

**The Effect of Information Systems Resources and Capabilities on  
Company Performance in the South African Financial Services  
Industry: A Resource Based Perspective**

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## Abstract

The purpose of this study was to determine the effect that information system resources and capabilities have on company performance. This study was a replication of research conducted in the United States where Resource Based theory was used as the theoretical framework to analyse the relationships between the identified constructs. The relationship between IS resources and IS capabilities was posited to be positive. Likewise the relationships between IS Capabilities and IT support for Core Competencies and in turn company performance were hypothesised to be positive.

A quantitative methodology was employed, using a five-point Likert scale survey, which was emailed to senior managers within the Financial Services sector of South Africa. The Partial Least Squares multivariate technique was used to analyse the data. The structural model provided support for two of the hypotheses, whilst support for the remaining three could not be established. The empirical results were then analysed to develop the implications for South African business managers.

## Declaration

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

Yashil Narandas

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## Table of Contents

1	Introduction to the Research Problem.....	1
1.1	Introduction.....	1
1.2	Background to the research.....	1
1.3	Evidence of the problem.....	2
1.4	Research aims and scope .....	3
1.5	Choice of topic is defended .....	4
1.6	Summary .....	5
2	Literature Review .....	6
2.1	Introduction.....	6
2.2	IT – Organisation Performance Overview.....	7
2.2.1	A Review of the definitions of the IT Construct.....	8
2.2.2	A review of the Organisation Performance Construct.....	9
2.2.3	IT – Organisation Performance Literature.....	9
2.3	Resource Based Theory.....	12
2.4	Information System Resources.....	14
2.5	IS Capabilities.....	15
2.6	Core Competencies.....	18
2.6.1	IT Support for Core Competencies .....	19
2.7	Summary of the Literature Review .....	22
3	Research Hypotheses.....	24
3.1	Introduction.....	24
3.2	Hypotheses.....	24
3.3	Summary .....	27
4	Research Methodology .....	28
4.1	Introduction.....	28

4.2	Research Philosophy.....	28
4.3	Quantitative / Qualitative method.....	30
4.4	Research Method .....	30
4.5	Population and Sampling.....	33
4.6	Unit of Analysis.....	34
4.7	Data Measurement Types and Scaling Options .....	34
4.8	Data Collection .....	37
4.9	PLS Analysis .....	38
4.10	Questionnaire .....	39
4.11	Limitations of the Study .....	39
4.12	Summary .....	40
5	Presentation of Results .....	41
5.1	Introduction.....	41
5.2	Respondent Profile .....	41
5.3	Analysis of Measurement Model.....	45
5.4	Measures.....	52
5.5	Structural Model .....	61
5.6	Summary .....	68
6	Discussion of Results.....	69
6.1	Introduction.....	69
6.2	Discussion per Hypothesis .....	69
6.2.1	Hypothesis 1 .....	69
6.2.2	Hypothesis 2.....	71
6.2.3	Hypothesis 3.....	75
6.2.4	Hypothesis 4.....	77
6.2.5	Hypothesis 5.....	80
6.3	Summary .....	81

7 Conclusion .....	82
7.1 Contribution of this study .....	82
7.2 Implication for Business Managers.....	83
7.3 Future research ideas.....	85
8 References.....	87
9 Abbreviations .....	93
10 Appendix .....	94
10.1 Survey Questions .....	94
10.2 LISREL Output .....	96
10.3 Frequency Graphs.....	105

## List of Tables

Table 2.7-1 Summary of Constructs and Indicator .....	23
Table 5.2-1 Definition of Indicators.....	44
Table 5.3-1 Tabular representation of the Measurement Model.....	47
Table 5.3-2 Correlation Matrix of Independent Variables .....	48
Table 5.3-3 Measurement Equations .....	50
Table 5.4-1 IS Human Capital .....	52
Table 5.4-2 IT Infrastructure Flexibility .....	53
Table 5.4-3 IS Partnership Quality .....	55
Table 5.4-4 IS Capability .....	57
Table 5.4-5 IT Support for Core Competence .....	58
Table 5.4-6 Firm Performance .....	60
Table 5.5-1 Correlation Matrix of Independent Variables .....	66
Table 5.5-2 Covariance Matrix of Independent Variables.....	66

