and formal consideration of external environmental factors that can affect organisations. The identification of the direction taken by technology and the use of vendors and consultants may add to the understanding of technology and its usefulness. Pirani and Salaway (2004:3) concluded in a report, in which higher education institutions reported effective IT alignment, some of the contributing factors as being the following:

- a clearly articulated vision and/or priorities;
- planning linked to organisational budget;
- the continuous planning or engaging of IT in planning activities;
- effective IT governance processes;
- effective IT strategic planning processes;
- greater communication with, and the involvement of, key organisational departments; and
- the clear documentation of approved IT initiatives.

The alignment of IT with business is directly affected by the strategic planning that is influenced by the IT. Business plans (BPs) which, in turn, impact on the budget are explicitly linked to clearly articulated organisational vision and goals. Institutions report that they have dynamic or stable environments as a result of the prevailing alignment between IT and business (Pirani & Salaway, 2004:3). These researchers identified that planning and alignment appeared to be more critical and more difficult in unfavorable organisational climates. Another key enabler of alignment is the close relationship between IT and business staff, where plans are made and shared. Pirani and Salaway (2004:6) state that "unless a plan is shaped by many and known by all, the view of IT may be incomplete, incorrect or incoherent". Where the perception of the planning process is effective, where IT leaders have a clear vision of the organisation, and where IT plans are integrated into the organisational budget, such factors are positively associated with alignment. Other researchers, such as Luftman *et al.* (1999) and Pirani and Salaway (2004), also strongly suggest that senior executive support is the primary enabler of IT and business alignment.

2.2.2.4 IT Supporting Business Processes

The introduction of new technology, with its ongoing concomitant review, has a significant impact on the support that IT can deliver to a business. Cegielski, Reithel and Rebman (2005) suggest that, though new technology might not provide an immediate advantage for an organisation, however, there might be future benefits associated with the research and prototype that may be developed. Porter (1998:216) suggests that, when applying new technology, the consideration for choosing the technology that will prove to be the best and most efficient lies in where technology supports the competitive advantage.

Emerging technology should not be considered as of benefit for a finite length of time, but rather as an ongoing strategy within the IT environment. The support of business aims not only to achieve the organisational vision and goals, but also to use IT as a tool to provide a business competitive advantage. In conducting a Delphi survey, Cegielski *et al.* (2005) concluded that emerging technology is the top-ranked issue related to the technical alignment of IT with business. The introduction of new technology into an organisation has one purpose: business and technical alignment. Cegielski *et al.* (2005) suggest that emerging technology can only be explored after the IT strategist has assessed the business alignment issues in respect of the emerging IT. Cegielski *et al.* (2005:116) quote "attempts to conform organizational processes around an EIT (emerging IT) are tantamount to placing the cart in front of the horse." As developers tend to latch onto new technology and the speed at which such new technology develops increases, supporting new systems becomes increasingly more time-consuming.

2.2.2.5 Improving processes

In order to effectively link business requirements with IT solutions, issues of alignment must be considered. Bleistein, Aurum, Cox and Pradeep (2004:206) noted that the alignment of IT with business strategy, to which they refer as requirement engineering (RE), can have a significant and positive impact on business performance. When organisational requirements change, any misalignment could disrupt the harmony between business and IT. Bleistein, Cox and Verner (2005:1300) call such an approach "a requirements engineering approach that unifies the modeling of business strategy with the modeling of system requirements. This unification

enables validation of system requirements against objectives of business strategy via explicit linkages within a single model". Such unification may also result in the validation of business requirements and IT systems. A mutual understanding of business strategies must exist between IT and business managers, with such strategies being incorporated into IT planning and development activities. Bleistein *et al.* (2005) suggest that a variety of cross-communication and collaboration activities between business and IT managers has to occur if requirements engineering alignment is to be achieved. Even more explicitly suggested is the cross-referencing of written plans between business and IT.

2.2.2.6 Resources

The terms 'business competitive advantage' and 'operational effectiveness' (otherwise referred to as 'best practice activity') cannot be used interchangeably. Business competitive advantage is concerned with what an organisation does differently from its competitors to achieve the most effective use of human resources and technology deployment. (These factors will be discussed in more detail in the next section of this chapter.) In order to successfully align the requirements of business and IT, Bleistein *et al.* (2005) present a model that commences by understanding the overall business strategy; separating best practice from strategic competitive advantage; presenting each outcome as separate goals; integrating these separate goals into a single model; and, finally, refining these goals down to systems requirements (see Figure 4).

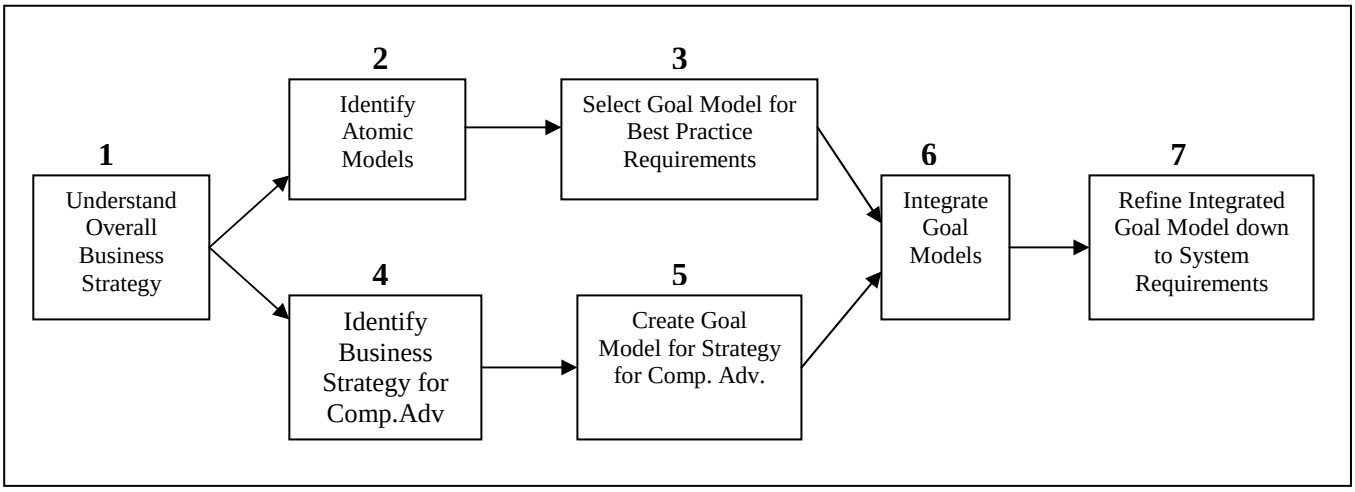


Figure 4: High-level process for requirements engineering (Bleistein *et al*., 2004:265)

In Figure 4, the entities numbered 1 to 7 indicate the activities required to move from strategy to best practice. The competitive advantage components are performed in parallel. The above numbering does not necessarily imply the sequence to be followed. Such a process takes a 'breakdown into smaller components' approach to business strategy: The overall understanding of business strategy (1) requires that a separate best practice path be taken (2) from that of strategy aimed at competitive advantage (4). The separate goal models are presented (3, 5). The two goal model path areas then integrate into a single goal model (6), which is refined down to system requirements (7). Such activities are described in greater detail below.

Re-engineering is highly recommended when strategic changes are necessary in order to preserve and maintain flexibility and competitiveness. Van der Raadt *et al.* (2004) suggest that there are architectural types, initiated either by business, IT or IT service providers. Organisations that focus on the use of IT exclusively as a competitive advantage may miss other valuable opportunities that become available.

Although their study now appears somewhat dated, Reich and Benbasat (1996) found that the two dimensions presented in measuring the linkage between business and IT objectives are the intellectual and the social. Reich and Benbasat (1996:74) conclude that there are two viable possibilities: “the understanding of objectives” and “congruence in IT vision”.

2.2.2.7 Collaboration

Ferratt, Lederer and Hall (1995) suggest that much benefit is obtainable when a group of participants makes use of a collaborative architecture, by means of which technical challenges can be met and the focus placed on the opportunities made available by means of core business competitive advantage. Data sharing can also result in the reduction of costs, while customers stand to reap the benefit of improved service. Melling and Gartner Group (1994), however, question the effective use of IT in creating competitive advantage when developing a new architecture. To achieve this advantage, they maintain, IT must fully understand the user’s specific needs.

Andriole (2006:85) offers additional insights into the issue of collaboration, maintaining that, “Before investing in the technology, business managers must focus on their collaborative business future, and the extent to which their technology can be integrated.” Customer-centric components, such as customisation, optimisation automation and transactional trust can develop from collaboration. The technology integration mentioned refers to back-office, front-office and virtual office data and applications integration over cross-platform security architectures and communication infrastructures. According to Andriole (2006:85), the more collaborative and integrative a project proves to be, the more attention it should be given.

A value-add to business could consist of IT proactively supporting the organisation. Ramnath and Landsbergen (2005:58) suggest that the implementation of a responsive and unified adaptive system forms part of the strategic IT plan. The systematic gathering of potential business requirements and measuring of the response rate in fulfilling these demands, how well the demands are satisfied, and the response time in developing new demands can all add to the efficient and effective support of business.

Due to the internal and external rate of change confronting an organisation, changes to business requirements can cause enterprises to innovate new business processes and IT systems. The alignment between business and IT is defined by Aversano, Bodhuin and Tortorella (2005:1338) as "the degree to which the information technology mission, objectives, and plans supported the business mission, objectives, and plans". Furthermore, 'fit' and 'integration' should exist between business and IT strategy, also extending to the business and IT infrastructure.

In order to prevent misalignment, defect detection can be employed early on in the process, when changes are requested and planned. To detect misalignment, it is necessary to identify which rules satisfy alignment, as well as how to evaluate these rules in terms of success criteria. Aversano *et al.* (2005) identify the following parameters as being of importance:

- technical coverage: the percentage of process activities adequately supported by the software system (how much it covers them); and
- technological adequacy of activity: the adequacy of the software system used for the supporting activity (how well it covers them, on the basis of how well, or how much of, the system is used).

Aversano *et al.* (2005:1340) state in basic terms that "the adequacy is high if the software components analyze the input of activity and produce the output expected by the execution of the activity in the expected time and using the available resources". In order to fully appreciate the impact of changes made to business processes and the IT systems that support business, it is necessary to understand the following dependencies and relationships existing among and between processes and systems.:

- the set of activities (what);
- the use of the IT system to support business process (how);
- a set of software component (consisting of);
- the dependence of one activity on another (dependency); and
- the support of the activity (support).

Aversano *et al.* (2005) suggest that the type of modifications and the rules pertaining to business processes or IT components have to be considered when propagating

change. A single change can, potentially, have negative impact upon business processes or IT components that may depend on the input or output from the new rule or business process involved. What can be concluded is that, if a parameter of measure is determined to be a value lower than the associated given threshold, the business and IT alignment has been broken, resulting in the situation having to be swiftly corrected.

The fields of business management and IT are well-established in both management schools and industry. Although the interdisciplinary educational codes are not new, the combination of IT and management courses may provide innovative and challenging educational opportunities. Wagner, Boisvert and Kuilboer (2005) suggest that the understanding of IT and business alignment concepts could commence as early in a student's life as during undergraduate study. The mixing of both IT and management courses could be introduced from second year IT-related degrees, allowing for students to extend the ambit of their studies into the management field. The breakdown of the silo departments could be achieved from as early on as higher education, assisting the alignment of business and IT much earlier than only when graduates first enter the workplace.

2.2.2.8 Enablers and Inhibitors

Enablers and inhibitors of business and IT alignment are discussed by Luftman *et al.* (1999), who focus on the following activities required for the alignment of IT with business: strong support from senior management; leadership; appropriate prioritisation; trust; and effective communication. Such factors are evolutionary and dynamic. The authors conclude that business and IT alignment remains a core issue in

the contribution that it makes to gaining business competitive advantage. The competitive advantages of IT and business are discussed later in this thesis (see section

2.3 Business advantage, page 58).

An understanding of the business environment is essential, along with the enabling factors previously discussed. A key concern for business executives is the application of IT in an appropriate and timely manner that aligns IT and business strategies, goals and visions by supporting business both effectively and efficiently. The following list of enablers and inhibitors of IT and business alignment is adapted from Luftman *et al.* (1999:16). Comprehensive insight has to be gained into such factors, due to the key role that they play in alignment.

Enablers:

- **Senior executive support for IT**
    - Such support identifies the need for business to be more aware and supportive of technology in the way in which it recognises the value of IT.
    - Senior management should define and communicate organisational vision and strategies, including the role of IT.

Involvement of IT in strategy development

- The strategy formulation process in which IT participates in the creation of business strategies should be marked by mutual co-operation and a closer working relationship.
- Cross-functional teams should engage in ongoing debate.
- More effective communication between IT and business should entail both listening to the needs and recommendations as expressed by the other.

- The ability to leverage IT resources in order to build a competitive advantage should result from an atmosphere of open and honest communication.

- **Understanding of the business by IT**
  - Business concepts should dominate IT dialogue.
  - By focusing on furthering their technical understanding, IT practitioners should come to identify business opportunities.

- **Partnership between business and IT**
  - IT should support business process measurements.
  - A successful business and IT partnership would facilitate closer alignment.
  - Customised products should be built for business, tailored to meeting specific requirements and to taking advantage of new technology and business opportunities.

- **Well-prioritised IT projects**
    - The prioritisation of IT projects can be achieved by timeously applying technologies to strategies in order to keep in stride with one's competitors.
    - Sound prioritisation depends on planning new technological acquisitions and on building an appropriate infrastructure.
- **IT leadership**
    - Leadership should promote IT and take advantage of new technology before competitors apply such technology innovatively.

Inhibitors:

- The lack of a close relationship between IT and business.
- The inability of IT to prioritise well.
- The failure of IT to meet its commitments.
- The failure of IT to understand business.
- The lack of support granted IT by senior non-IT executives.
- The lack of leadership among IT management.

Most of the aforementioned enablers can be seen as the inverse of the inhibitors. However, the order of importance of such factors is clearly not equable. The lack of a close relationship between IT and business may also be due to the lack of communication and knowledge sharing between the two, which may result in the failure of IT to participate in strategy formulation. Business executives may direct IT initiatives that are unrealistic and not in line with organisational priorities, resulting in non-delivery of IT projects. Such misunderstanding between business and IT can also have a negative impact on the following: delivery; budget; IT support; and application functionality.

In order for organisations to be able to improve their processes, both inhibitors and enablers have to be identified. Bateman and Rich (2003: 185) state, “The general and cultural nature of the identified enablers indicate that managers perceive progressing process improvement (PI) activities are reliant on a change of the culture within organisations parallel to ‘upskilling’ the technical knowledge of employees for change to be successfully enacted.” Continuous improvement generally takes place over a much longer period of time, when compared to PI. Bateman and Rich (2003) categorise enablers and inhibitors into the following groups: process issues; strategy and objectives; leadership and motivation; cultural issues; measurement and information; training; learning; skills; and other miscellanies.

In order to improve the mindset of employees, an open-minded culture and enthusiasm should be encouraged. Predictable inhibitors can be eliminated before any issue of concern manifests itself as a problem. If managers improve their planning, their attempts at effective leadership should more positively impact on the performance of line workers. As regards knowledge sharing, the role played by effective communication as an enabler of PI has been identified, as feeding into performance measurements. Bateman and Rich (2003) generally conclude that the competitive environment constantly demands that the organisation be able to identify enablers and inhibitors both in local and widespread improvement activities. The ability to determine such factors becomes increasingly critical in an environment subject to change.

The speed at which technology is advancing is ever increasing, with the early adoption of new technology creating an atmosphere both of perceived usefulness and

fear (Porter, 1998:220,332). The decision not to adopt technology early is based on certain critical barriers. Cenfetelli (2004), citing Venkatesh and Brown (2001:91), maintain that barriers (or inhibitors) consist of: rapid change; high cost; and lack of understanding and knowledge. The perceptions of reliability, assurance, and serviceability are raised by business when adopting new technology, as organisations then find themselves on the "bleeding edge", instead of on the cutting edge, of technology. The risk of failure, which affects the budget, motivation, and the relationship between business and IT, is not regarded as a justifiable risk. Resource availability and the cost associated with this barrier is another concern for organisations. These researchers and others all identify inhibitors as comprising the following: distrust; dissatisfaction; anxiety; and the lack of usage as a result of too little training, which may even result in complete system rejection. These particular antecedents may all be indicative of the general phenomenon of usage inhibition. Cenfetelli (2004) concludes in his study that inhibitors only discourage the use of technology, and not the realistic value of new technology. However, the absence of such inhibitors does not necessarily encourage the use of technology. The main lesson to be learnt from such a finding is that a more positive perspective and attitude has to be present in order to enable the full encompassing and encouragement of the use of technology systems.

2.2.2.9 Understanding Competitors

In wanting to remain competitive, an understanding of the competitor could prove to be valuable, as such an understanding would facilitate an awareness of what they are doing and why they behave in the way in which they do. Porter (1998: 71–74) refers to the context in which a competitor is understood as "a framework for competitor

analysis". In order to implement a competitive strategy, Porter (1998:47) urges the posing of questions such as the following:

- "With whom should we pick a fight in the industry, and with what sequences of moves?"
- "What is the meaning of that competitor's strategic move, and how seriously should we take it?"
- "What areas should we avoid in order to avoid an emotional or desperate response from our competitor?"

Organisations should be alert to challenging competitive actions in the market sector and seek to develop a solid market position to enable them to survive in a competitive battleground.

An organisation's resource base can be a key component in reacting to any attacks from competitors regarding conceiving new ideas and opportunities. To this end, the development of resources, such as staff, finance, marketing and IT, is critical. Managers need to make decisions and to deploy the available resources with regard to their competitive responsiveness based on the information that they obtain and can utilise. Two fundamental judgements need to be made with regard to the information that management uses, namely:

- which information to use and consider; and
- how to use it.

Decision makers not only have constantly to keep themselves up-to-date with their competition, but they also have to consider the effect of their competitors' moves on their own resources. Debruyne, Frambach and Moenaert (2006) suggest that the

availability of resources may influence decision makers in various ways, depending on how they react to the competition offered by new products or services.