## List of Figures

Figure 2.1-1 The Core Competency Model .....	7
Figure 2.6-1 Hierarchy of Competencies.....	18
Figure 2.6-2 Research model.....	21
Figure 4.2-1 Research philosophy alternatives .....	28
Figure 4.4-1 Framework for Customer Data Analysis.....	32
Figure 4.7-1 Types of Data Measurement .....	34
Figure 5.3-1 The Measurement Model .....	46
Figure 5.4-1 Factor Loadings for IS Human Capital .....	52
Figure 5.4-2 Factor Loadings for IT Infrastructure Flexibility .....	53
Figure 5.4-3 Factor Loadings for IS Partnership Quality .....	55
Figure 5.4-4 Factor Loadings for IS Capability .....	57
Figure 5.4-5 Factor Loadings for IT Support for Core Competencies.....	58
Figure 5.4-6 Factor Loading on Firm Performance .....	60
Figure 5.5-1 The Structural Model.....	61
Figure 5.5-2 Hypothesis 1 .....	62
Figure 5.5-3 Hypothesis 2 .....	63
Figure 5.5-4 Hypothesis 3 .....	63
Figure 5.5-5 Hypothesis 4 .....	64
Figure 5.5-6 Hypothesis 5 .....	65

## List of Equations

Equation 5.5-1 .....	62
Equation 5.5-2 .....	63
Equation 5.5-3 .....	64
Equation 5.5-4 .....	64
Equation 5.5-5 .....	65

## 1 Introduction to the Research Problem

### 1.1 Introduction

The purpose of this chapter is to present an overview of the research study. This section will provide the reader with a high level understanding of the background of the research, present evidence of the research problem, detail the area of focus of the research, scope the aim of the research, and justify the reasons for selecting this area of study.

### 1.2 Background to the research

The debate around the contribution of Information Technology (IT) to the attainment of the business goals and objectives has been widely researched (Rivard, Raymond and Verreault, 2006). Ravichandran and Lertwongsatein (2005), suggested that IT-business value, which is the impact of IT on organisational performance, remains a focus area of management for the following two reasons. Firstly, the fact that IT plays an increasingly strategic role in most organisations. Secondly, these organisations continue to make significant investments in IT.

Despite the depth of research, there is still uncertainty as to the mechanisms by which IT relates to company performance. Furthermore, recent literature by Zhang (2007), as well as Nakata, Zhu and Kraimer (2008) suggested that the theoretical lens for understanding the relationship between IT and company performance has shifted strongly towards the Resourced Based View (RBV) of the organisation. This

shift together with the two reasons suggested earlier in section 1.2, indicated that further research was required to understand how internal factors of the organisation such as a company's competencies, can be a source of competitive advantage in the attainment of performance objectives.

Finney, Leug and Campbell (2008) presented an argument that places core competencies as the primary means by which a company can create and sustain a competitive advantage. In that research, Finney *et al.* (2008) described core competencies as being made up of combinations of a company's resources and capabilities. Furthermore, these competencies are valued by the market and are also difficult for competitors to emulate. In essence, a company is able to differentiate itself from its competitors on the basis of core competencies and this is what enables it to out-perform its rivals. This research study extends the work done by Ravichandran and Lertwongsatein (2005) in the United States to use Resource Based theory and examine how Information System (IS) resources and capabilities combine in support of core competencies to influence company performance in the South African context.

### 1.3 Evidence of the problem

The sizable growth in technology spend has prompted managers to question the contribution of IT to company performance (Nakata *et al.*, 2008). The research indicated a division of views, with Carr (2003) stating that computer technology delivers no significant gains due to its commodity nature. However, Kohli and

Devaraj (2003) argued that IT does in fact contribute to company performance. One of the key developments in this area of research pointed out the fact that investment in IT is not sufficient to ensure company level performance directly. Ravichandran and Lertwongastein (2005) propose that IT investments need to be converted into IT assets. In addition, these IT assets must be used in specific support of the business for it to be of any value to the company. In other words, they must be deployed in support of the company's core competencies. The inherent risk of not doing this is that given the ubiquitous nature of IT, a company cannot extract any sustained competitive advantage from the technology as it can be easily copied by competitors.

The body of research relating to IT-business value has put forward the argument that there is a need to understand how, as well as the extent to which IT influences company performance (Melville, Kraemer, and Gurbaxani, 2004). This view was also supported by Quan, Hu and Hart (2004) highlighting a requirement for the analysis of the impact of IT on company performance and productivity. Furthermore, Finney *et al.* (2008) argued that a lack of strategic direction from the business can cause IT investments to be misdirected. This can lead to the inefficient deployment of IT resources in non-value adding initiatives.

#### **1.4 Research aims and scope**

This study draws on the Resourced-Based view (RBV) of the company as a theoretical framework. This study aimed to determine how IS resources and capabilities affect company performance. In so doing, the study will examine the relationships between IS resources and IS capabilities, and in turn IT support for the

core competencies of companies in the South African Financial Services Industry. The basic premise is that the performance of a company can in part be explained by the effective use of IT to support and augment its core competencies.

### **1.5 Choice of topic is defended**

Garg, Joubert, and Pellissier (2005) concluded that in the South African Banking context, investments in IT are meaningless unless IS support is aligned with the management of environmental uncertainty. Garg *et al.* (2005) posit that it is the external environment which ultimately impacts on company performance. Oerlemans, Rooks, and Pretorius (2005) conducted an empirical investigation of the technology strategy – performance relationship. Their study focussed on innovative companies within the South African manufacturing and services context. According to Oerlemans *et al.* (2005, p. 53) "...the combination of specific technology strategy activities, that is internal in combination with external technology audits, is relevant to company performance." Both these locally based studies placed emphasis on the external environment as a key contributor to performance. This study on the other hand explores an internal view of the company, to derive the effects of IS resources and capabilities on company performance within the South African Financial Services Industry. The Financial Services sector was selected as it is the largest sector on the Johannesburg Stock Exchange and therefore presented the opportunity to generalise the findings of this study to the sector.

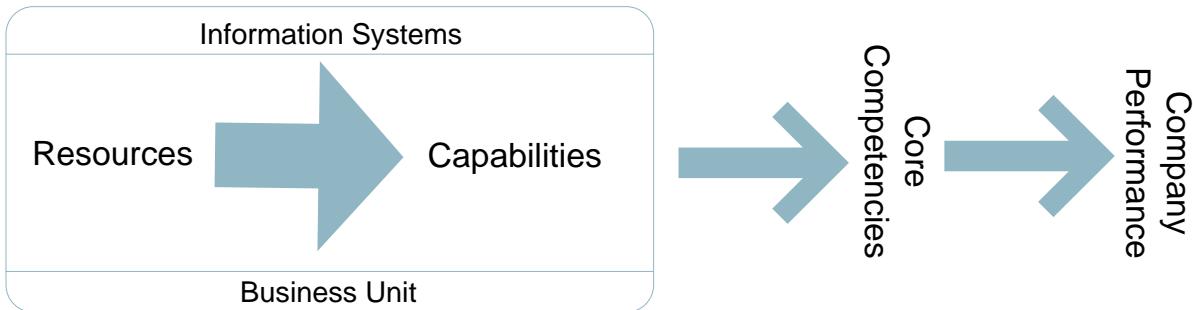
## 1.6 Summary

Chapter 1 has presented an overview of the research study. This chapter outlined the background within which this study was conducted. It has furthermore provided evidence of the problem as well as listed the aims and the scope of the study. Finally, the choice of topic is justified in the context of this study. Chapter 2 will present the results of the non-empirical research by commencing with the IT-Organisation Performance literature.