Debruyne *et al*. (2006) suggest that the urgency to react and the feasibility of dealing with such an event reflect the motivation and ability to respond. The motivation reflects the risk an organisation faces in deciding not to respond to a competitive attack, which is justified by the perceived success expected from the competitive product or service launch. The ability to respond is the decision-maker's conclusion and suggestion about the possibility of reacting effectively. The reaction may involve employing the most effective instrument, suggesting that the reactor decides on the capabilities of the organisation concerned.

Debruyne *et al.* (2006:7) further suggest that the use of resources and the motivation to react is based on the "liability-of-wealth" and the "strong-competitor hypothesis". Though resourceful firms represent powerful forces, such representation does not necessarily mean that they will exercise that ability to conquer their market, with such failure resulting in a "fat and happy syndrome" and resultant negative growth within the organisation, as described by Debruyne *et al.* (2006:7). Surplus resources may create the false illusion of invulnerability within the minds of the decision-makers concerned, resulting in the underestimation of the magnitude of the competitive product or service involved. The strategic value and impact of new products introduced into the market need to be considered carefully by organisations. The introduction of a new product by the competitor can either have a major or minor impact, with the possibility of a negative impact on the organisation causing it to lose its top market share position.

The strong-competitor hypothesis is based on the assumption that resourceful firms are more resilient to competitive attacks, and, when employed effectively, such an outlook can serve as the foundation for positional advantages. Debruyne *et al.* (2006:8) suggest that strong customer relationships, high brand awareness and reputation all make it more difficult for competitors to penetrate the market with new products in order to establish a strong presence.

A competitive advantage may be achieved by maintaining a high level of presence in the market sector by means of effective marketing strategies. Porter (1998:9) states that "…established firms have brand identification and customer loyalties which stem from past advertising, customer service product differences, or simply being the first in the industry." An organisation may also introduce a new product more easily if there is product awareness and pre-established brand loyalty, in which case the customers would more easily consume the organisation's product or service.

2.2.2.10 Technology

The presence of technology may pose various challenges in reaction to competitive attacks. From a positive perspective, however, technology may enable a more adequate and speedy response. The presence of new technology may also place an organisation in a more advantageous position, so that it can react more effectively.

Financial resources may create an opportunity to react to competitive actions as a result of excess resources being available and ready for utilisation.

Debruyne *et al.* (2006:10) define 'Competitor Orientation' as involving decisions about what information to use and how to use it in order to make and/or take the best possible decisions. The awareness of such information enables decision makers to react in a more informed and responsive manner, based on their resource base. Porter (1998: 68–71) shares the view that knowing what the competition is trying to achieve should place any firm in an advantageous position that enables it to counteract any threats posed by the competition.

2.2.3 Strategic factors in summary

This chapter discussed how, in order to achieve and maintain a competitive advantage, the alignment of IT with business should be maximised. Factors conducive to such alignment have been identified as follows:

- senior executive support for IT;
- involvement of IT in strategic development;
- understanding of the business by IT;
- an ongoing partnership between business and IT;
- well-prioritised IT projects; and
- strong IT leadership.

The collaboration between IT and business is critical. The factors discussed so far have been categorised into two: the enablers and the inhibitors. As architecture has been identified as the foundation for the use of IT in business, such alignment stands to bridge the gap between IT and business. A strategy regarding how IT will be used in an organisation is pivotal to its advantage and should precede the choice of technology by an organisation. As change is constant, the re-engineering of business

processes may be required. Such change will, in turn, present new opportunities that could be advantageous to the organisation concerned.

Enablers and inhibitors of business and IT alignment were identified as consisting of leadership, appropriate prioritisation, trust and effective communication. Consideration of cultural issues could be required if an organisation plans to expand. Resource availability and choices for outsourcing or growing internal skills are important decisions that management has to make. Management needs to gather information of value and not just to amass large quantities of largely irrelevant information. Information that is of value can be used in response to competitive attacks in a reactive decision-making exercise, as well as, possibly, in a proactive way, thereby preventing the loss of revenue and the downtime of information systems. Maintaining customer awareness may also help to ensure remaining one step ahead of one's competitors. Most business organisations measure their success in terms of the balance sheet and the financial resources that they have available for sustaining their business or enhancing their processes.

Business advantage as a phenomenon is discussed in the next section.

2.3 Business advantage

This section reviews the various components of IT architecture and the strategic factors that contribute to the competitive advantage of an organisation.

2.3.1 Introduction

As electronic commerce grows, the success or failure of local and global business may well come about as a result of how well organisations can adapt and make use of IT. As discussed in the previous section, the creation of strategies aligned to the organisational vision and goals shared by business and IT is one of the first steps towards evolution in the business world. In line with such strategies, the vision and mission of an organisation serve to direct the plans of how IT can contribute to the competitive advantage that arises from the efficient and effective employment of the IT.

2.3.2 Discussion

2.3.2.1 Technology

The alignment of IS plans (ISPs) with BPs can contribute to creating a competitive advantage. Kearns and Lederer (2000:265) suggest that aligning ISP and BP strategies improves strategic performance, and assists in maintaining competitive advantage. The alignment of business with IT can also be improved by way of adopting a strategy of targeting customers with products by means of web-based technology. A customer profile can be developed in this way that enables specific customers to be targeted with specialised products and services, allowing for the retention of the best and most profitable customers. Kearns and Lederer (2000:266) and Porter (1998: 34–40) suggest that a competitive advantage can be achieved by means of the generic

competitive strategies identified as cost leadership, product differentiation and market focus. These researchers, together with others such as Henderson and Venkatraman (1993), argue that the lack of such strategies is the reason why many businesses fail to realise the full value from their IT investments. Whereas such investments are often planned within the ISP along independent decision-making lines, such decisions should rather be governed by the objectives of the organisation, as expressed by the BP, with strategies in sync with alignment leading to IS effectiveness.

Kearns and Lederer (2000:267) identify two types of alignment associated with the use of IT for competitive advantage, namely the alignment of ISPs with BPs and the reciprocal alignment of BPs with ISPs.

The purpose of strategic IS alignment is to support business objectives and to increase the opportunity for IS-based competitive advantages. ISP–BP alignment is the direct reference of these two plans, missions, goals and objectives to that of the organisation. The alignment of BP–ISP directly references the ISP and acknowledges specific IT opportunities that can be used strategically to maintain the competitive advantage. The collaboration of these two plans, when formulated together, also enhances competitive advantage, thereby also encouraging communication and trust.

The purpose of this dichotomy of alignment is that a BP reflects the experience and knowledge necessary to leverage the IS-based resource to its full potential. The importance of ISP–BP is that it signifies that IS understands business and the related strategy aimed at achieving the organisational vision. A definite competitive advantage is reflected by the fusion of business objectives and process with IT.

IT-based resources can also create competitive advantages by creating switching costs (from one product or service to another); lowering product costs; creating product differentiation; enabling existing strategies; creating new business competitive strategies; lowering the bargaining power of supplier and customers; and even imposing barriers to the market entry of competitors. This view is also shared by Porter (1998) in his five forces analysis of competitive strategy. The alignment of ISP with BP is a positive influence for providing an organisation with competitive advantage.

The use of IT as a competitive competency, if used precisely and intelligently and in a corrective manner, will support the organisational strategy by underpinning successful business processes. The key factors that Haque, Garten and Webb (2004:31) list as contributing to the use of IT as a competitive strategy are listed in

Table 2.

Table 2: Key success factors

Key Factors	Activities
Top executive engagement	Recognising the value of IT Serving as active sponsors and champions of IT projects
IT and business strategy alignment	Learning to leverage IT resources to build competitive advantage Marketing the value of IT Providing information access to the appropriate people
IT governance	Defining who provides input regarding decision-making Defining who makes decisions Defining who does the implementations Ensuring that resources are used responsibly Ensuring that all IT-related risks are known and managed and that the core resources are secured
Application delivery and management	Deriving benefit from project management and delivery management processes, based on best practices and standards Employing project management methodologies Employing International Standards Organisation (ISO) 900X

A competitive strategy that can be influenced by IT is the appropriate selection of available technology innovation and invention, which must take place continually and systematically. Such ongoing selection prevents a situation of chaos from developing, as well as the creation of silos, which are not conducive to business.

2.3.2.2 Management Information

Evolving a set of guidelines to follow in devising a competitive strategy should lead to a profitable and sustainable business. Rather than simply accumulating masses of information it is important to interpret the information correctly. Vassell and Amin (2005) list various themes for consideration when strategising for a sustainable competitive advantage.

A distinctive strategy not only requires a clever business model, but also a distinctive position in the marketplace, enabling it to become established in the mindset both of the customer and the potential customer, so that profits can be generated as quickly as possible. Such a strategy needs to set out “who” the target market might be and also “who won’t”, “what” product or service will be offered in terms of its specific scope; and “how” the product or service will be delivered to customers and introduced to potential customers, all of which closely resembles the view espoused by Porter (1998:38).

Porter (1985) introduced the ‘value chain’ concept as a structured manner of examining all the activities that an organisation performs as regards how they interact and collaborate with each other to provide competitive advantage.

In order for the strategy to be valid in a fast-paced and changing environment, such as that in which business and technology function, the rules of strategy have to keep up with customer needs and wants. The speed of response impacts on supply and demand, which, in turn, reflects on profits and losses. Researchers suggest that the ‘how’ rules be maintained, as should the boundary conditions; the priority of such rules; the timing of implementation; and, finally, the current rules of the product or service within the market. Vassell and Amin (2005) suggest that, even though the environment is complicated, the rules need to be simple to follow and implement.

Atomising is defined as the concentration of companies that focus on a narrow industry sector in order to achieve dominance. Research indicates that the greatest

gain appears to be attained from a narrow domain and to come about as the result of collaborating with supply-chain peers.

Networking exists when a large number of organisations work together as one, thus making them more valuable than if they were to work separately. In this way, a product or service is exposed to a potentially much larger customer base, as opposed to when marketing is carried out on its own.

Versioning, as previously described, is about offering a product or service at various price points, which helps to secure a business advantage. An example of versioning could be selling a motor vehicle as a base model, compared to selling another version of the vehicle, with a whole range of additional features, such as electric windows, central locking and more. Another example could be that of a vehicle cleaning service offering to wash and vacuum a vehicle, while additional services at a higher price could include deodorising, polishing and engine steam cleaning. A strategy of providing free samples could also assist an organisation to reach its critical mass sooner than without such offers, whereby it could become the dominant player in the field.

Vassell and Amin (2005) identified the ongoing strategy of disruptive change in which the leadership of an organisation changes hands or merges periodically. Organisational change of their strategy as a result of such factors as merging, new ownership, increase in competition, and decrease in supply could influence customers to switch to new suppliers.

The fact that customers are always at the centre of all effective strategies is key to considering the implementation of a customer-centered strategy (Vassell & Amin, 2005).

Lowering the reaction time to respond to opportunities and threats in business, and being proactive in response to time-sensitive business opportunities can also support competitive advantage. Sluggish response to opportunities can lead to costly decision making. Understanding what customers need and how to provide a product or service before one's competitors do could impact on the sustainability of an organisation.

2.3.2.3 Proactive Action

'Zero latency', a term coined by the Gartner group in 1998, is defined as "the enterprise strategy to speed up the flow of information and business processes to achieve a competitive advantage", (Nguyen, Schiefer & Tjoa, 2005). Such a process can be secured by way of IT solutions and database mechanisms, based on the event–condition–action (ECA) sequence and data warehouses (DWs). Real-time data warehousing (RTDW) introduced real-time automatic data updates to the DW, improving response time. Automated systems response time results in the prevention of non-service delivery. These factors have resulted in organisations becoming more proactive in their marketing, enabling them to be dominant and strong business competitors. Such proactiveness can be facilitated by means of business intelligence or artificial intelligence, which entails the use of systems to provide ready access to necessary information.

Chen, Chen and Faulkner (2005) suggest that an organisation should maximise its decision-making capabilities by means of implementing a fully integrated enterprise system. The way in which to achieve this is by ensuring that enterprise-level information systems planning precedes all detailed system design. Increasing system automation and improving system control requires the integration of IT resources and enterprise data, which may provide the background for artificial intelligence. An improvement in the efficiency and effectiveness of business operation support adds to the ability and capacity to support management decisions.

2.3.2.4 Resources

Grid computing consists of all IT systems working together as one 'super computer'. Such computing makes computing processor power, a resource that is not fully utilised, available. In terms of this type of computing, batch jobs are run at night, when more computing processing power is needed. In this way, multiple stand-alone PCs (personal computers) can be networked together to create one large super-computer, thus allowing for the optimal sharing of resources, an improve utilization of IT resources and improved ROI.

The question of how to acquire IT skills and resources most economically affects many aspects of an organisation. Due consideration must be given to the question of whether all or part of the IT service should be handed to specialised suppliers, or be maintained in-house. Substantial cost savings can be generated if the correct approach is taken. Roy and Aubert (2002), in answer to the above, point out that many view IT as a key component of any organisation that makes its resources readily available to the market. Another critical competitive advantage offered by keeping IT skills in-

house is the years of experience in the field gained by the organisation in this way, with such crucial competencies helping to ensure its long-term competitiveness.

The outsourcing of IT functionality can lower the potential of business to innovate. Motivated and loyal IT staff cannot be purchased on a daily basis by organisations. Specialised and new ideas that require action in support of business generally have financial implications impacting on the firm's profitability. To build capability and capacity takes time. The local knowledge of in-house developers can produce solutions much more easily and speedily. By possessing such knowledge, staff can make a sustained contribution towards the attainment of competitive advantage.

However, outsourcing would be appropriate for non-strategic activities. The higher the strategic value of an asset or resource, the more justified a company is in preserving and maintaining the specific skill and service to itself. The presence of strategic resources is based on two factors: strategic value and presence value (see Figure 5).

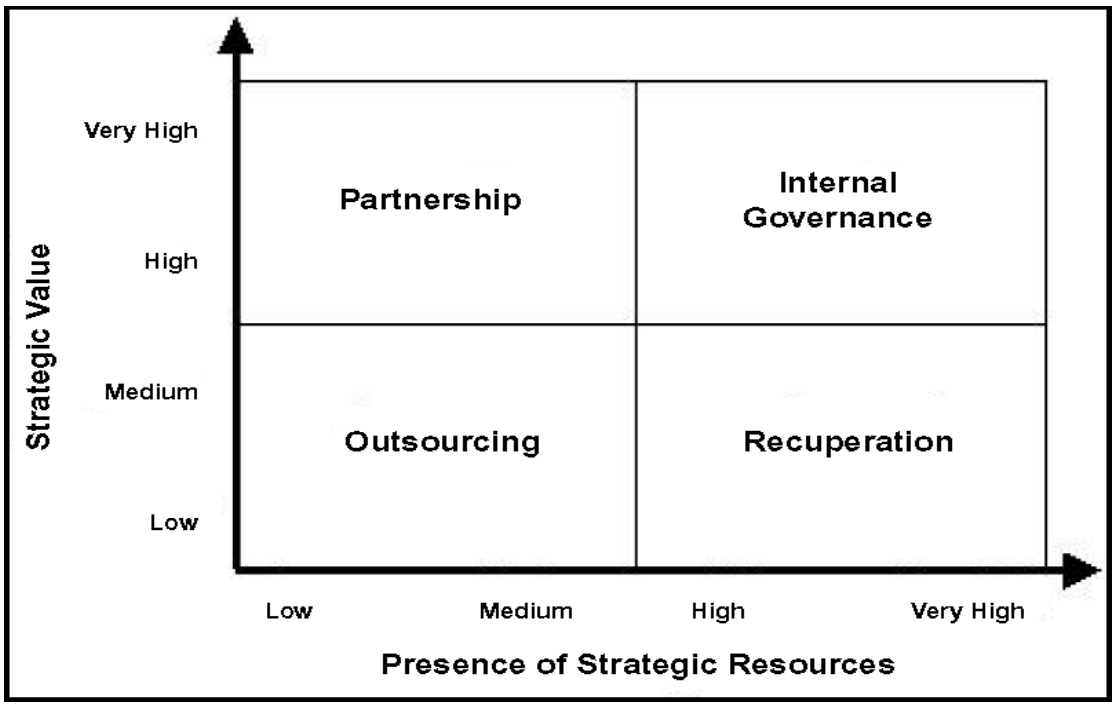


Figure 5: Strategic value and presence of resources (Roy & Aubert, 2002:32)

Making decisions concerning resources should be based on how valuable the resource is to the organisation. Such value can be linked to the competitive advantage role that it is able to play within the organisation.

2.3.2.5 Total Quality Management

As the value of IT in supporting business has gained general acceptance, the quality of service delivery must be maintained and continually improved within the set IT service delivery expectations. The total IS quality methodology needs to be understood within the basic principles of total quality management (TQM). Stylianou and Kumar (2000) suggest that Total IS quality is multidimensional, including: infrastructure; software; data information; administrative quality; and service quality. Such dimensions make up the enterprise quality model (see Figure 6).

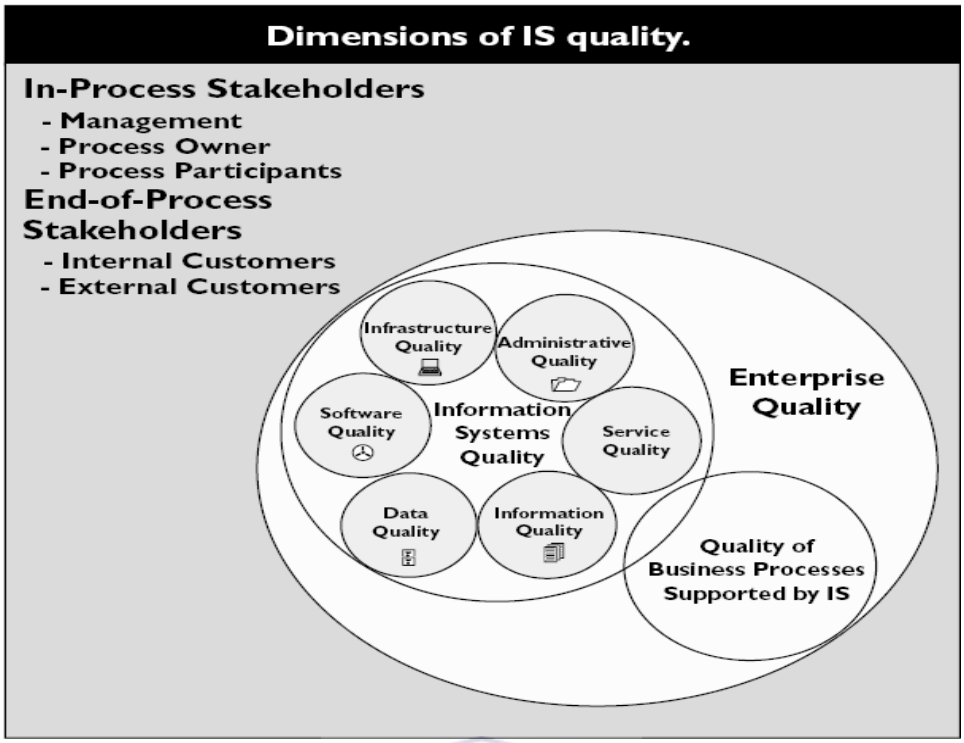


Figure 6: Dimensions of IS quality (Stylianou & Kumar, 2000:100)

Service quality should be a priority that is implemented at the start of any project planning. Given well-designed business processes and well-integrated IT components, the quality of IS delivery depends on maximising the impact of products and service, for which it will receive due credit in its being judged, trusted, and accepted more readily by business management.

Various perceptions of quality are based on the relative importance of specific dimensions and attributes. Stylianou and Kumar (2000:102) note that "with the decision-making authority taken away from the IS area, the responsibility for the quality of those processes should rest entirely with the customer. In reality, however, the perception remains that IS, is somehow still responsible."

In instituting a TQM programme, lessons should be learnt both from past successes and failures in the following areas:

- customer focus;
- process approach;
- leadership;
- broad participation and teamwork;
- the motivating of staff;
- training;
- product / service measurement and constructive feedback;
- accountability for results and the rewarding of achievements; and
- self-assessment.

In collaboration with BPR, EA can fulfil its promise to assist an organisation to achieve its goals and objectives. Galliers (1993) previously discussed the period beyond achieving competitive advantage by way of the implementation of IT strategies, questioning whether the advantage that was gained in this way was planned or merely accidental. Change in business processes, as impacted by IT development, brought about opportunities, such as requirements for different types of staff and skills required to support business by means of IT. The soft changes brought about in this way provided growing opportunities for organisations either to maintain their competitive advantage or to become more competitive.

Christiaanse (2005:95) states that "[a] new era in the B2B [business–to–business] marketplace will be driven by network-level optimization offering many advantages over point-to-point relationships for vendors and customers." Christiaanse suggest

that a marketplace that provides collaborative services will represent 40 to 50 per cent of revenue and create the most value within and outside organisations. IOSs, such as those of electronic data interchange (EDI), have enabled organisations to collaborate with one another and to exchange information more timeously and efficiently. EDI may provide an advantage over competitors who have not yet accepted the need to adopt such an approach to conducting B2B transactions. The ability quickly to deploy integrated solutions involving many business partners while keeping costs down holds much in store, with the real benefit of trading by way of the collaboration of back-end systems not being fully realised and costs not being reduced.

Data exchange, proprietary rights and the confidentiality of information are all factors of concern to organisations that wish to collaborate. Such issues will take time to be resolved. How to obtain competitive advantage if all organisations are on the same footing is also problematic. Ferratt *et al.* (1995:139) suggest that benefits can be obtained by a group of participants making use of collaborative architectural solutions. Technical challenges may be solved through such collaboration, with the focus being placed on business competitive advantage opportunities. Costs can be reduced by way of data sharing, while customers reap the benefits as a result of improved focus area service and products.

2.3.3 Business advantage summary

Many business competitive advantages have been identified and discussed so far in this study, including the alignment of IT and business that strengthens the direction of organisational strategy in achieving its business vision and goals. IT and business should complement each other and function as one cohesive unit to achieve such

objectives. A well-planned organisational strategy needs to be present to underpin successful business processes.

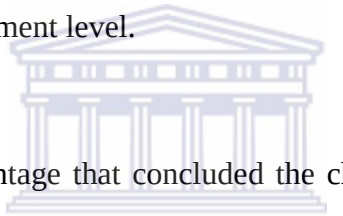
The strategy of the organisation should be used to determine which technology to select. Appropriate decisions made during planning, derived from the availability of information, could, in turn, decrease the reaction time taken to respond to opportunities and threats. Information management is important to astute decision-makers, not only for management, but also for business intelligence or artificial intelligence systems that can respond proactively to situations based on the delivery of timely, correct and appropriate information. Collaboration on resources and technology internal to an organisation leads to the breakdown of silos. External collaboration between business organisations can greatly enhance competitive advantage for business by reducing redundancy. Research has also determined that, not only is such advantage experienced on a business level, but, more importantly, the customer will ultimately reap the rewards of such collaboration.

2.4 Chapter summary

Starting by reviewing the different types of architecture and how they support the competitive advantage of a business, this chapter concluded that architecture is a valued component when designing a business solution. The collective architecture that manages organisational objects is EA, with the sub-architectures being business; information; application; software; and technical architecture. SOA was found to be a style of multi-tier computing that assists organisations in sharing data and logic among multiple applications and usage modes. A key factor of SOA is that the various services that work together to make up SOA do not directly depend on each

other. SOA can also be considered as a collection of best practice principles, including the standardisation of workflows; translation co-ordination; orchestration; collaboration; loose coupling; business process modeling; and other concepts that support agile computing. Maximising ROI by using existing services is identified as a critical success factor. TCO is reduced by removing duplicate services.

Regarding strategic factors, alignment between IT and business features was found to be most strong amongst successful organisations. Such alignment may serve to bridge the divide between IT and business, maximising the enabler and minimising the inhibitors. The result is improved communication, knowledge sharing and strategic planning at executive management level.



The review of business advantage that concluded the chapter showed that proactive decision-making may be achieved through making information available. Collaboration between IT and business prevents the creation of silos. Collaboration by external businesses, even when they are from different market sectors, may lead to their assisting each other to provide better customer service delivery.

The next chapter will cover the research design and the preparation of the measuring instrument, aimed at gathering data to test the hypothesis.

CHAPTER THREE

3. Research methodology

3.1 Introduction

The objective of this study is to understand the role of IT architecture within organisations, as well as the factors that support competitive business advantage. The need for organisations to be competitive and to create and maintain a business advantage within their specific environs is investigated. A research instrument will be designed and used to explore the role of IT architecture and its strategic function, together with factors such as the alignment of IT with business, by way of joint strategic planning, communication and top management support. These components all contribute to the experience of business advantage.

The survey conducted for this study took place between July and August 2006 across different industries, with the respondents comprising junior to executive IT and business management. Participants were invited via e-mail to participate in the survey. The research instrument used was an online questionnaire that gathered the quantitative data.

The qualitative survey that followed gathered more in-depth information concerning the topic of research. Conducting the survey also provided interviewees with the opportunity to express their attitudes and beliefs and to obtain a deeper understanding of attitudes relevant to the study. Interview sessions were scheduled and open-ended questions were posed in order to gather qualitative data.

3.2 Research instrument

Online surveys have become a more cost-effective method for collecting data, with the time needed for collecting data being relatively short (Couper, 2000; Madge, 2004). The instrument (see Appendix 3) requested relevant demographic details (Frick, Bachtinger and Reips, 1999) and consisted of 11 items to which there are three dimensions: architecture; strategic factors; and business advantage. The questions were developed from the previously described literature study (see Appendix 1). Excluding the questions asked in the demographical details section, all other questions had to be completed prior to the final submission of the questionnaire. In this way, only useable data was gathered by way of every questionnaire completed. The individual items focused on key factors specific to each dimension, of which each was operationalised using the Likert Scale (Burgess, 2001:24). Respondents had to rate each question using a six-point response rating scale. A seventh option of 'statement not relevant' was included for each question.

Potential participants in the survey were invited by e-mail, which included a cover letter (see Appendix 2). Couper (2000), Andrews, Nonnecke and Preece (2003) recommend that, in order to increase the response rate, a cover letter be sent to the sample population, as well as follow-up reminder e-mails. The invitational e-mail included the abstract of the research proposal, providing the potential respondent an opportunity to gain further insight into the research topic. The estimation of how long it would take to complete the survey (10 minutes) was also provided. A log-in ID and password was supplied to each participant for personal access to the survey. Appropriate telephone calls were also made to improve the response rate.

Two software packages, namely the **S**tatistical **P**ackage for **S**ocial **S**ciences (SPSS) Version 14.0 and Microsoft Excel 2003, were used for the analysis of the quantitative data gathered. The statistical analysis of the data was descriptive.

The survey data was held in a database which made it easier to code and download. After downloading the responses, the data was imported into SPSS. On completion of this process, the data was purified, with all missing data being replaced by the mode of each item. Data analysis and frequency tables were drawn from within this application.

Once the frequency tables were produced using SPSS, the results from the rating scales were added and the totals were recalculated into percentages and graphically presented using the spreadsheet graph functionality.

3.3 Pilot survey

The pilot survey forms the last step in a research design, consisting of the process of testing the viability of a questionnaire using a small sample before starting on the main survey. By detecting any inadequacies in the instrument used (Mansfield, 2005:185), an opportunity is provided for the correction of any defects. Such a test run can reveal unanticipated problems that might be encountered with question wording or completion instructions.

In order to evaluate the reliability and validity of the questionnaire used in this survey, a pilot test was conducted with 10 respondents. Comments and suggestions about the instrument were received and assessed. The question completion times were recorded, being found to be between 7 to 10 minutes. The time taken to complete the questionnaire can help determine whether the respondents understand the questions and whether the questions are eliciting useful answers. After the elision of one question from the questionnaire the main survey was administered. The question "What decision-making authority do you have?" was omitted as no significant value was obtained by way of this question in relation to factors supporting business advantage. The pilot sample selection was a time-efficient approximation of the truth.

The method of determining sample size contains an element of random sampling. When very large population groups are identified, it is often difficult or impossible to identify every member of the population, so that the pool of available subjects tends to be biased. The random selection was drawn from among potential respondents on a mailing list of which the current researcher was a member.

Compiling a list of potential respondents resulted in the identification of a total of 160 potential respondents.

3.4 Likert scale

The Likert scale is a rating scale that is frequently used in the social sciences, which can be applied to gather data on attitudes, perceptions, values or behaviour. The rating scale is designed to elicit information about some qualititative attribute. The objective of such a scale is to enable the development of a method for assessing the number of choices given to a respondent (Munshi 1990). Six- to seven-point scales are most common (Jacoby & Matell, 1971). A six-point Likert scale was chosen for the purposes of this study in order to encourage respondents to avoid taking a 'neutral' position. Ensuring the assuming of a specific position in relation to questions asked is recommended by Kendall (2006). Accordingly, the rating scale from 'strongly agree' to 'strongly disagree' was applied (see Table 3).

Table 3: Rating scale

Strongly agree	Agree	Mildly agree	Mildly disagree	Disagree	Strongly disagree	Statement not relevant

3.5 Reliability

A Cronbach's α (alpha) reliability test was conducted on each of the set dimensions. The model of internal consistency, based on the average inter-item correlation, was determined using the scale of reliability. The coefficient α as a general rule should be > 0.7.

Cronbach's α is defined as

$$\alpha = \frac{N}{N-1}\left(\frac{\sigma_X^2 - \sum_{i=1}^{N}\sigma_{Y_i}^2}{\sigma_X^2}\right)$$

where *N* is the number of components (items), σ_X^2 is the variance of the observed total test scores, and $\sigma_{Y_i}^2$ is the variance of component *i*. Coefficient α can take values between 1 and minus infinity (although only positive values make sense). Where coefficient α = 1, all items are perfectly reliable and the *N*-item test correlates well with the true scores.

3.6 Validity

Reliability is concerned with how well the survey data can be reproduced. The idea of a reliable survey is that each time that the same survey is administered with a similar distribution and sample population roughly the same result should be obtained (Kitchenham & Pfleeger, 2002).

Validity, in contrast, focuses on how well the instrument measures what it is supposed to measure, and on whether it measures what it is designed to measure. According to Judd, Smith and Kidder (cited in Yang, Jun & Peterson, 2004), content validity can be ensured by an expert who reviews the measuring technique used and who decides whether it will measure what it is intended to and whether all point have been considered. Validity is a subjective assessment of how appropriate an instrument appears to be to the reviewers during the pilot survey.

3.7 Bias

The impact of researcher bias during the administration of a questionnaire is of importance to any study that employs such a method of data collection. A researcher develops a survey aimed at obtaining specific results. The instrument used may inadvertently be biased, meaning that the wording of the questions is constructed in such a way that desired results are obtained. Kitchenham and Pfleeger (2002:20) suggest that bias can influence answers by unduly influencing the way in which a question is asked; the number of questions asked; the range and type of response categories; and the instructions given to respondents. These researchers further suggest that bias can be avoided by developing neutral questions; by taking care to use wording that does not influence the way in which a respondent thinks about the problem; by asking enough questions to adequately cover the topic; by paying attention to the order of questions (so that the answer to one does not influence the response to another); and by using clear instructions.

Non-response bias may result in a respondent not having sufficient information to answer a particular item or in a respondent refusing to answer the survey as a result of too little time or a failure to understand the subject matter (Mohadjer, Bell & Waksberg, 1994:7). Notwithstanding the possible bias that may occur when gathering data, online survey research is an acceptable method of data collection. With a growth in internet access and usage, access to the instrument is minimised, thereby reducing non-response bias.

Online bias may be introduced as a result of all respondents replying to the same questionnaire under similar conditions such as at their own convenience and in

privacy. As the sample population in the current study are all managers, this introduces a degree of bias. However, interviewer bias is minimized due to his physical absence from the interview situation. The respondents may, accordingly, feel more at ease and likely to express what they truly think in response to the answers. They may also answer in their own time. Online surveys are less expensive than offline ones, as the cost of travel and postage usually far exceeds that of e-mail in the former.

3.8 Quantitative analysis

In quantitative research, features are classified and counted, with statistical models being constructed to explain what is observed. Lynch (1983:462) suggests that quantitative data exists in the form of numbers that can be counted, with the possibility of generalising findings to a larger population. Direct comparisons can be made between two or more corpora,[1] as long as valid sampling and significance techniques have been used. Thus, quantitative analysis allows discovery of which phenomena are likely to be genuine reflections of the behaviour of the frequency and rarity of particular phenomena, and thus of their relative normality or abnormality. Quantitative instruments are, therefore, structured by nature. Quantitative approaches have one reality, which is created by dividing and studying the constituents of an entity. This data also generally seeks verification or proof of hypotheses (Maykut & Morehouse, 1994).

[1] A collection of texts, spoken and/or written, designed and compiled based on a set of clearly defined criteria.

3.9 Qualitative analysis

The literature shows that use of both quantitative and qualitative data is a sound and commonly used method of gathering data. In terms of the use of a quantitative method, the classification of data in a structured manner would help to explain what is observed in the results of the data gathered. The results of qualitative data might give the researcher an alternate view of the research undertaken than otherwise might have been obtained from the literature review or from quantitative research into the same topic.

A qualitative study usually depends on inductive reasoning processes to interpret and structure the meanings that can be derived from data. Thorne (2006:68) states that qualitative data can be obtained from transcripts of open-ended, focused, and exploratory interviews. By conducting interviews, the qualitative researcher seeks to recognise an in-depth understanding of the thoughts, opinions and attitudes of the sample population identified. In the current study, such an understanding relates to the support granted by IT architectural factors to business advantage.

The supplementary interviews for the current study were conducted by the same researcher in person, with each interview lasting between 40 and 75 minutes. Open-ended questions were compiled, based on the quantitative instrument that corresponded to the dimensions of the questionnaire. The sequence in which questions are asked in order to assess core issues is important to any interview.

A list of questions was sent to all interviewees as preparation for the interview (see Table 4). Structured, open-ended interviews containing a standardised list of questions were conducted for each interviewee in order to create the same stimulus (Patton, 2003:7).

Table 4: Qualitative questions

1. Initial Open-ended Question Give your view on the following statement: The use of IT is fully exploited by business. Qualify your reasoning.
2. Architecture Should the IT development be driven from a research and development (R&D) point or should business always be the driving force, pushing the limits of IT in a structured manner to support the business needs of the organisation?
3. Strategic Factors One of the key relations that exists between IT and Business is that of alignment. How can such alignment be achieved?
4. Business Advantage In the context of using IT as a strategic tool to achieve a competitive advantage: **a.** Should technology first be considered, in regards to its use of how to achieve the competitive advantage or business processes being modified (Business Process Re-engineering: BPR), with the role of IT in supporting those processes then being considered? **b.** Collaboration can be explored from both a technology and a business perspective. What is your opinion of such a statement? Qualify your reasoning.

3.10 Research summary

This chapter discussed the composition of the research instrument, which consisted of four sections. An indication was given of how much time the instrument took to complete and the extent to which the questionnaire was made available. The data analysis using SPSS and Microsoft Excel 2003 were also discussed. The chapter then described how the pilot survey was conducted and how the questionnaire was amended prior to the administration of the main survey. The Likert scale consisted of six points, with a seventh containing a 'statement not relevant' option. The Cronbach's α, reliability and validity were discussed. A review of researcher, non-response and online bias provided the motivation for using an online survey. Quantitative analysis can be used to generalise findings to a large population. The use of supplementary qualitative analysis was illustrated. This approach provided information that could not be gathered during the quantitative analysis process. An overview of the questions posed during the interviews was then presented. The chapter concluded with the motivation behind using both methods of research.

The next chapter presents the analysis of the data gathered by the research instrument. It describes the interviews conducted during this study and concludes with a discussion of the findings.

CHAPTER FOUR

4. Data analysis and discussion

In this section the results are presented of both the quantitative and qualitative data. Tables and graphs are used to represent the data, with quotes from the interviewees obtained during the interviews also included.