## 2 Literature Review

### 2.1 Introduction

This chapter provides a non-empirical review of the recent literature sources dealing with the effect of IS resources and capabilities on company performance. The chapter leads into a discussion of the various themes and will commence with an assessment of the literature relating to the IT construct as defined in section 2.2.1, and the impact on company performance in section 2.2. Past research in this area indicated that there is an assortment of definitions of IT which have led to the many disparate studies being conducted in this area. The Company Performance literature suggested a somewhat more congruent definition of the construct, which is largely explained by Operating Performance and Market Based Performance. Subsequent to the definition of these constructs, the relationship between IT and Company Performances will be assessed within section 2.2.3. An in-depth study of the RBV of the company was conducted in section 2.3 to establish the relevance of the theory to this study. The remaining sections of the literature focus on the relationship between IS Resources and Capabilities, and how they align in support of Core Competencies to ultimately deliver organisation level performance.



**Figure 2.1-1 The Core Competency Model (Adopted from Ravichadran and Lertwongsatien, 2000)**

## 2.2 IT – Organisation Performance Overview

Numerous studies have been conducted over the years to identify the performance impacts of IT on organisations. Researchers have used conceptual, theoretical and analytical approaches, as well as conducted various empirical studies to gain insight into the extent to which IT within organisations delivers improved performance (Melville *et al.*, 2004). In addition, these studies have been conducted at various levels of analysis including the process level, functional level and company level. However, before a review of the relationship can be undertaken, there needs to be a common understanding of the constructs involved. These constructs are discussed in the sections that follow, namely section 2.2.1 and 2.2.2.

### 2.2.1 A Review of the definitions of the IT Construct

In order to gain an understanding of the relationship between IT and organisation performance, a clear definition of the construct IT must be formulated. Part of the reason why there has been so many disparate studies on the contribution of IT is due to the fact that there has been a diverse set of definitions of IT, and how it is applied in the organisation (Melville *et al.*, 2004). Orlikowski and Lacono, (2001) conducted a review of the different definitions and uses of the IT construct which will be discussed in turn. Firstly, IT is viewed as a tool which is unproblematic and hence does what it was designed to do. The second point of reference is that of the proxy view, where IT is understood through the perception of the users; the extent to which a system is integrated into the operational activities; and the monetary measures of IT, in other words how much is spent on IT. Thirdly, the ensemble view looks at incorporating the interactions of skills and technology into the development and implementation of IT. The fourth view looks at the computational aspects of IT to store, retrieve and process information. The nominal view of IT is purported to refer to the technology being absent from the literature. In other words, IT is not described, conceptualised or theorised in any of the reviewed articles. Given the above views, it validates why there is such a diverse set of literature on the impact of IT. Therefore, the premise of this study attempts to view IT as a dynamic and complex set of processes and artefacts, where the non static nature of IT is due to the fact that new technologies are invented, additional features developed and existing functions re-engineered as a result of failure (Orlikowski and Lacono, 2001).

## 2.2.2 A review of the Organisation Performance Construct

Ravichandran and Lertwongsatein (2005) evaluated organisation performance against two items, as follows:

- Operating Performance: An examination of the extent to which the factors of profitability, productivity, and financial performance exceeded that of competitors.
- Market based Performance: An assessment of the success of the company in entering new markets and developing new products and services for the market.

## 2.2.3 IT – Organisation Performance Literature

The widespread research into the performance effects of IT on the organisation has yielded mixed results. Early literature suggested the paradox of IT held true for studies that were conducted in the early nineties (Mitra, 2005). However, recent studies as with that conducted by Zhang (2007), and Nakata *et al.* (2008) suggested a positive relationship between IT and company performance measures.