4.1 Quantitative results

The expected response rate, as indicated by Bureau for Social Research (2006) and Powell and Dent-Micallef (1997), indicated that the expected percentage of usable responses would be between 25–30%. The research survey instrument used actually achieved a 34.38% response. Of the 160 e-mails sent out as invitations to participate in the online survey, 55 responses were received. The 65.62% that did not respond might have been due to certain e-mail address no longer being valid, or spam filters resulting in the invitation not having been received, or the topic of research is of little or no interest, or the potential respondents lacked sufficient time to participate in the study. A response from 4.38% of respondents indicated difficulties with website access. This may have been due to service provider network problems.

4.1.1 Demographic details

Answering the demographic items was not compulsory, with the result that not all items were answered. Assessing demographic information at the beginning of a questionnaire can reduce the drop-out rate and may lead to the collection of more complete demographic data about the participants. Such a positive effect can be reached without bias (Frick *et al*., 1999).

The following demographic data was gathered by means of the survey conducted (see Table 5).

Table 5: Demographic details

Item #	**Question**
Item1	Organisational sector/industry
Item2	How long has your organisation been in operation?
Item3	How many years of experience do you have in your current career?
Item4	How many employees are there in your organisation?
Item5	Is your organisation operating nationally or internationally?
Item6	Which of the following best describes your role in the organisation?
Item7	What is your age?
Item8	In which department do you work?
Item9	How long have your been employed at this organisation?
Item10	What is your highest level of education?
Item11	In which field are you educated?

Item1: Organisational sector/industry

This study did not focus on any one specific type of organisation. This result is found in Table 6. The leading three sectors consist of education, IT and consultancies, which are represented by 29.1%, 20% and 18.2% of 55 respondents, respectively.

Table 6: Organisational sector/industry

Organisational sector/industry	Frequency (n=55)	Percentage
Education	16	29.1
Information Technology	11	20.0
Consultancy	10	18.2
Manufacturing	4	7.3
Customer Service	3	5.5
Banking	2	3.6
Communications	2	3.6
Property	2	3.6
Export	1	1.8
Finance	1	1.8
Marketing	1	1.8
Media	1	1.8
Transportation	1	1.8
Total	**55**	**100.0**

Although no specific industry type was targeted, Education, IT and Consultancy organisations were largely represented, a combined representation of 67.3%.

Item3: Incumbent years of experience in current career

The years of experience that respondents have may reflect the attitude of how specific questions relate to the three dimensions of the study, with the results being presented in Table 7.

Table 7: Incumbent years of experience current career

Experience in years	Frequency (n=55)	Percentage
0–5	8	14.5
11–15	11	20.0
16–20	13	23.6
21+	9	16.4
Total	**55**	**100.0**

A significant group were those with 6 to 10 years experience (25.5%). As discussed earlier (see page 66 of the study), the years of experience of staff members could be considered as an enabler of business advantage. The boundary of the item represents the lowest results for this item, with those with more than 21 years and those with between 0 and 5 years consisting of 16.4% and 14.5% of 55 respondents, respectively.

Item6: Incumbent position in the organisation

The fact that the managerial position held by most interviewees may have an influence on the degree of support acknowledged is suggested as an enabler of business advantage.

Table 8: Incumbent position in the organisation

Position in organisation	Frequency (n=55)	Percentage
Executive Management	17	30.9
Management	16	29.1
Senior Management	14	25.5
Skilled	8	14.5
Total	**55**	**100.0**

Table 8 reflects that 85.5% of respondents had senior to executive management positions at the time of the study. A more even spread of data gathered was obtained with this item with the only significant representation being skilled respondents.

Item7: Incumbent age

Age may impact on the varying attitudes of respondents with regard to privacy issues (Lu, Yu, Liu & Yao, 2003). The understanding and acceptance of new concepts and technology may also vary between age groups. Risk-taking generally occurs in younger age groups.

Table 9: Incumbent age

Age in years	Frequency (n=55)	Percentage
0 (not answered)	4	7.3
46–50	16	29.1
36–40	13	23.6
41–45	10	18.2
30–35	9	16.4
51+	3	5.5
Total	**55**	**100.0**

Table 9 shows the highest age group, comprising 46 to 50 year olds, appeared to form the majority of the respondents. Of the respondents, 7.3% did not answer this question as it was not compulsory.

Item10: Incumbent level of education

The level of education may influence the level of motivation to progress. Warr and Birdi suggest that age and educational level were related to employees learning motivation.

Table 10: Incumbent educational level

Education level	Frequency (n=55)	Percentage
Degree	21	38.2
Diploma	14	25.5
Honours	8	14.5
Matric	4	7.3
Masters	4	7.3
Certificate	3	5.5
Doctoral	1	1.8
Total	**55**	**100.0**

Table 10 is ranked on the frequency of education level and shows that most respondents had a tertiary-level qualification. What can be noted also is that 23.6% of respondents have a postgraduate qualification namely Honours, Masters or Doctoral.

4.1.2 IT Architecture

The Cronbach's α on this dimension showed 0.73 (see Table 11). The reliability of this dimension was internally consistent (Cronbach, 1951), and is, therefore, accepted.

Table 11: Architecture reliability statistics

Cronbach's alpha	No. of items
0.73	5

The data analysis of these questions (see Table 12) on this dimension indicates the positive attitude expressed that IT architecture plays a major role in the design and planning of solutions to support business advantage.

Table 12 : Questions regarding the architectural dimension

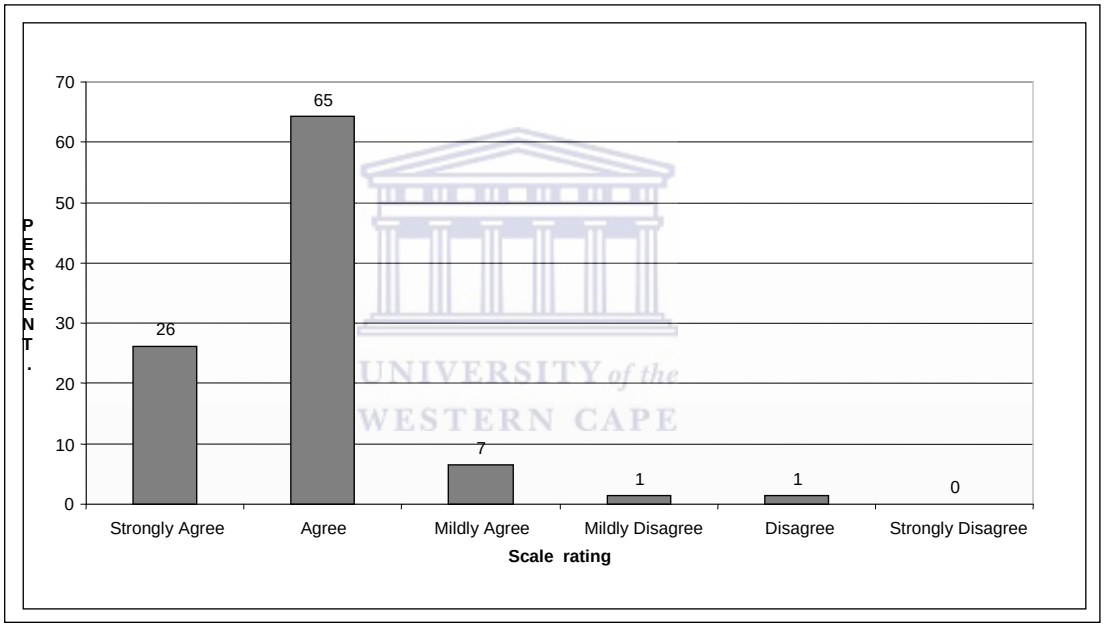
Item #	**Question**
Item1:	Too much effort is spent on technology as opposed to providing the architectural solution.
Item2:	Unified modeling language provides a suitable base for defining profiles for formally modeling software architecture.
Item3:	Software architecture must be driven by decisions during design time, not during run-time.
Item4:	Architect and implementation version control is not important and is a nice to have.
Item5:	The earlier in the project a defect is discovered, the cheaper it will be to fix.

Table 12 lists the 5 items of the architectural dimension of the instrument. The data gathered was analysed and an overall attitude of this dimension is presented in Table 13 and Graph 1: Architecture.

Table 13: Architecture - Overall response (Items1 – 5)
(n=55)

	Item1	Item2	Item3	Item4	Item5	Percentage
Strongly Agree	21	7	16	15	13	**26**
Agree	29	39	36	36	37	**65**
Mildly Agree	4	6	1	2	5	**7**
Mildly Disagree	1	1	1	1	0	**1**
Disagree	0	2	1	1	0	**1**
Strongly Disagree	0	0	0	0	0	**0**
Total	55	55	55	55	55	**100**

Graph 1: Architecture - Overall response (Items1 – 5)
(n=55)



The numeric and graphic representation of the data clearly indicates that architecture is an important component in organisations. 91% of respondents strongly agreed or agree. Surprisingly, 2% disagree or mildly disagree. Possibly, the respondents did not understand the question.

Item1: Planning the architectural solution first

The first item of this dimension of the research suggests that the architectural solution must be achieved first. The data gathered indicate that architecture is important. It can therefore be concluded that architectural planning must first be undertaken before developing an appropriate business solution.

Table 14: Planning the architectural solution first

	Frequency (n=55)	Percentage
Strongly Agree	21	38.2
Agree	29	52.7
Mildly Agree	4	7.3
Mildly Disagree	1	1.8
Total	**55**	**100.0**

Table 14 shows the results gathered and supports and the literature survey that suggests that more attention should be paid to architecture before a technology solution is developed. A positive attitude from all respondents was obtained of this item. 1 respondent mildly disagreed to this statement. There is no clear indication to this response other than to possibly conclude that the question could have been misunderstood.

Item2: Unified Modeling Language to formally model software architecture

Unified Modeling Language (UML) is a standardised language used to create an abstract model of a system. This open standard is used to maintain a structured approach in the developing an architectural business solution as discussed earlier on page 22.

Table 15: Unified Modeling Language to formally model software architecture

	Frequency (n=55)	Percent
Strongly Agree	7	12.7
Agree	39	70.9
Mildly Agree	6	10.9
Mildly Disagree	1	1.8
Disagree	2	3.6
Total	**55**	**100.0**

The data gathered in Table 15 indicate that a structured and standardised approach is best. 83.6% of respondents agree or strongly agree. A possibility for 5.4% of respondents who mildly disagree or disagree is that UML does not completely satisfy the structural and behavioural requirements for describing software architectures from a runtime perspective.

Item3: Decisions made during design time.

Architecture could be considered as a high level QA leverage point, as discussed on page 31.

Table 16: Decisions made during design time

	Frequency (n=55)	Percentage
Strongly Agree	16	29.1
Agree	36	65.5
Mildly Agree	1	1.8
Mildly Disagree	1	1.8
Disagree	1	1.8
Total	**55**	**100.0**

The results of Item 3 indicate that 65.5% of respondents agree that architectural decisions are driven during design (see Table 16). This item relates to quality assurance management where strategic decisions are made that directly relate and could impact the business solution. The correct decision made here, will result in a more clear understanding of what the architecture will be. A further 29.1% of respondents strongly agree.

Item4: Version control

Apart from the actual task of designing the architecture of an organisation, the ability to record the architecture versions must be ensured. When business requirements change, the architectural solution is therefore modified. The version change from the previous architecture has to be recorded and was discussed earlier as version control. The architecture is an evolving document consisting of many versions, hence the need for version control.

Table 17: Version control

Version control	Frequency (n=55)	Percentage
Agree	1	1.8
Mildly Agree	1	1.8
Mildly Disagree	2	3.6
Disagree	36	65.5
Strongly Disagree	15	27.3
Total	**55**	**100.0**

Table 17, shows the result of item 4. The question was negatively worded, resulting in a negative attitude being observed in 65.5% of the respondents. This result indicates that version control is a favourable component to have for architecture and software development.

Item5: Early defect detection

Item 5 of this dimension clearly reflects the very positive attitude that QA is definitely required to ensure that solutions are developed with as few defects as possible from the architectural phase of development (see Table 18).

Table 18: Early defect detection

	Frequency (n=55)	Percentage
Strongly Agree	13	23.6
Agree	37	67.3
Mildly Agree	5	9.1
Total	**55**	**100.0**

The data gathered on this question was the only item on which all respondents reflected a completely positive attitude, showing that they all felt that the dimension of architecture does support business advantage.

4.1.3 Strategic factors

This dimension consists of 10 items (see Table 20) presented in the second part of the instrument. The Cronbach's α for this dimension was 0.78 (see Table 19).

Table 19: Strategic factors reliability statistics

Cronbach's alpha	No. of items
0.78	10

Table 20: Questions regarding strategic factors

Item #	**Question**
Item1:	One enabler of IT and business alignment is the support from non-IT executives.
Item2:	IT applications are best led by all line managers who thoroughly understand the business situation which the applications are intended to support.
Item3:	Strategic alignment of IT exists when a business organisation's goals and activities are in harmony with the information systems that support them.
Item4:	The degree of alignment can be measured by the existence of IT and business systems from the point of view of the organisation's managers and the business process's executors.
Item5:	The ability to identify the enabler and inhibitors is a key factor in helping organisations improve processes.
Item6:	An organisation that has available resources does not necessarily have to be negatively affected by new product competition.
Item7:	Possessing resources will, by default, place an organisation in a more competitive advantageous position.
Item8:	A better understanding of your competitors is valuable when making a decision based on their competitive moves.
Item9:	It is necessary for IT executive management to be inclusive of non-IT initiatives.
Item10:	Cross-functional education to merge IT and Business Concepts to second-year students is a good place to introduce the alignment of IT and Business.

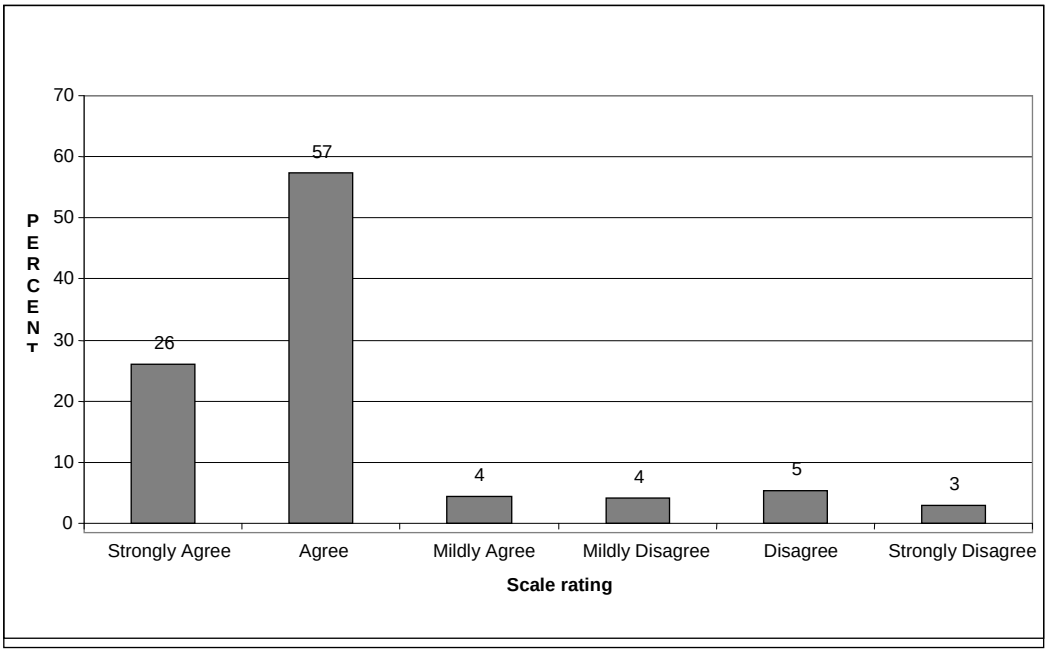
The positive attitude expressed by respondents reflected that strategic factors, such as alignment and communication, as discussed earlier, support business advantage. The highest rating for this dimension was that 57% agree, with the second highest group, 26%, strongly agreeing. The rest of the respondents, amounting to 4%, mildly agreed, with the balance of 12% not completely sharing this view.

Table 21: Strategic factors- Overall response (Items1 – 10)
(n=55)

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	**Percentage**
Strongly Agree	17	15	29	17	18	2	6	21	8	10	**26**
Agree	30	35	23	33	35	34	17	29	36	43	**57**
Mildly Agree	2	1	0	4	0	11	0	0	5	1	**4**
Mildly Disagree	2	2	1	1	1	3	9	1	2	1	**4**
Disagree	1	1	2	0	1	5	11	4	4	0	**5**
Strongly Disagree	3	1	0	0	0	0	12	0	0	0	**3**
	55	55	55	55	55	55	55	55	55	55	**100**

Table 21 quantitatively shows the data gathered for this dimension. On the evaluation of item1, three respondents strongly disagreed, which was possibly due to the fact that a negative association was made with IT executives. However, the question may also have been misunderstood. Although an overall positive attitude is observed, attention to item7 and the spread of its results indicate that resources may be a very topical subject for discussion. Item7 deals with resources which consist of components discussed earlier, see page 53 and 66.

Graph 2: Strategic factors- Overall response (Items1 – 10)
(n=55)



A graphical presentation (Graph 2) clearly shows the importance of strategic factors that support business advantage. More detailed findings of this dimension are presented below.

Item1: Non-IT executive support

One of the key business issues is the alignment with IT. Alignment can be improved by better communication between business and IT, and by the sharing of strategic plans and information. Such alignment may also bridge the gap between business and IT (see page 35). In order to survive the turbulence experienced by both business change and technological progress, opportunities and threats constantly present themselves to management.

Table 22: Non-IT executive support

	Frequency (n=55)	Percentage
Strongly Agree	17	30.9
Agree	30	54.5
Mildly Agree	2	3.6
Mildly Disagree	2	3.6
Disagree	1	1.8
Strongly Disagree	3	5.5
Total	**55**	**100.0**

The results of Item1 shown in Table 22 of this dimension reflect that 85.4% of respondents agreed or strongly agree that the alignment of IT and business is an enabler that supports business advantage and which must be supported by the non-IT executives. Interestingly, note that 5.5% of respondents strongly disagree. These respondents may be of the opinion that IT matters should remain within the control of the IT executive. IT executives could feel that they may lose that control should non-IT executives have an influence in IT matters.