An early study performed by Sircar, Turnbow and Bordoli (2000), concluded that the output measures of the company being sales, assets and equity had a positive relationship with IT investments. This study differentiated between human capital and non-human capital to suggest that staff training had a better correlation with company performance than computer capital.

Rivard *et al.* (2005) informed that the notion that the IT-Business performance link has been studied from two perspectives. The first perspective looks at strategy as a positioning perspective, in which IT is used to alter the competitive forces in the industry. The second perspective follows the resource-based view, where the organisation is conceptualised as a collection of resources. In the same time period, Ravichandran and Lertwongsatien (2005) implemented resource-based theory to look at the effect of IS resources and capabilities on firm / company performance. Both these studies reflect on the role of complementary resources in the organisation to ensure improved performance at the company level.

Quan *et al.* (2003) adopted a different view point to look at IT-Company Performance from a duopoly perspective. Their work differed from the current study in that the benefits from IT are seen as a function of market sensitivities to the price and quality of the products and services offered.

Byrd, Lewis and Bryan (2006) used the manufacturing sector to look at the effect that strategic alignment has on the relationship between IT and company performance. Their study concluded that IT investments in organisations which have a close alignment between IT and business strategy will lead to performance gains. On the other hand, Devaraj and Kohli (2003) suggested that it is the actual usage of technology that may explain some of the early discrepancies in the results of IT related company performance improvements. Another perspective was put forward by Tallon and Kraemer (2007) who posit that due to the lack of objective measures in

evaluating the impact of IT, that perhaps perceptual measures could be better suited to explain the relationship. However, their study did not provide a compelling argument for the accuracy of such perceptions of the contribution of IT.

With a time series analysis, the role of IT in the new economy was researched by Lee, Gholami and Tong (2005). Their study has implications for South Africa where it was concluded that although IT investments are worthwhile in developed countries, the results are not as favourable in the developing economies. However, a study conducted by Jarvenpaa and Leidner (1998) extended the RBV of the company to a developing country context. Their study selected a pioneering company in the Mexican information content industry to examine how such a company achieved a competitive advantage in a market that lacked basic technological infrastructure.

As indicated in section 2.2.3, the study by Zhang (2007) provided evidence to support the indirect performance effects of IS. That study suggested that further empirical research is needed in this area to understand how to manage and deploy IS resources, given the co-existence of other complementary organisational resources and hence the indirect impact on company performance. This view is supported by Nakata *et al.* (2008) who make two specific contributions. Firstly, given the fact that IT capability influences company performance, the relationship may be indirect rather than direct. Secondly, the social related notion that IT capability cannot on its own produce improvements, but that people also play a role in the design and use of the system to achieve the organisational objectives. In a further

review of the more current literature, Morris and Strickland (2008) have now successfully adopted the Capability Maturity Model (CMM) to explain company performance as a result of IS process improvements.

### **2.3 Resource Based Theory**

Resource-based theory developed out of the management strategy literature. The theory posits that companies compete on the basis of resources that are unique, difficult to imitate, and also non-substitutable (Baradwaj, 2000). The Resource Based View (RBV) has subsequently been used to explain the relationship between how company's internal resources are developed and deployed, and the subsequent impact that this has on the organisation's performance. Priem and Butler (2001) are of the opinion that resources and products are two sides of the same coin. A significant contribution from their work was to emphasise the importance of resources as an antecedent to products and services which ultimately deliver company level performance.

RBV has been employed in a variety of ways to explain numerous research programs such as Human Resource Management, Knowledge Management and Strategic Management. This study employs IT as one such resource input to understand the relationship with IT capabilities in an effort to support the core competencies of the company and hence facilitate performance.

Proponents of the RBV have looked at the organisation as a bundle of resources within an administrative framework to investigate the heterogeneity of company resources as a source of competitive advantage and hence organisation performance (Baradwaj, 2000). That research went on to stipulate further the conditions under which a resource can offer a competitive advantage. These conditions are listed as: value, rarity, inimitability and non substitutability. A valued resource is one that assists a company in achieving above normal profits in the market or industry in which it competes. In the case where these resources are also inimitable and non-substitutable, that company will be able to sustain the advantage over other industry rivals. Over time, this sustained advantage will lead to improved performance of the company as a whole (Newbert, 2008). However, Priem and Butler (2001) earlier concluded that value and rarity are necessary but not sufficient conditions of resources for company performance.

In addition to the possession of resources, Newbert (2008) also highlighted the need to exploit these resources in combination with the organisation's capabilities to be able to extract above normal profits which was considered to represent performance in that study. Newbert (2008) used competitive advantage as a mediating variable to test the resources and capabilities relationship as opposed to previous studies that posit a direct relationship between resources and company performance.

Despite the initial broad definition of resources to include assets, knowledge and capabilities, this study follows the movement initiated by Baradwaj (2000) to

distinguish between a company's resources and capabilities. The reason for this is largely due to the fact that Baradwaj (2000) refers to resources as the basic unit of analyses, which are then aggregated in an effort to create capabilities. These capabilities are further specialised to facilitate functional capabilities such as Production, Manufacturing, Marketing and IT.

## 2.4 Information System Resources

This section will build upon the premise that resources are the bedrock of an organisation's capabilities. Ravichandran and Lertwongsatien (2005) suggested three general categories for the classification of IT resources. The first category is that of Human Resources (HR). HR in this study relates to the skill level and proficiency of the IS staff to perform IT related functions. The literature extended the view of HR to include tenure as a measure of the level of proficiency and a requisite to the establishment of company specific knowledge thereby building expertise. The second category being IT infrastructure sophistication, relates to the ability of IT to meet business requirements or adapt to strategic changes. Reference is made to the readiness of the IT platform to deliver a flexible infrastructure to allow the business to be nimble enough to take advantage of market opportunities. Another important characteristic that points to the sophistication of IT is the ability to deliver relevant information. The third category is the IS Partnership Quality dimension. This included both internal and external (vendor) related partnerships. Internal alignment between the IS function and the different business units was critical in ensuring that IS providers understand the business imperatives to facilitate the core

competencies of the organisation. External vendor relationships also play a key role in securing expertise in domains that may not form part of the incumbent IS provider skill levels. The external vendors help to augment the internal IS function and thus provide a better service to the business jointly. IT enabled intangibles were initially identified and preferred by Baradwaj (2000) to the Partnership dimension highlighted here in section 2.4. However, this proposition did not receive much further investigation and was later substituted.

In essence, researchers of the RBV of IT argued that a company's ability to differentiate itself is a function of its internal IT resources. The leverage that a company was able to achieve as a result of HR, IT Infrastructure Flexibility and Quality of Partnerships, ultimately helped to establish a company-wide IT capability.

## 2.5 IS Capabilities

Capabilities have gained a fair amount of consideration within RBV literature (Schreyogg and Kliesch-Eberl, 2007). The primary reason for this lies in the understanding that organisational capabilities are one of the major sources of competitive advantage. This competitive advantage is sustained or diminished, depending on the availability and allocation of resources that are rare and of better quality than others. Capabilities develop as a result of, or in the context of organisational resource allocations. Schreyogg and Kliesch-Eberl (2007) view capabilities as evidence of organisational learning. While every company strives to

be known for at least one of their capabilities, the external environment can play a role in moderating this impact.

Resources have been described in section 2.4 as either physical (e.g. IT infrastructure) or intangible (e.g. Partnership Quality). Capabilities refer to an organisation's capacity to deploy such resources in combinations that make appropriate business sense and provide the desired company results (Jarvenpaa and Leidner, 1998). In addition, Capabilities represent a "shared way" of doing things. Schreyogg and Kliesch-Eberl (2007) stipulate that capabilities can be built at various levels in the company. The research identified three characteristics of capabilities: problem solving and complexity, practising and success, and reliability and time.