Item2: Business management understanding the IT environment

A further factor in support of business advantage is the understanding of IT by business managers, which may enable managers to improve their business processes by making full use of technology.

Table 23: Business management understanding the IT environment

	Frequency (n=55)	Percentage
Strongly Agree	15	27.3
Agree	35	63.6
Mildly Agree	1	1.8
Mildly Disagree	2	3.6
Disagree	1	1.8
Strongly Disagree	1	1.8
Total	**55**	**100.0**

The results in **Table 23** of this dimension reflect that 63.6% of the respondents agreed that the line managers needed to know more about IT, which knowledge would, in turn, enable managers to make more informed decisions.

Item3: Strategic business and IT alignment

A good architecture should bridge any gap existing between business and IT. Item 3 of this dimension is related to this vision. The architectural maturity and alignment can facilitate the harmonisation of business with IT management. Alignment can serve to build the relationship between business processes, applications, information and technology.

Table 24: Strategic business and IT alignment

	Frequency (n=55)	Percentage
Strongly Agree	29	52.7
Agree	23	41.8
Mildly Disagree	1	1.8
Disagree	2	3.6
Total	**55**	**100.0**

Table 24 reflects that 94.5% of respondents agree or strongly agree that alignment must exist between IT and business when their activities are in harmony in order to achieve organisational vision and goals.

Item5: The identification of enablers and inhibitors

It is important to identify enablers and inhibitors that may contribute to the alignment or misalignment of business and IT.

Table 25: The identification of enablers and inhibitors

	Frequency (n=55)	Percentage
Strongly Agree	18	32.7
Agree	35	63.6
Mildly Disagree	1	1.8
Disagree	1	1.8
Total	**55**	**100.0**

Item 5 of this dimension reflects that 96.3% of respondents agree or strongly agree (see Table 25) that, aligned IT and business function more effectively as a single cohesive unit, as earlier discussed (see page 39). A thorough understanding of the business environment by IT management is thus an important factor that supports alignment. It has a positive effect on delivery and budget may be experienced and the support granted by IT to business could directly affect business advantage.

Item6: The availability of resources

The availability of resources to strategically respond to competitors can largely affect the survival of commercial organization. The lack of appropriate resources at the most opportune time may allow an organization to response to any competitive attacks resulting in the organization to not be negatively affected.

Table 26: The availability of resources

	Frequency (n=55)	Percent
Strongly Agree	18	32.7
Agree	35	63.7
Mildly Disagree	1	1.8
Disagree	1	1.8
Total	**55**	**100.0**

Table 26: **The availability of resources** show a positive attitude of 96.4% of respondents who agree or strongly agree. No reasonable conclusion can be made to why 3.8% of mildly disagree or disagree. A possibility can be that they may have misunderstood the question

Item7: Possessing resources makes an organisation more competitive

Staff may be regarded as an organisation's greatest asset. Upskilling the technical knowledge of employees is an enabler of organisational factors (see page 51). Such upskilling has great value for an organisation's potential to grow and remain competitive. Ensuring that resources are maintained, whether human or other may benefit an organisation. However, the data gathered on the issue does indicate that a business advantage may not completely depend on having such resources available.

Table 27: Possessing resources makes an organisation more competitive

	Frequency (n=55)	Percentage
Strongly Agree	6	10.9
Agree	17	30.9
Mildly Disagree	9	16.4
Disagree	11	20.0
Strongly Disagree	12	21.8
Total	**55**	**100.0**

The results of item 7 on this dimension indicate that 41.8% of respondents agree or strongly agree with this statement (see Table 27). If the outer limits of this item are recalculated, 41.8% respondents also strongly disagree or disagree, perhaps indicating that IT resources can successfully be outsourced. There are varied opinions on this topic. The results obtained for this item indicate a larger spread of the attitude compared to the clustering seen in other results. The spread of the data for this item could afford more deliberation. The impact of the availability of resources could be significant. Having resource available not being utilized optimally or not having resources when most needed and are not available will negative impact an organization. The reserve will therefore have a positive influence. A clear understanding of the organization environment, the purpose and availability of resources will be required to enable the success of an organization. This understanding will determine how resources will be managed. As discussed earlier, (see page 68 and Figure 5) resources are required based on the strategic value and presence value. Because organization have varied strategies, such a generic question to a sample population of many organizations, with considering these factor as mentioned, a reasonable spread of responses should be anticipated.

Item8: Understanding your competitors

Understanding competitor behaviour is of value to management in that it enables a proactive response to opportunities and threats (see page 56). The motivation to respond is based on the fact that the competitor's moves may have an impact within the market sector that could threaten the organisation's current market share position.

Table 28: Understanding of competitors

	Frequency (n=55)	Percentage
Strongly Agree	21	38.2
Agree	29	52.7
Mildly Disagree	1	1.8
Disagree	4	7.3
Total	**55**	**100.0**

Table 28 shows that 90.9% of respondents agree or strongly agree that value lies in understanding an organisation's competitors when making decisions.

Item9: IT executives' inclusive of business decision-making

Strategic planning (in the form of interaction between business and IT by way of formal planning sessions) is a factor that may support business advantage. Such joint planning sessions will ensure that competitive advantage does not occur by accident. Lessons can be learnt during review workshops, which form part of TQM (see page 70). Clarity on vision and objectives can be attained during planning sessions, which have been identified as a fundamental task required to be undertaken during architectural design. Strategic planning directly impacts on alignment.

Table 29: IT executives' inclusive of business decision-making

	Frequency (n=55)	Percentage
Strongly Agree	8	14.5
Agree	36	65.5
Mildly Agree	5	9.1
Mildly Disagree	2	3.6
Disagree	4	7.3
Total	**55**	**100.0**

As shown in Table 29 the results support the view that IT executives should participate in non-IT initiatives, with 80% of respondents agreeing or strongly agreeing that such participation should take place. It is uncertain why 10.9% disagree or mildly disagree.

Item10: Cross-functional education

Although the introduction of cross-functional education is an established concept, the literature review undertaken indicates that the idea of introducing a business management course into a formal IT qualification is relatively new. The alignment of IT with business may take place relatively sooner.

Table 30: Cross-functional education

	Frequency (n=55)	Percentage
Strongly Agree	10	18.2
Agree	43	78.2
Mildly Agree	1	1.8
Mildly Disagree	1	1.8
Total	55	100.0

As indicated in Table 30, 96.4% agree or strongly agree. As discussed earlier, see page 46 the data gathered supports this strategic factor.

4.1.4 Business advantage

This dimension achieved Cronbach's α of 0.85 (see Table 31). The positive attitude of respondents agreed that business advantage is supported by architecture and the enabling strategic factors. The highest rating of this dimension is that 61% of the respondents agree, with the second highest group (20%) strongly agreeing to this dimension. The results of the questions (see Table 32) for this dimension are presented in Table 33 and Graph 3.

Table 31: Business advantage reliability statistics

Cronbach's alpha	No. of items
0.85	6

Table 32: Questions regarding the business advantage

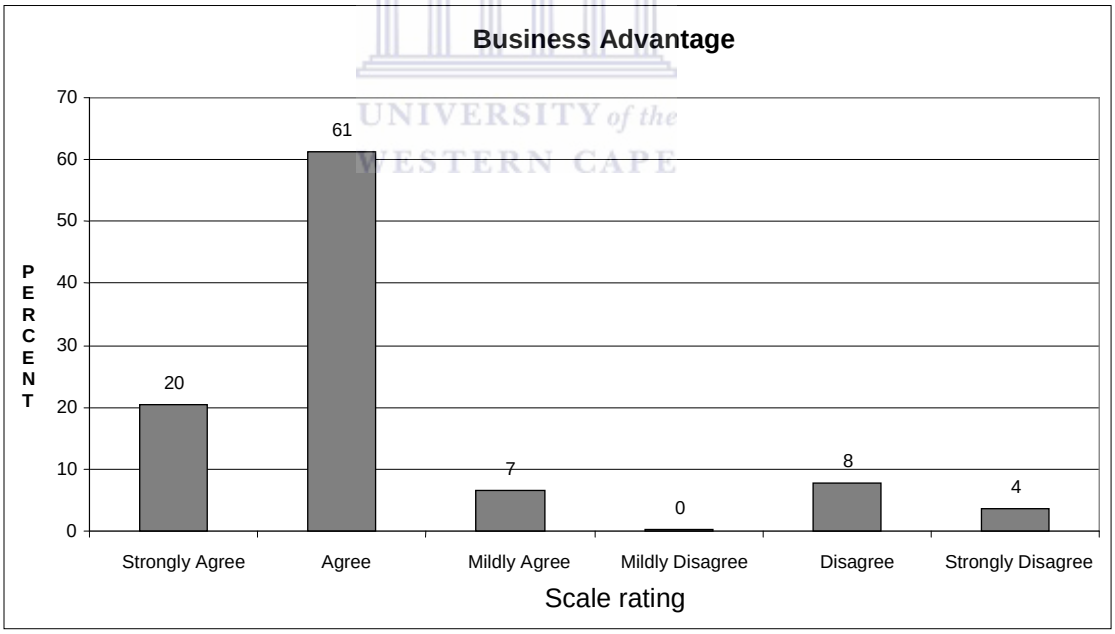
Item #	Questions
Item1	Competitive advantage cannot be claimed solely on the use of superior technology.
Item2	IT by itself is a weapon for maintaining competitive advantage.
Item3	The appropriate interpretation of management information is more important than is the quantity of information amassed specifically for developing strategies.
Item4	It is important to be proactive in responding to exceptional situations and in taking advantage of time-sensitive business opportunities.
Item5	The IT department is simply a cost centre and organisations can outsource all their IT services.
Item6	TQM programmes have a significant impact on organisational competitiveness.

Table 33: Business advantage- Overall response (Items1 – 6)
(n=55)

	Item1	Item2	Item3	Item4	Item5	Item6	**Percentage**
Strongly Agree	14	4	12	14	13	10	**20**
Agree	38	10	40	40	33	41	**61**
Mildly Agree	2	11	1	0	6	2	**7**
Mildly Disagree	0	0	0	0	0	1	**0**
Disagree	1	20	2	1	1	1	**8**
Strongly Disagree	0	10	0	0	2	0	**4**
n =	55	55	55	55	55	55	**100**

Table 33 shows the set of items related to this dimension. The data for Item 2 has a greater spread of responses and show negative attitude. Based on this finding, IT can therefore not be the single factor for maintaining competitive advantage.

(n=55)



Graph 3: Business advantage

Graph 3 shows the overall attitude of this dimension. 81% of respondents agree or strongly agree with the items listed of this dimension to support business advantage. The respondent may be able to identify additional business advantages

and therefore responded with a negative attitude. This graph shows that 12% disagree or strongly disagree.

Item1: The use of superior technology

In changing business environments, the survival of organisations depends to some extent on agility and adaptability. Organisations that employ IT enjoy an advantage by adopting superior technology that supports the business efficiently and effectively. The strategic alignment of IT and business could improve the overall organisational performance.

Table 34: The use of superior technology

	Frequency (n=55)	Percentage
Strongly Agree	14	25.5
Agree	38	69.1
Mildly Agree	2	3.6
Disagree	1	1.8
Total	**55**	**100.0**

As indicated in Table 34, the use of technology that is more advance will create and maintain business advantage. 94.6% of respondents agree or strongly agree. This view is closely related to item4 of this dimension in that, being proactive to identify new and improve technologies before competitors do, will keep the organization ahead of the competition. Although a positive attitude is obtained, caution may be advised due to acting to soon with the view to be leaders may result in unexpected results. An example could be that of the WAP technology introduced in the late 1990's. This technology did not produce the expected ROI and had an organization over-invested in this technology sector, losses may have been incurred.

Item2: IT as a weapon

When IT is used to support the business's core strategies for success it can be an enabler of the achievement of competitive advantage. Though IT provides the critical spark to transform business processes into competitive advantage, such transformation may not depend on it. Innovation and invention or re-invention should take place continually in all areas for competitive advantage to endure.

Table 35: IT as a weapon

	Frequency (n=55)	Percentage
Strongly Agree	4	7.3
Agree	10	18.2
Mildly Agree	11	20.0
Disagree	20	36.4
Strongly Disagree	10	18.2
Total	**55**	**100.0**

Table 35 shows a bit more of a spread within the data gathered. The results indicate that 36.4% (the highest response) of respondents disagree that IT is not a weapon that support business advantage. Apart from the strongly agree response the rest of responses show a close response variance. The purpose of IT is to support business process and improve, where required to do so. With this in mind IT is therefore not the "Silver Bullet" that will ensure business success.

Item3: Appropriate interpretation of information

In order to make decisions, credible information is more important than the quantity of information acquired. This information is used by decision-makers to be either reactive to competitive attacks or proactive to opportunities or threats. It is

therefore important to interpret information appropriately as opposed to amassing huge quantities of information .

Table 36: Appropriate interpretation of information

	Frequency (n=55)	Percent
Strongly Agree	12	21.9
Agree	40	72.7
Midly Agree	1	1.8
Disagree	2	3.6
Total	**55**	**100.0**

Table 36 shows that 94.6% of respondents agree or strongly agree. We find ourselves living in an environment where information is transported along networks at alarming volumes. A possibility for the negative attitude for this item might be due to the misunderstanding of the question.

Item4: Proactive response to opportunities

Targeting customers with a specific product or service can make use of specific web-based technology, such as profiling, by deploying business intelligence systems. Valuable information obtained from these systems can enable organisations to be proactive, and to take advantage of opportunities, thus preventing the loss of revenue or market share.

Table 37: Proactive response to opportunities

	Frequency (n=55)	Percentage
Strongly Agree	14	25.5
Agree	40	72.7
Disagree	1	1.8
Total	**55**	**100.0**

The data in Table 37 reflect the importance of being proactive in responding to potentially advantageous opportunities. Only one respondent disagreed with the statement. No significant demographic information could explain such an unusual response, with which 72.7% of the respondents. The concept of 'Zero Latency' (Nguyen, Schiefer & Tjoa, 2005), positively contributes to business processes that drive competitive advantage. To decrease the response time when reacting to customer needs impacts the resultant sustainability. Limiting responses to time-sensitive opportunities may cause customers to look elsewhere where their service expectations are not met.

Item5: Outsourcing of IT services

The likelihood of resources providing a business advantage largely depends on the effective utilisation of such resources. The results of item 5 indicate that 83.6% of respondents disagree or strongly disagree with the statement (see Table 38).

Table 38: Outsourcing of IT services

	Frequency (n=55)	Percentage
Strongly Agree	13	3.6
Agree	33	1.8
Mildly Disagree	6	10.9
Disagree	1	60.0
Strongly Disagree	2	23.6
Total	**55**	**100.0**

Furthermore, IT resources and skills are becoming more critical with regard to the skill level required. Internal competencies ensure long-term competitiveness within organisations. Motivated and loyal IT staff take time to develop. Organisations may incur large costs by importing specialised services that might otherwise have been

secured through in-house development. Local knowledge could produce the same services delivered with lower costs, which would have an impact on the organisational profitability. That the contribution of staff to business advantage may be of great value is supported by the data gathered, as indicated above.

Item6: Total quality management (TQM)

A fairly logical approach can be followed where organisations can remain in business by providing quality service or products. The basic principles of TQM must be maintained to deliver products that satisfy quality standards, that are on time and that are within budget. The practice of TQM does positively contribute to the trust displayed by business towards IT and their ability to deliver as required, which impacts on the alignment of business with IT that, in turn, supports business advantage.

Table 39: Total quality management

	Frequency (n=55)	Percentage
Strongly Agree	10	18.2
Agree	41	74.5
Mildly Agree	2	3.6
Mildly Disagree	1	1.8
Disagree	1	1.8
Total	**55**	**100.0**

In Table 39, 92.7% of the respondents agree or strongly agree TQM can significantly support business advantage. Less respondents, 3.6% mildly disagree or disagree that TQM may support business advantage. TQM is more of a task, it

should be considered part of the process to ensure that the best is delivered from documenting a concept through to the final delivery of the product or service.

4.2 Qualitative results

This section presents the results of the interviews conducted. A correlation is made between the findings presented in the literature reviewed and the direct comments of the interviewees. The verbatim comments are presented in italics.

A broad summary of relevant interview responses are presented and the findings are categorised in the three dimensions presented throughout the study. The majority of responses are selected based upon the most common words used to express the interviewees' thoughts and opinions.

Table 40: Qualitative questions

1. Initial Open-ended Question The use of IT is fully exploited by business.
2. Architecture Should the IT development be driven from a research and development (R&D) point or should business always be the driving force, pushing the limits of IT in a structured manner to support the business needs of the organisation?
3. Strategic Factors One of the key relations that exists between IT and Business is that of alignment. How can such alignment be achieved?
4. Business Advantage In the context of using IT as a strategic tool to achieve a competitive advantage: **a.** Should technology first be considered, in regards to its use of how to achieve the competitive advantage or business processes being modified (Business Process Re-engineering: BPR), with the role of IT in supporting those processes then being considered? **b.** Collaboration can be explored from both a technology and a business perspective. What is your opinion of such a statement? Qualify your reasoning.

Table 40 lists the qualitative questions presented (repeated from page 83).

Question1: Initial Open-ended Question

In response to this first question interviewees generally felt that IT was not being fully exploited, and consequently business has not reaped the full benefits possible. This view was further motivated by suggestions that business managers need to more clearly understand technology. They would then know where and when IT could best be utilized. This aspect has been dealt with earlier in this document (see

page 37). As one interviewee commented, "*Business must understand technology to make an impact on [its] usefulness…*".

This point was further elaborated. Business, said some respondents, needs to drive IT. Business should use technology to improve processes, not just build IT products, especially not merely for the sake of technology. One interviewee felt that it was the responsibility of business management to motivate IT, seeking constantly to improve their support abilities.

In order for IT to be fully exploited a need for continued training was identified. As one interviewee noted, "*IT is of great value but worth very little if ongoing training is not maintained*".

Finally to conclude discussion on this question, when addressing quality assurance, one interviewee stated, "*There needs to be a measuring-tool to measure the full use and exploitation IT against the maximum capacity available*".

Question2: Architecture

For an effective business each process and its requirement should be mapped to an enterprise component that relates to a single or, possibly, to several closely-related business processes. The processes then expose a set of high-level services that exist on the component's interface. One interviewee made mention that the functions of business and IT need to be integrated in specialist areas (identified earlier in this document as the EA).

The qualitative research investigated EA and found strong support for it during the interviews. One senior manager believes *"Business and IT should engage with each other and plan [their competitiveness] strategically."*

Developed solutions are justified by the value they add to business profitability and market share. This view is supported by comments suggesting that provision be made for checks and balances within planning, to ensure that product delivery and business expectations are met. The systems that are developed to support business are all integrated and should function as one cohesive unit to underpin the organisational vision and goals. A common view exists that the EA should serve as the key resource, comprising of people, processes and technology.

Organisations have to be sensitive to the rapid pace of technological advance. Planning should take place within shorter time periods. Short- to medium-term planning is required in preference to excessive long-term planning. Effective long-term planning is rarely possible given the speed of technological advances.

The need for effective interdepartmental communication was strongly supported by most interviewees. Communication between IT and business, and between business and the customer, who is the end-user of technology, was also strongly recommended. Although the use of technology can be complicated, a relatively simple approach would enable everyone to benefit from advances in, and the employment of, technology.

The implementation of ongoing quality control fosters accountability, and engenders a responsible attitude of staff towards their day-to-day functions. This is evident in an organisation that chooses to exploit IT to the full.

Organisations may present themselves as leaders and pioneers when deploying technological products**.** An example of such deployment is seen in Internet banking security, with the concomitant danger of potentially exposing confidential information over wide area networks (WANs).

Trying to achieve, support and maintain business advantage does create a paradox: business cannot operate without IT, and IT cannot survive without business, especially where R&D is concerned. One respondent (a company director) suggested that a distinction be made between the concepts of business, IT and R&D. Business must drive IT. IT in turn should support business. R&D must be focused on the business domain. Such mutual co-operation could directly benefit the business, improving its advantage in this way. R&D also identifies possible opportunities or threats.

The interviewees generally expressed the belief that business imperatives should be the driving force behind all strategic planning and decision-making. They viewed IT as being a tool – never the driving force behind business decision making.

Business needs must be analysed first. IT executives, as part of this process, should encourage IT alignment with business strategies in order to support the latter, as and when required. Overall, the business vision is the focal point of all strategic decisions. As stated by one interviewee, *"business should drive business"*. A business may operate within the specific guidelines of the business model. Such a model has to be flexible enough to adapt to change and influence from both internal business requirements and external environments.

Question3: Strategic Factors

Qualitative responses provided several ideas on how IT can be utilised efficiently and effectively. The basic underlying tone, however, is a call for consistency. Insights were provided into how human and IT resources should be viewed as assets by the organisation. Staff are educated on an ongoing basis maintaining their skills level. One interviewee suggested, *"IT solutions can be of great value but are worth very little if ongoing training is not part of the equation."* The blurred lines between IT and business can be removed if alignment is achieved through joint strategic planning sessions, as discussed before (see page 38).

Although many examples of strategic factors that support business advantage have been discussed many respondents shared a common view: Strategic factors are influenced by the business type; the size of business; its geographical position; the

target market; and other parameters. These factors will always vary in the amount of attention that they require. One interviewee indicated that ROI could be quantified to justify expenditure. However, return on value (ROV), in his opinion, should also be achieved. ROV (such as company value) is more difficult to measure due to its lack of tangibility.

Again, alignment and communication enable staff to produce what is needed within required quality standards. They would then not have to redo substandard work due to misunderstandings and ambiguities.

One common response was that alignment should be driven from the top down. As one business manager stated: *"There must be a top-down approach, from executive management"*. Effective alignment begins at the executive level and proceeds down the organisational hierarchical tree.

In order for a business to survive, one respondent (an independent financial advisor) believed that a small business should grow its IT infrastructure at the same pace as the business grows. One owner suggested that *"Small business should be prepared for the day they become part of the greater business community, and small business can grow its IT infrastructure organically. The more the business grows, the greater the IT presence should grow"*.

Most of the interviewees felt that larger organisations made better use of IT than their small to medium counterparts. One business owner has observed that the smaller the business, the smaller the IT budget, and the larger the organisation, the

larger the IT budget, even on a comparative percentage basis. Financial resources, as discussed before on page 55 and 57, are one important strategic factor. The effective deployment of these resources is important. An example of budgeting was seen as follows: a small business might have an IT budget of 10% of the total expense budget, while a large company might have an IT budget of 40% of its total expense budget.

The same level of IT may not be currently required by all businesses, however, if the use of IT can be encouraged as a benefit improving financial performance and reducing the TCO, a definite contribution to business advantage is possible.

Question4: Business Advantage (a)

One business advantage comes from forward-thinking staff who are operating in an environment where their skills are maintained at a high level. The anticipation of competitive behaviour can be managed where organisations are proactive and take advantage of opportunities presented. To profit from such opportunities business process re-engineering may be required.

Many of the qualitative observations are consistent with those described in the literature. For example, as one interviewee remarked, "*Organisations must maintain the ability to be proactive and be prepared for when a big boom does hit that business or market sector. Small business, especially, should not be caught off-guard, as the bigger business will be more than able to seize this opportunity and possibly kill off any competition. Small business should know the limits of its*

resources, but be proactive, and this state of readiness must be maintained – however, not to the detriment of the organisation's cash flow ability".

Other advantages include business providing improved products and/or services to customers. Improved RAS (see page 2) can also be maintained.

Where joint strategic planning is done by executive management, buy-in is achieved from the beginning of new projects. Such buy-in may improve the likelihood of the project succeeding. Many advantages noted by the interviewees were similar to those identified in the literature, all being conducive to enhancing business advantage.

Question4: Business Advantage (b)

As regards collaboration, the predominant response was that IT and business do not collaborate enough. Collaboration is still very much inwardly-focused within organisations, though this was not the intended direction of the question. One interviewee elaborated on his suggestion that "we should not live in a box" by saying that the world is moving at such a fast pace that there will always be ample room for new growth and opportunities.

4.3 Summary

This chapter began with an analysis of demographic details. A total of 160 invitations were sent out, to which 55 responses were received. Education (29.1%), IT (20%) and consultancies (18.2%) were the industry types most strongly represented.

Regarding the first dimension of architecture, the data gathered identified that 90% of respondents agree or strongly agree with the statements made. The results concur with the findings explored in the literature that architecture is important with regard to the design and planning of solutions. The next dimension dealt with alignment, inhibitors and enablers as factors supporting business advantage. 85.4% of the respondents reflected a positive attitude towards strategic factors supporting business advantage. The data gathered in regards to the final dimension of the instrument also showed a generally positive attitude. 81% of respondents agree or strongly agree with the items listed in the dimension that business advantage is supported by a sound architecture, by IT and business alignment and by the enablers of organisations.

The qualitative data obtained identified that EA can integrate IT and business functions. Solutions are justified by what value they add to business success. A consistent view was identified in that staff must also be regarded as assets to organisations, with ongoing training being provided to improve the skill level. The larger an organisation, the more widespread the IT presence observed. The advancement of technology happens fast and organisations should plan carefully with respect to their IT strategy. With increasing exposure to the internet, online security of information has to be ensured by the service providers involved. Though R&D is necessary, the focus should be on the core business of the organisation to be of more value. The alignment of IT with business has to be driven all the way from top management down to the operational staff. As small businesses start up and expand, strategy must be adopted that prepares them to

improve their use of IT. Although collaboration between different organisations was discussed in the literature, most interviewees associated collaboration with internal partnerships between departments within the same organisation.

The next and final chapter will conclude this study with recommendations as to the research described here.

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CHAPTER FIVE

5. Conclusions and recommendations

This chapter concludes the research project, draws conclusions and makes recommendations based on the findings of the study.

This study set out to explore IT architecture and strategic factors that support business advantage. Businesses today succeed or fail, based on their ability to maintain business advantage. This study addressed the following three related questions:

1. What roles does IT architecture play in achieving business objectives?
2. What are the strategic factors that contribute to the alignment between a business and its IT?
3. What are the business advantages achieved by such alignment?

An empirical, qualitative and quantitative study was conducted.

The hypothesis was formulated with the intention of accepting the null hypothesis. The research data gathered tested the hypothesis and a plausible explanation and conclusion is given in support of the acceptance of the null hypothesis:

H1: IT architecture enhances the competitive advantage of business.

5.1 The first dimension: Architecture

Coverage of this dimension explored the role of IT architecture. The coverage consisted of five items that determine the attitudes of the sample population. Quantitative data showed that effective architecture positively contributes towards the planning of business objectives. Architecture is the plan that contributes to the organisation's vision and goals, making it necessary to first design an architecture before developing a business solution. A structured approach is best followed when designing architecture. A sound architecture is required for systems and processes to operate effectively within rapidly changing business and technologies. A reasonable conclusion can be made that architecture can also assist in maintaining a plan in support of a business solution.

A number of architectures were discussed, which are collectively referred to as EA. Each of these architectures (business; information; application; software; and technical) are managed independently, though they work together as one cohesive unit. A good EA, therefore, ensures that the correct relationships are maintained between architectures.

SOA is an approach that entails the breaking down of a large problem into smaller manageable components that ultimately address the final solution. A key factor of SOA is that the various services that work together to make up SOA do not directly depend on each other for their functioning. ROI, in terms of the use of current services in which investment has already taken place, was identified as one of the critical success factors. TCO is, therefore, reduced by preventing the duplication of services.

The architecture can therefore be seen to improve the planning process. The early identification of risks may reduce the possibility of failure and lower costs by allowing for the early detection of defects.

Further, output of the approved architectural design may provide the high-level QA leverage point. The result encountered for item 5, early defect detection, on this dimension completely agrees with such a statement, with confidence being expressed in QA as a practice far in advance of any development taking place. Furthermore, an approved and accepted architecture could provide the QA necessary for development, which, in turn, may result in a quality product being developed that is within budget and possibly delivered before the due date of delivery. The findings of this study show that architecture forms a key component when implementing any solution ranging from the initial concept to the deployment of appropriate business solutions.

The positive attitude expressed on this dimension enables drawing of the conclusion that well-designed architecture positively supports business advantage.

5.2 The second dimension: Strategic factors

This dimension considered the strategic factors contributing to the alignment between business and IT, namely: alignment; communication; knowledge sharing; and joint strategic planning between business and IT. Though incomplete, this list, nevertheless, highlights some of the major factors concerned. The gap in alignment between business and IT must also narrow with time (see page 35). The data gathered from item 1 in this dimension clearly identifies the need for business

management to support IT strategies. When alignment takes place, the silos within organisations break down, contributing to staff adding further value to the organisation by exerting more effort. The factors discussed were also grouped into enablers and inhibitors, with the conclusion being drawn that enablers, such as communication, strategic planning, and sharing of information and knowledge, must be maximised and that inhibitors, such as miscommunication, lack of planning and unsuccessful leadership, should be minimised.

Business decisions should precede the choice of technology platforms, with the purpose of IT being to support business. The possession of vast amounts of information does not necessarily mean that all the information available is valuable to an organisation. The literature has noted that the management of information is critical when making time-sensitive decisions; therefore, the conclusion can be drawn that the correct tools must be employed to enable the gathering of valuable information, on the basis of which informed decisions can be made. As a direct result of competition, maintaining sound customer awareness can prove to be valuable, as knowing and understanding client behaviour can lead to the making of, informed decisions in relation to how resources can best be used when faced by competitor onslaught.

The literature and 57% of the respondents agree that the Strategic Factors identified in this study positively support business advantage. The expression of such an attitude was confirmed by the strong agreement of 26% of the respondents.

All the factors identified were found to contribute to the support of achieving business advantage in profit-driven and commercial organisations.

5.3 The third dimension: Business advantage

The business advantages achieved by ensuring a good architecture and positive strategic factors were lastly explored. The use of superior technology as a tool was found to contribute to business advantage, though technology was not asserted to be the single most important component. A reasonable conclusion is therefore that IT is regarded as a tool to be used and its main purpose is acknowledged as being to support business, not to drive it. Information about competitors proved to be of significant value when organisations needed to be proactive and to take advantage of prevailing opportunities or threats.

Staff retention is beneficial, as staff who do not move on to other organisations maintain the business knowledge that they have already accumulated within the organisation for which they work. Such staff can therefore, by means of their knowledge, add to the business advantage of their current employer, as opposed to taking their knowledge and skill elsewhere, helping to minimise the costs of having to replace staff. Financial resources can then be freed up for more effective use elsewhere, facilitating the expenditure of both time and effort on business strategy planning as opposed to replacing staff who could feasibly have been retained. With QA processes in place, the research shows that successful project delivery can be expected.

Technology has had a profound effect on how business is conducted, all the way through from the beginning of the production era to today's information age. Collaboration is of great value when geographical boundaries do not limit the potential size of the customer base. Technology, therefore, offers the possibility of breaking new ground and of new opportunities being discovered that can make organisations leaders in their respective fields of business.

Collaboration, as discussed in the literature review, indicates the need for attention and focus to be placed on customer service. Where less focus is placed on developing software solutions, more energy can be directed towards providing improved customer service or products, which is where the true focus should lie.

The data gathered (see Graph 3) showed a positive attitude in regards to this dimension, with 81% of respondents agree or strongly agree with the support of business advantages identified.

In conclusion, customers are both internal and external to an organisation, and should always be at the centre of strategic planning.

5.4 Summary

Architecture is a high-level plan for designing a solution. The literature review introduced the concept of EA, identifying a number of architectures that are managed separately, though they function as one cohesive unit within an organisation as part of the architectural business solution. The data gathered from the survey established the same attitude. The study confirmed that SOA prevents the duplication of services, with wide-ranging problems being resolved when broken down into their smaller individual components. Although not directly dependant on each other, such services function as part of the entire business solution. Finally, the critical success of SOA is ROI of services in which investment has already taken place. TCO is, in turn, reduced by cutting back on the duplication of services.

Business and IT alignment must be achieved and maintained for both to function as one cohesive unit. Such factors were identified as enablers that contribute to business advantage. The inhibitors that negatively support business advantage have also to be minimised. When business and IT are aligned, a positive effect on the organisational vision and goals is experienced and the support granted by IT to business may directly affect business advantage

The following business advantages have been identified and discussed in this study:

- The alignment of IT with business strengthens the direction of the organisational strategy aimed at achieving the vision and goals of the latter.
- A well-planned organisational strategy must be present in order to underpin successful business processes.
- Organisational strategy should determine what technology is selected.
- Business, therefore, prescribes the direction that IT has to follow in order to achieve the organisation's vision and goals.
- Proactive decisions can be made on the basis of valuable information and not on the accumulation of masses of potentially irrelevant information.
- The collaboration of resources and technology internal to an organisation may lead to the breakdown of silos within the latter.
- Collaboration externally between business organisations can greatly enhance the competitive advantage of a business by reducing redundancy.

IT and business should, therefore, complement each other and function as one cohesive unit in order to achieve such objectives. Research has also determined that not only is advantage experienced on a business level, but, more importantly, the customer will ultimately reap the rewards of such collaboration

The data gathered supports the conclusion that this study fails to reject the null hypothesis. A plausible and confident conclusion is deduced, with little doubt that IT architecture and strategic factors do support business advantage.

5.5 Recommendations

This study, which was limited to the geographical area of Cape Town, has addressed architectural and strategic factors in support of business advantage. As mentioned earlier, technology and the explosion of the internet can break down geographical barriers that may allow businesses to operate, irrespective of location. The sample population was not specific to any industry type, so that the views expressed by participants in this study might reflect too broad a view. Further research in this field could broaden the field geographically and not limit the sample population to one specific area alone, especially in light of the fact that the internet has worldwide range. By limiting future surveys to one type of industry, specific conditions prevailing within specialist industry types could be identified.

With time, if the same sample population were once more to be invited to complete the same questionnaire, a different response may be obtained, as the respondents acquire new knowledge that influences their opinions on certain subjects. An understanding of how to use pre-existing tools to cope with the current environment can assist future planning. Gaining access to such information could assist with decision making when dealing with legacy IT issues in support of the maintenance of business advantage.

Two relatively new areas have been identified that are open to further research , namely:

- collaboration between organisations; and
- SOA.

The null hypothesis posed in this study has been satisfied. However, the value of strategic factors that support business advantage could be investigated in finer detail in order to determine:

- what economic ROV is realised by employing a factor (such as communication) that supports business advantage; and
- how much alignment is obtained from joint strategic planning between business and IT as a result of improved communication.

The issue of collaboration might require additional in-depth study, which can possibly be defined within the context of where, when and how to collaborate. The question arises: How can collaboration between organisations be achieved in order to improve business processes, products and/or services?

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Appendix 1: Questionnaire compilation

Architecture			
	Source	**Page**	**Item**
1	Pace J.A.D and Campo M.R. (2005). "*ArchMate: From Architectural Styles to Object-Oriented Models through Exploratory Tool Support*." OOPSLA, 16 - 20 Oct 2005, pp. 117 – 132.	118	Over-much effort is spent on technology, as opposed to providing an architectural solution for a problem.
2	Oquendo F. (2006). "*Formally Modelling Software Architectures with the UML 2.0 Profile for π–ADL*", ACM SIGSOFT Software Engineering Notes, Vol. 31, No. 1, Jan 2006, pp. 1 – 13.	1	UML provides a suitable base for defining profiles for formally modeling software architecture.
3	Giesecke S., Warns T. & Hasselbring W. (2005). "*Availability Simulation of Peer-to-Peer Architectural Styles*", WADS, ACM, 17 May 2005, pp. 1 – 6.	3	Software architecture must be driven by decisions taken during design time, not during run-time.
4	Nistor E.C., Erenkraantz J.R., Hendrickson SA. & Van Der Hoek A. (2005). "*ArchEvol: Versioning Architectural-Implementation Relationships*", SCM 5-6 Sep 2005, pp. 99 – 111.	100	Architect and implementation version control is not important, being only a nice to have.
5	Dustin E. (2003). "*Effective Software Testing*", Addison-Wesley, Pearson Education, Boston, MA 02116.	4	The earlier on in a project that a defect is discovered, the cheaper it will be to fix.

Organisational factors			
	Source	**Page**	**Item**
1	Duedahl M., Andersen J. and Sein M.K. (2005). "*When Models Cross the Border: Adapting IT Competencies of Business Managers*", SIGMIS-CPR, ACM, Apr 2005, pp 40 – 48.	40	The support granted by non-IT executives is an enabler of IT and business alignment.
2	Duedahl M., Andersen J. and Sein M.K. (2005). "*When Models Cross the Border: Adapting IT Competencies of Business Managers*", SIGMIS-CPR, ACM, Apr 2005, pp 40 – 48.	44	IT applications are best led by all those line managers who thoroughly understand the business situation which the applications are intended to support.
3	Bleistein S.J., Cox K. and Verner J. (2005). "*Strategic Alignment in Requirements Analysis for Organizational IT: an Integrated Approach*", Symposium on Applied Computing, ACM, Mar 2005, pp 1300 – 1307.	1300	The strategic alignment of IT exists when a business organisation's goals and activities are in harmony with the information systems that support them.
4	Aversano L, Bodhuin T & Maria Tortorella. (2005). "*Assessment and Impact Analysis for Aligning Business Processes and Software Systems*", ACM Symposium on Applied Computing, pp. 1338 – 1343.	1340	An analysis of the degree of alignment exists between a business and IT system from the point of view of both the organisation's managers and the business process's executors.
5	Bateman N and Rich N. (2003). "*Companies' perceptions of inhibitors and enablers for process improvements activities*", International Journal of Operations & Production Management, Vol. 23 No. 2, pp. 185 – 199.	198	The ability to identify enablers and inhibitors is a key factor in helping organisations to improve their processes.

Organisational factors (cont.)			
	Source	**Page**	**Item**
6	Debruyne M, Frambach R.T, Moenaert R. (2006). "*Firm Resources: A Double-Edged Sword? Resources As Enablers And inhibitors Of Competitive Responsiveness*", Vlerick Leuven Gent Management School, Vlerick Leuven Gent Working Paper Series, Feb 2006. pp. 1 – 41.	9	An organisation that has resources available does not necessarily have to be negatively affected by new product competition.
7	Debruyne M, Frambach R.T, Moenaert R. (2006). "*Firm Resources: A Double-Edged Sword? Resources As Enablers And inhibitors Of Competitive Responsiveness*", Vlerick Leuven Gent Management School, Vlerick Leuven Gent Working Paper Series, Feb 2006. pp. 1 – 41.	9	The possession of resources will, by default, place an organisation in a more competitive advantageous position.
8	Debruyne M, Frambach R.T, Moenaert R. (2006). "*Firm Resources: A Double-Edged Sword? Resources As Enablers And inhibitors Of Competitive Responsiveness*", Vlerick Leuven Gent Management School, Vlerick Leuven Gent Working Paper Series, Feb 2006. pp. 1 – 41.	10	A better understanding of one's competitors is valuable when making a decision based on their competitive moves.
9	Pirani J.A and Salaway G. (2004). "*Information Technology Alignment in Higher Education*", Education Center for Applied Research, EDUCAUSE, Jun 2004, pp. 1 – 10.	8	It is not necessary for IT executive management to be inclusive of IT initiatives.
10	Wagner J, Boisvert D, Kuilboer J.P. (2005). "*Cross-Functional Concentrations Merge IT and Business Concepts*", SIGITE, 20–22 Oct 2005, pp 179 – 184.	179	Cross-functional education aimed at merging IT with business concepts for second-year students is a good place for introducing the alignment of IT and business.

Business advantage			
	Source	**Page**	**Item**
1	Kearns G.S and Lederer A.L. (2000).“*The effect of strategic alignments on the use of IS-based resources for competitive advantage*”, Journal of strategic Information Systems, 21 Jul 2000, pp. 265 – 293	270	Competitive advantage cannot be claimed solely on the basis of the use of superior technology.
2	Haque M, Garten K, Webb T. (2004). “*Using IT as a Competitive Weapon*”, Available from: http://www.umsl.edu/~lacity/oloralf04g3.ppt, [Accessed: 16 June 2006]	51	IT by itself can be used as a weapon for maintaining competitive advantage.
3	Vassell C and Amin N. (2005). “*A Meta Strategy for Electronic Commerce: A Twin Level Framework*”, ICEC, 15 - 17 Aug 2005, pp.139 – 144.	139	The appropriate interpretation of management information is more important than the quantity of information amassed specifically for developing strategies.
4	Nguyen T.M, Schiefer J, Tjoa A.M. (2005). “*Sense & Response Service Architecture (SARESA): An Approach towards a Real-time Business Intelligence Solution and its use for a Fraud Detection Application*”, DOLAP, 4 - 5 Nov 2005, pp. 77 – 86.	77	It is important to be proactive in responding to exceptional situations and to take advantage of time-sensitive business opportunities.
5	Roy V and Aubert B.A. (2002). “*A Resource-Based Analysis of IT Sourcing*”, The Data Base for Advances in Information Systems, Vol. 33, No. 2, Spring 2002, pp. 29 – 40.	30	The IT department is simply a cost centre and organisations can outsource all their IT services.
6	Stylianou A.C and Kumar R.L. (2000). “*An Integrative Framework for IS Quality Management*”, Communications Of The ACM, Vol. 43, No. 9, Sep 2000, pp. 99 – 104.	101	Total Quality Management (TQM) programmes have a significant impact on organisational competitiveness.

Appendix 2: Covering letter

11 July 2006

Thesis degree of Masters in Information Management in the Department of Economic and Management Sciences, University of the Western Cape

Dear Sir / Madam:

I am completing my Masters Degree and my research has brought me to the point of conducting a survey in which I would like to invite you to participate. This research covers IT Architectural Factors Supporting Business Advantage in our changing business environment we find ourselves in daily. To obtain a more in-depth view, I have attached my Masters Thesis Proposal: Abstract for you to read at your convenience.

There is no direct benefit to participating. However, the results of this survey could be of interest and value to your organisation.

It is estimated that the total amount of time spent on completing the questionnaire will be 10 minutes and be conducted from 01 July 2006 – 30 August 2006. Your participation in this survey is voluntary and should you choose to take part, your answers will be treated in confidence. Please feel free not to answer any questions that you may find intrusive.

If you have any queries about the questionnaire, please contact me. My contact details are as follows:

Tel : 021 959 3687 (Office)
Cell : 082 4425269
Email: dsissing@uwc.ac.za

Sincerely,

Donovan Sissing

Appendix 3: Instrument

Donovan Sissing: Masters in Information Management Thesis 2006 (MIM)

Introduction: This research questionnaire has 4 sections and should take approximately 10 minutes to complete.

1. Demographic Details: Required to group and analyse response into a more meaningful context.

The following sections can be answered by rating your answers to a response rating scale:

2. Architecture: This section covers the various architectures that directly or indirectly influence IT within organisations.

3. Strategic Factors: Questions in this section are aimed at what issues are to be considered that complement IT to make an organisation competitive.

4. Business Advantages: In this section we cover how we can use those factors to make a business more competitive.

Demographic details

Question 1

In which market sector / industry is your organisation?

Select an option

Question 2

How long has your organisation been in operation?

0 – 1 Yr	2 – 5 Yrs	6 – 10 Yrs	11 – 15 Yrs	16+ Yrs

Question 3

How many years of experience do you have in your current career?

0 – 5 Yrs	6 – 10 Yrs	11 – 15 Yrs	16 – 20 Yrs	21+ Yrs

Question 4

How many employees are there in your organisation?

Select an option

Question 5

What is the geographical coverage of your customer base?

Select an option

Question 6

Which of the following best describes your position in the organisation?

Select an option

Question 7

What is your age?

Select an option

Question 8

In which field of study are you educated?

Select an option

Question 9

In which department do you work?

Select an option

Question 10

How long have you been employed at this organisation?

○ 0 – 5 Yrs	○ 6 – 10 Yrs	○ 11 – 15 Yrs	○ 16 – 20 Yrs	○ 21+ Yrs

Question 11						
What is your highest level of education?						
○ Matric	○ Certificate	○ Diploma	○ Degree	○ Honours	○ Masters	○ Doctoral

Architecture							
This is a compulsory question.							
	Strongly agree	**Agree**	**Mildly agree**	**Mildly disagree**	**Disagree**	**Strongly disagree**	**Statement not relevant**
a. Too much effort is spent on technology as opposed to providing the architectural solution.	○	○	○	○	○	○	○
b. Unified Modeling Language provides a suitable base for defining profiles for formally modeling software architecture.	○	○	○	○	○	○	○
c. Software architecture must be driven by decisions during design time, not during run-time.	○	○	○	○	○	○	○
d. Architect and implementation version control is not important and is only a nice to have.	○	○	○	○	○	○	○
e. The earlier in the project that a defect is discovered, the cheaper it is to fix.	○	○	○	○	○	○	○

Organisational Factors							
This is a compulsory question.							
	Strongly agree	**Agree**	**Mildly agree**	**Mildly disagree**	**Disagree**	**Strongly disagree**	**Statement not relevant**
a. An enabler of IT and business alignment is the support from non-IT executives.	○	○	○	○	○	○	○
b. IT applications are best led by all line managers who thoroughly understand the business situation, which the applications are intended to support.	○	○	○	○	○	○	○
c. Strategic alignment of IT exists when a business organisation's goals and activities are in harmony with the information systems that support them.	○	○	○	○	○	○	○
d. The degree of alignment can be measured by the existence of IT and business systems from the point of view of the organisation's managers and the business process's executors.	○	○	○	○	○	○	○
e. The ability to identify the enabler and inhibitors is a key factor in helping organisations improve processes.	○	○	○	○	○	○	○

f. An organisation that has available resources does not necessarily have to be negatively affected by new product competition.							
g. Possessing resources will, by default, place an organisation in a more competitively advantagous position.							
h. A better understanding of your competitors is valuable when making a decision based on their competitive moves.							
i. It is necessary for IT executive management to be inclusive of non-IT initiatives.							
j. Cross-functional education to merge IT and Business Concepts for 2nd year students is a good place to introduce the alignment of IT and Business.							

Business Advantage							
This is a compulsory question.							
	Strongly agree	**Agree**	**Mildly agree**	**Mildly disagree**	**Disagree**	**Strongly disagree**	**Statement not relevant**
a. Competitive advantage cannot be claimed solely on the use of superior technology.	○	○	○	○	○	○	○
b. IT by itself is a weapon by which to maintain competitive advantage.	○	○	○	○	○	○	○
c. The appropriate interpretation of management information is more important than the quantity of information amassed specifically for developing strategies.	○	○	○	○	○	○	○
d. It is important to be proactive in responding to exceptional situations and in taking advantage of time-sensitive business opportunities.	○	○	○	○	○	○	○
e. The IT department is simply a cost centre and organisations can outsource all their IT services.	○	○	○	○	○	○	○
f. Total Quality Management (TQM) programmes have a significant impact on organisational competitiveness.	○	○	○	○	○	○	○

Thank you for participating in the survey.

Appendix 4: Quantitative results

Demographic details:

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11
Respond1	Education	16+ Yrs	0 – 5 Yrs	501 – 1000	International	Executive Management	46 – 50 Yrs	Other	IT	16 – 20 Yrs	Doctoral
Respond2	Manufacturing	2 – 5 Yrs	0 – 5 Yrs	51 – 100	International	Management	41 – 45 Yrs	Marketing	Marketing	0 – 5 Yrs	Degree
Respond3	Consultancy	6 – 10 Yrs	0 – 5 Yrs	0 – 50	International	Senior Management	41 – 45 Yrs	Computer Science	Other	0 – 5 Yrs	Degree
Respond4	Consultancy	6 – 10 Yrs	0 – 5 Yrs	0 – 50	International	Senior Management	41 – 45 Yrs	Computer Science	Other	0 – 5 Yrs	Degree
Respond5	Education	16+ Yrs	0 – 5 Yrs	501 – 1000	International	Management	46 – 50 Yrs	Management	Administration	16 – 20 Yrs	Masters
Respond6	Education	16+ Yrs	0 – 5 Yrs	1001 – 2500	International	Skilled	0 Yr	Engineering	IT	0 – 5 Yrs	Masters
Respond7	Education	16+ Yrs	0 – 5 Yrs	1001 – 2500	International	Skilled	0 Yr	Engineering	IT	0 – 5 Yrs	Degree
Respond8	Education	16+ Yrs	0 – 5 Yrs	501 – 1000	International	Management	46 – 50 Yrs	Management	Administration	16 – 20 Yrs	Masters
Respond9	Marketing	16+ Yrs	6 – 10 Yrs	501 – 1000	National	Executive Management	30 – 35 Yrs	Other	Marketing	11 – 15 Yrs	Diploma
Respond10	Customer Service	2 – 5 Yrs	6 – 10 Yrs	101 – 500	National	Senior Management	30 – 35 Yrs	Computer Science	IT	0 – 5 Yrs	Degree
Respond11	Customer Service	2 – 5 Yrs	6 – 10 Yrs	101 – 500	National	Senior Management	30 – 35 Yrs	Computer Science	IT	0 – 5 Yrs	Degree
Respond12	Export	11 – 15 Yrs	6 – 10 Yrs	501 – 1000	International	Senior Management	36 – 40 Yrs	Management	Marketing	6 – 10 Yrs	Degree
Respond13	Manufacturing	6 – 10 Yrs	6 – 10 Yrs	501 – 1000	National	Skilled	30 – 35 Yrs	Computer Science	IT	0 – 5 Yrs	Degree
Respond14	Education	16+ Yrs	6 – 10 Yrs	501 – 1000	International	Skilled	30 – 35 Yrs	Other	IT	0 – 5 Yrs	Matric
Respond15	Communications	6 – 10 Yrs	6 – 10 Yrs	501 – 1000	National	Executive Management	36 – 40 Yrs	Management	Marketing	6 – 10 Yrs	Diploma

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11
Respond16	Finance	16+ Yrs	6 – 10 Yrs	1001 – 2500	International	Management	36 – 40 Yrs	Finance	Finance	11 – 15 Yrs	Honours
Respond17	Information Technology	6 – 10 Yrs	6 – 10 Yrs	1001 – 2500	International	Skilled	30 – 35 Yrs	Computer Science	IT	0 – 5 Yrs	Diploma
Respond18	Consultancy	2 – 5 Yrs	6 – 10 Yrs	101 – 500	National	Management	30 – 35 Yrs	Engineering	Marketing	6 – 10 Yrs	Degree
Respond19	Education	16+ Yrs	6 – 10 Yrs	501 – 1000	International	Skilled	30 – 35 Yrs	Other	IT	0 – 5 Yrs	Matric
Respond20	Banking	6 – 10 Yrs	6 – 10 Yrs	2501 – 5000	International	Management	51+ Yrs	Finance	Finance	6 – 10 Yrs	Diploma
Respond21	Banking	11 – 15 Yrs	6 – 10 Yrs	2501 – 5000	International	Management	36 – 40 Yrs	Finance	IT	6 – 10 Yrs	Degree
Respond22	Information Technology	6 – 10 Yrs	6 – 10 Yrs	101 – 500	National	Executive Management	36 – 40 Yrs	Management	IT	0 – 5 Yrs	Degree
Respond23	Consultancy	11 – 15 Yrs	11 – 15 Yrs	101 – 500	International	Executive Management	46 – 50 Yrs	Computer Science	Administration	11 – 15 Yrs	Degree
Respond24	Media	6 – 10 Yrs	11 – 15 Yrs	501 – 1000	National	Senior Management	41 – 45 Yrs	Human Ecology	Marketing	6 – 10 Yrs	Honours
Respond25	Information Technology	6 – 10 Yrs	11 – 15 Yrs	101 – 500	National	Senior Management	36 – 40 Yrs	Computer Science	IT	0 – 5 Yrs	Degree
Respond26	Education	16+ Yrs	11 – 15 Yrs	1001 – 2500	International	Management	0 Yr	Other	IT	0 – 5 Yrs	Honours
Respond27	Information Technology	2 – 5 Yrs	11 – 15 Yrs	0 – 50	National	Senior Management	36 – 40 Yrs	Computer Science	IT	6 – 10 Yrs	Degree
Respond28	Information Technology	6 – 10 Yrs	11 – 15 Yrs	101 – 500	National	Senior Management	36 – 40 Yrs	Computer Science	IT	0 – 5 Yrs	Degree
Respond29	Consultancy	2 – 5 Yrs	11 – 15 Yrs	0 – 50	National	Executive Management	36 – 40 Yrs	Computer Science	IT	6 – 10 Yrs	Degree
Respond30	Information Technology	6 – 10 Yrs	11 – 15 Yrs	501 – 1000	International	Management	46 – 50 Yrs	Computer Science	IT	6 – 10 Yrs	Certificates
Respond31	Manufacturing	6 – 10 Yrs	11 – 15 Yrs	1001 – 2500	Provincial	Executive Management	46 – 50 Yrs	Marketing	Finance	0 – 5 Yrs	Diploma
Respond32	Transportation	6 – 10 Yrs	11 – 15 Yrs	1001 – 2500	International	Management	36 – 40 Yrs	Computer Science	IT	11 – 15 Yrs	Diploma

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11
Respond33	Consultancy	16+ Yrs	11 – 15 Yrs	1001 – 2500	International	Management	0 Yr	Other	IT	0 – 5 Yrs	Honours
Respond34	Property	2 – 5 Yrs	16 – 20 Yrs	0 – 50	Provincial	Executive Management	41 – 45 Yrs	Other	0	0 – 5 Yrs	Matric
Respond35	Consultancy	6 – 10 Yrs	16 – 20 Yrs	501 – 1000	National	Executive Management	36 – 40 Yrs	Computer Science	IT	6 – 10 Yrs	Honours
Respond36	Customer Service	16+ Yrs	16 – 20 Yrs	0 – 50	Provincial	Executive Management	46 – 50 Yrs	Management	Other	16 – 20 Yrs	Diploma
Respond37	Education	16+ Yrs	16 – 20 Yrs	0 – 50	Provincial	Executive Management	46 – 50 Yrs	Management	Other	16 – 20 Yrs	Diploma
Respond38	Property	2 – 5 Yrs	16 – 20 Yrs	0 – 50	Provincial	Executive Management	41 – 45 Yrs	Other	0	0 – 5 Yr	Matric
Respond39	Consultancy	6 – 10 Yrs	16 – 20 Yrs	501 – 1000	National	Executive Management	36 – 40 Yrs	Computer Science	IT	6 – 10 Yrs	Honours
Respond40	Communications	16+ Yrs	16 – 20 Yrs	5001+	Provincial	Senior Management	41 – 45 Yrs	Management	Human Resource	0 – 5 Yrs	Honours
Respond41	Manufacturing	16+ Yrs	16 – 20 Yrs	2501 – 5000	International	Management	41 – 45 Yrs	Other	IT	11 – 15 Yrs	Certificates
Respond42	Education	16+ Yrs	16 – 20 Yrs	1001 – 2500	International	Management	46 – 50 Yrs	Engineering	IT	11 – 15 Yrs	Diploma
Respond43	Education	16+ Yrs	16 – 20 Yrs	1001 – 2500	International	Senior Management	36 – 40 Yrs	Management	IT	0 – 5 Yrs	Certificates
Respond44	Consultancy	2 – 5 Yrs	16 – 20 Yrs	0 – 50	National	Executive Management	46 – 50 Yrs	Finance	Finance	6 – 10 Yrs	Diploma
Respond45	Consultancy	2 – 5 Yrs	16 – 20 Yrs	0 – 50	National	Executive Management	46 – 50 Yrs	Finance	Finance	6 – 10 Yrs	Diploma
Respond46	Education	16+ Yrs	16 – 20 Yrs	1001 – 2500	International	Management	51+ Yrs	Education	IT	21+ Yrs	Degree
Respond47	Education	0 Yr	21+ Yrs	0	International	Management	30 – 35 Yrs	Other	IT	0 – 5 Yrs	Honours
Respond48	Information Technology	2 – 5 Yrs	21+ Yrs	0 – 50	Provincial	Executive Management	46 – 50 Yrs	Engineering	IT	0 – 5 Yrs	Diploma
Respond49	Education	16+ Yrs	21+ Yrs	2501 – 5000	Provincial	Skilled	41 – 45 Yrs	Other	IT	11 – 15 Yrs	Degree

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11
Respond50	Information Technology	2 – 5 Yrs	21+ Yrs	0 – 50	Provincial	Executive Management	46 – 50 Yrs	Engineering	IT	0 – 5 Yrs	Diploma
Respond51	Education	16+ Yrs	21+ Yrs	2501 – 5000	Provincial	Skilled	41 – 45 Yrs	Other	IT	11 – 15 Yrs	Degree
Respond52	Information Technology	16+ Yrs	21+ Yrs	0	International	Senior Management	46 – 50 Yrs	Computer Science	IT	11 – 15 Yrs	Degree
Respond53	Information Technology	16+ Yrs	21+ Yrs	0	International	Senior Management	46 – 50 Yrs	Computer Science	IT	11 – 15 Yrs	Degree
Respond54	Education	16+ Yrs	21+ Yrs	501 – 1000	International	Senior Management	51+ Yrs	Education	Administration	21+ Yrs	Masters
Respond55	Information Technology	16+ Yrs	21+ Yrs	51 – 100	International	Management	46 – 50 Yrs	Management	IT	16 – 20 Yrs	Diploma

Architecture: after replacing missing values with the mode

	Item1	Item2	Item3	Item4	Item5
Respond1	Agree	Agree	Strongly Agree	Disagree	Agree
Respond2	Agree	Agree	Agree	Disagree	Agree
Respond3	Agree	Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond4	Agree	Mildly Agree	Strongly Agree	Disagree	Strongly Agree
Respond5	Agree	Agree	Strongly Agree	Disagree	Agree
Respond6	Agree	Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond7	Agree	Agree	Strongly Agree	Disagree	Strongly Agree
Respond8	Agree	Agree	Agree	Disagree	Mildly Agree
Respond9	Agree	Mildly Agree	Agree	Disagree	Agree
Respond10	Agree	Agree	Agree	Disagree	Strongly Agree
Respond11	Agree	Agree	Agree	Disagree	Agree
Respond12	Agree	Agree	Agree	Disagree	Agree
Respond13	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond14	Agree	Agree	Agree	Disagree	Agree
Respond15	Strongly Agree	Agree	Agree	Disagree	Agree
Respond16	Strongly Agree	Agree	Agree	Disagree	Agree
Respond17	Strongly Agree	Agree	Agree	Disagree	Agree
Respond18	Agree	Agree	Agree	Disagree	Agree
Respond19	Strongly	Agree	Strongly	Strongly	Agree

	Item1	Item2	Item3	Item4	Item5
	Agree		Agree	Disagree	
Respond20	Agree	Agree	Agree	Disagree	Agree
	Mildly		Mildly		
Respond21	Disagree	Mildly Disagree	Disagree	Agree	Mildly Agree
	Strongly			Strongly	
Respond22	Agree	Agree	Agree	Disagree	Agree
Respond23	Agree	Agree	Agree	Disagree	Strongly Agree
Respond24	Agree	Agree	Agree	Disagree	Agree
	Strongly		Strongly		
Respond25	Agree	Agree	Agree	Disagree	Agree
	Strongly				
Respond26	Agree	Agree	Agree	Disagree	Agree
Respond27	Agree	Strongly Agree	Agree	Disagree	Agree
	Strongly				
Respond28	Agree	Agree	Agree	Disagree	Agree
Respond29	Agree	Strongly Agree	Agree	Disagree	Agree
Respond30	Agree	Strongly Agree	Agree	Disagree	Agree
			Strongly	Strongly	
Respond31	Agree	Agree	Agree	Disagree	Strongly Agree
	Strongly				
Respond32	Agree	Agree	Agree	Disagree	Agree
	Strongly				
Respond33	Agree	Disagree	Disagree	Disagree	Agree
Respond34	Agree	Agree	Agree	Disagree	Agree
	Strongly			Strongly	
Respond35	Agree	Strongly Agree	Agree	Disagree	Strongly Agree
Respond36	Agree	Agree	Agree	Disagree	Agree
Respond37	Agree	Agree	Agree	Disagree	Agree
Respond38	Agree	Agree	Agree	Disagree	Agree
	Strongly			Strongly	
Respond39	Agree	Disagree	Agree	Disagree	Strongly Agree
Respond40	Agree	Agree	Agree	Disagree	Agree
Respond41	Agree	Agree	Agree	Disagree	Agree

	Item1	Item2	Item3	Item4	Item5
Respond42	Strongly Agree	Agree	Agree	Strongly Disagree	Strongly Agree
Respond43	Agree	Agree	Agree	Disagree	Agree
Respond44	Strongly Agree	Agree	Agree	Disagree	Agree
Respond45	Strongly Agree	Agree	Agree	Strongly Disagree	Agree
Respond46	Strongly Agree	Agree	Agree	Disagree	Agree
Respond47	Agree	Agree	Strongly Agree	Disagree	Agree
Respond48	Strongly Agree	Strongly Agree	Strongly Agree	Disagree	Agree
Respond49	Mildly Agree	Mildly Agree	Agree	Mildly Disagree	Mildly Agree
Respond50	Strongly Agree	Agree	Strongly Agree	Strongly Disagree	Mildly Agree
Respond51	Mildly Agree	Mildly Agree	Agree	Mildly Agree	Strongly Agree
Respond52	Mildly Agree	Mildly Agree	Mildly Agree	Mildly Disagree	Mildly Agree
Respond53	Mildly Agree	Mildly Agree	Strongly Agree	Strongly Disagree	Agree
Respond54	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond55	Agree	Agree	Agree	Disagree	Agree

Strategic Factors: after replacing missing values with the mode

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10
Respond1	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree	Agree	Agree
Respond2	Strongly Agree	Strongly Agree	Agree	Mildly Agree	Agree	Agree	Strongly Disagree	Strongly Agree	Agree	Strongly Agree
Respond3	Strongly Agree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Agree	Mildly Agree	Agree
Respond4	Agree	Agree	Disagree	Agree	Agree	Disagree	Disagree	Agree	Mildly Agree	Agree
Respond5	Agree	Agree	Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Agree	Agree
Respond6	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Strongly Agree	Agree	Agree
Respond7	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Strongly Agree	Mildly Agree	Agree
Respond8	Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Agree	Agree
Respond9	Strongly Agree	Agree	Agree	Mildly Agree	Agree	Mildly Agree	Strongly Agree	Agree	Agree	Agree
Respond10	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Agree	Disagree	Strongly Disagree	Strongly Agree	Agree	Agree
Respond11	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Agree	Agree	Strongly Disagree	Strongly Agree	Agree	Agree
Respond12	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree	Strongly Agree
Respond13	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree
Respond14	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Strongly Agree
Respond15	Agree	Agree	Strongly Agree	Strongly Agree	Agree	Agree	Strongly Disagree	Agree	Agree	Agree
Respond16	Agree	Agree	Agree	Agree	Strongly Agree	Agree	Disagree	Agree	Agree	Agree
Respond17	Agree	Agree	Agree	Agree	Strongly	Agree	Disagree	Agree	Agree	Agree

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10
Respond18	Agree	Agree	Strongly Agree	Strongly Agree	Agree	Mildly Agree	Mildly Agree	Agree	Agree	Agree Strongly
Respond19	Agree Mildly	Agree	Agree	Agree Mildly	Agree Strongly	Agree	Agree	Agree	Agree Mildly	Agree
Respond20	Disagree Mildly	Agree Mildly	Agree Mildly	Agree Mildly	Agree Mildly	Disagree Mildly	Agree Strongly	Agree	Disagree	Agree
Respond21	Disagree Strongly	Disagree	Disagree	Disagree	Disagree	Disagree	Agree	Disagree Strongly	Disagree	Disagree
Respond22	Disagree Strongly	Disagree Strongly	Agree	Agree Strongly	Agree	Agree	Mildly Agree Strongly	Agree Strongly	Agree	Agree
Respond23	Agree Strongly	Agree Strongly	Agree	Agree Strongly	Agree	Agree	Disagree Strongly	Agree Strongly	Agree	Agree
Respond24	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree Mildly	Disagree	Agree	Agree	Agree
Respond25	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree	Mildly Agree Strongly	Agree	Agree	Agree
Respond26	Agree	Agree	Agree Strongly	Agree	Agree	Agree	Disagree	Agree Strongly	Agree Strongly	Agree Strongly
Respond27	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree Mildly	Disagree	Agree	Agree	Agree
Respond28	Agree	Agree	Agree Strongly	Agree	Agree	Agree	Mildly Agree	Agree Strongly	Agree Strongly	Agree Strongly
Respond29	Agree	Agree	Agree Strongly	Agree	Agree	Agree	Disagree	Agree Strongly	Agree Strongly	Agree Strongly
Respond30	Agree	Agree	Agree	Agree	Agree	Agree	Disagree	Agree Strongly	Agree	Agree
Respond31	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree	Agree Strongly	Agree	Mildly Agree	Agree
Respond32	Agree Strongly	Agree	Agree Strongly	Agree Strongly	Agree	Agree	Disagree Strongly	Agree	Agree	Agree
Respond33	Disagree	Agree	Agree	Agree	Disagree	Disagree	Disagree	Disagree	Disagree	Agree
Respond34	Strongly	Agree	Strongly	Agree	Agree	Agree	Strongly	Strongly	Agree	Agree

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10
	Agree Strongly	Strongly	Agree Strongly				Agree	Agree Strongly		Strongly
Respond35	Agree Strongly	Agree Strongly	Agree Strongly	Agree	Agree Strongly	Agree	Agree	Agree	Disagree	Agree
Respond36	Agree Strongly	Agree Strongly	Agree Strongly	Agree	Agree Strongly	Agree	Agree	Agree	Agree	Agree
Respond37	Agree Strongly	Agree	Agree Strongly	Agree	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree
Respond38	Agree Strongly	Agree Strongly	Agree Strongly	Agree	Agree	Agree	Agree	Agree Strongly	Agree	Agree Strongly
Respond39	Agree	Agree	Agree Strongly	Agree Strongly	Agree Strongly	Agree Mildly	Agree	Agree Strongly	Disagree Strongly	Agree
Respond40	Agree	Agree	Agree	Agree	Agree	Agree	Disagree	Agree	Agree	Agree
Respond41	Agree	Agree Mildly	Agree	Agree Mildly	Agree Strongly	Agree Mildly	Agree	Agree	Agree	Agree
Respond42	Agree	Agree Mildly	Agree	Agree	Agree	Agree	Mildly Agree Strongly	Disagree	Agree Strongly	Agree
Respond43	Agree	Disagree	Agree	Agree	Agree Strongly	Disagree	Disagree	Disagree	Agree	Agree
Respond44	Agree	Agree	Agree	Agree	Agree Strongly	Agree	Disagree	Agree	Agree	Agree
Respond45	Agree	Agree	Agree Strongly	Agree Strongly	Agree	Agree	Disagree Strongly	Agree	Agree	Agree
Respond46	Agree Strongly	Agree Strongly	Agree Strongly	Agree	Agree Strongly	Agree	Disagree	Agree Strongly	Agree	Agree Strongly
Respond47	Agree	Agree	Agree Strongly	Agree Strongly	Agree Strongly	Agree Mildly	Disagree	Agree	Agree Strongly	Agree
Respond48	Agree	Agree	Agree	Agree	Agree	Agree Mildly	Agree	Agree	Agree	Agree
Respond49	Agree	Agree	Agree Strongly	Agree Strongly	Agree Strongly	Agree Mildly	Agree	Agree	Agree Strongly	Agree
Respond50	Agree	Agree	Agree	Agree	Agree	Agree Mildly	Agree	Agree	Agree	Agree
Respond51	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree	Agree

	Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10
Respond52	Mildly Agree	Strongly Agree	Strongly Agree	Agree	Agree	Mildly Agree	Mildly Agree	Strongly Agree	Agree	Agree
Respond53	Mildly Agree	Strongly Agree	Strongly Agree	Agree	Agree	Mildly Agree	Mildly Agree	Strongly Agree	Agree	Agree
Respond54	Disagree	Agree	Strongly Agree	Strongly Agree	Strongly Agree	Agree	Mildly Agree	Mildly Disagree	Agree	Mildly Agree
Respond55	Strongly Disagree	Strongly Disagree	Agree	Agree	Agree	Mildly Disagree	Mildly Agree	Agree	Mildly Disagree	Agree

Business Advantage: after replacing missing values with the mode

	Item1	Item2	Item3	Item4	Item5	Item6
Respond1	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond2	Agree	Strongly Agree	Agree	Agree	Strongly Disagree	Agree
Respond3	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond4	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond5	Strongly Agree	Strongly Disagree	Strongly Agree	Strongly Agree	Mildly Disagree	Strongly Agree
Respond6	Agree	Disagree	Strongly Agree	Strongly Agree	Disagree	Agree
Respond7	Agree	Disagree	Agree	Strongly Agree	Disagree	Agree
Respond8	Strongly Agree	Strongly Agree	Agree	Agree	Mildly Disagree	Strongly Agree
Respond9	Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond10	Strongly Agree	Mildly Agree	Strongly Agree	Strongly Agree	Disagree	Strongly Agree
Respond11	Agree	Mildly Agree	Agree	Agree	Disagree	Agree
Respond12	Agree	Agree	Agree	Agree	Disagree	Agree
Respond13	Agree	Agree	Agree	Agree	Disagree	Agree
Respond14	Agree	Mildly Agree	Agree	Agree	Disagree	Agree
Respond15	Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond16	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond17	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond18	Agree	Mildly Agree	Agree	Agree	Disagree	Strongly Agree
Respond19	Mildly Agree	Mildly Agree	Agree	Agree	Disagree	Agree
Respond20	Agree	Agree	Agree	Agree	Mildly Disagree	Agree
Respond21	Disagree	Agree	Disagree	Disagree	Agree	Disagree
Respond22	Agree	Strongly Disagree	Agree	Agree	Disagree	Agree
Respond23	Strongly Agree	Mildly Agree	Strongly Agree	Strongly Agree	Disagree	Strongly Agree
Respond24	Agree	Mildly Agree	Agree	Agree	Disagree	Agree
Respond25	Agree	Mildly Agree	Agree	Agree	Disagree	Strongly Agree
Respond26	Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond27	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond28	Agree	Mildly Agree	Agree	Agree	Disagree	Strongly Agree
Respond29	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Disagree	Strongly Agree

	Item1	Item2	Item3	Item4	Item5	Item6
Respond30	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond31	Agree	Disagree	Agree	Strongly Agree	Disagree	Agree
Respond32	Strongly Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond33	Strongly Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond34	Agree	Agree	Agree	Agree	Strongly Agree	Agree
Respond35	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond36	Agree	Agree	Agree	Agree	Disagree	Agree
Respond37	Agree	Agree	Agree	Agree	Disagree	Agree
Respond38	Strongly Agree	Agree	Disagree	Agree	Strongly Agree	Agree
Respond39	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Disagree	Agree
Respond40	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond41	Agree	Agree	Agree	Agree	Strongly Disagree	Agree
Respond42	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Strongly Disagree	Strongly Agree
Respond43	Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond44	Agree	Disagree	Agree	Agree	Disagree	Agree
Respond45	Agree	Disagree	Strongly Agree	Agree	Disagree	Agree
Respond46	Agree	Strongly Disagree	Agree	Agree	Strongly Disagree	Agree
Respond47	Agree	Strongly Disagree	Agree	Agree	Mildly Disagree	Agree
Respond48	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Strongly Disagree	Agree
Respond49	Agree	Strongly Agree	Agree	Agree	Mildly Disagree	Agree
Respond50	Strongly Agree	Disagree	Strongly Agree	Strongly Agree	Strongly Disagree	Mildly Disagree
Respond51	Strongly Agree	Strongly Agree	Agree	Strongly Agree	Mildly Disagree	Mildly Agree
Respond52	Agree	Mildly Agree	Agree	Agree	Disagree	Agree
Respond53	Mildly Agree	Mildly Agree	Mildly Agree	Agree	Disagree	Mildly Agree
Respond54	Agree	Disagree	Strongly Agree	Strongly Agree	Disagree	Agree
Respond55	Agree	Agree	Agree	Agree	Disagree	Agree