As mentioned in section 2.5, capabilities can develop at various levels in the organisation such as at the departmental, divisional or organisational level. Thus, it is necessary to confine our area of analysis for this study. This study will concentrate on the capabilities within the core functional areas of planning; systems development; systems support; and operations (Ravichandran and Lertwongsatien, 2005). The reasons for this are two-fold. Firstly, capabilities can be observed within the general functional classification of a company's activities. Secondly, there is a lack of attention from researchers on the contribution of IT/IS Capabilities to performance related studies. Stoel and Muhanna (2009) also distinguish between external and internal IT capabilities. However, this study once again limits the focus

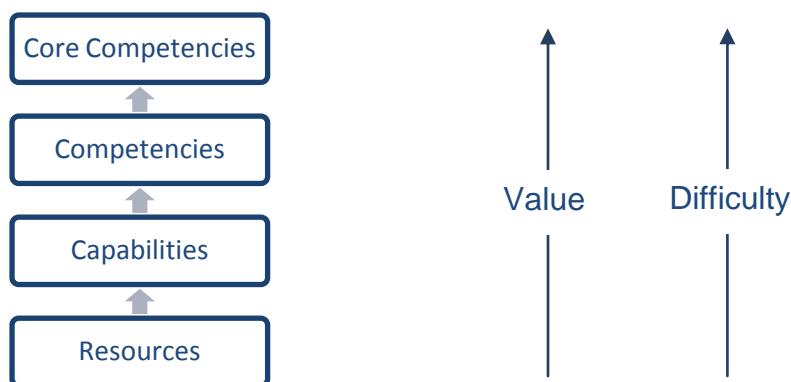
to internal factors and hence focuses on the routines and processes within IT that enable the delivery of services to the organisation.

Ravichandran and Lertwongsatien (2005) postulated that the ability to exploit core competencies is dependent on the IS Functional Capabilities. This implies that a considered approach must be adopted when deploying IT services. In other words, it must align with the strategic imperatives of the organisation. Following the IT systems development life cycle, IT planning is the first process in this chain that will assist in identifying business priorities and ensuring that IT is deployed in support of the business goals. Kearns and Sabherwal (2007) provide evidence in their study that the achievement of the strategic alignment between business and IT can lead to an improvement in performance through the support of core competencies. Therefore, the targeted use of IT is critical in the achievement of organisational level performance.

Following planning, systems development is the next key capability that will ensure that quality systems are deployed. Once deployed, it is necessary to make certain that these IT systems are utilised by the business. Therefore, the IS support capability is of key importance in this regard. Finally, the operations process and capability help to ensure that the business is able to function without disruption. Based on the above, the targeted use of IT resources, which are combined to form capabilities, can lead to a superior market position for the company and hence deliver above normal performance gains.

## 2.6 Core Competencies

The literature presented a strong association between Core Competencies and strategy design. Hamel and Prahalad (1990) advocated that core competencies represent the collective learning of the organisation, and it is the basis upon which industry rivals compete in the market. Ravichandran and Lertwongsatein (2005) describe competencies as those aspects which the company excels in. Torkkeli and Tuominen (2001) suggested the notion of a hierarchy of competencies within organisations as per Figure 2.6-1.



**Figure 2.6-1 Hierarchy of Competencies (Adopted from Torkkeli and Tuominen, 2001)**

At the lowest level, the resources provide the foundation or the building blocks. Capabilities at the second level are the organisation's ability to leverage the company resources. The third and fourth levels differ only in terms of the range of applicability. Competencies refer to a cross functional integration of capabilities e.g. IT capability enabling Marketing to enter into new markets. Thus, a Core Competence is an aggregation of competencies that traverse the organisation.

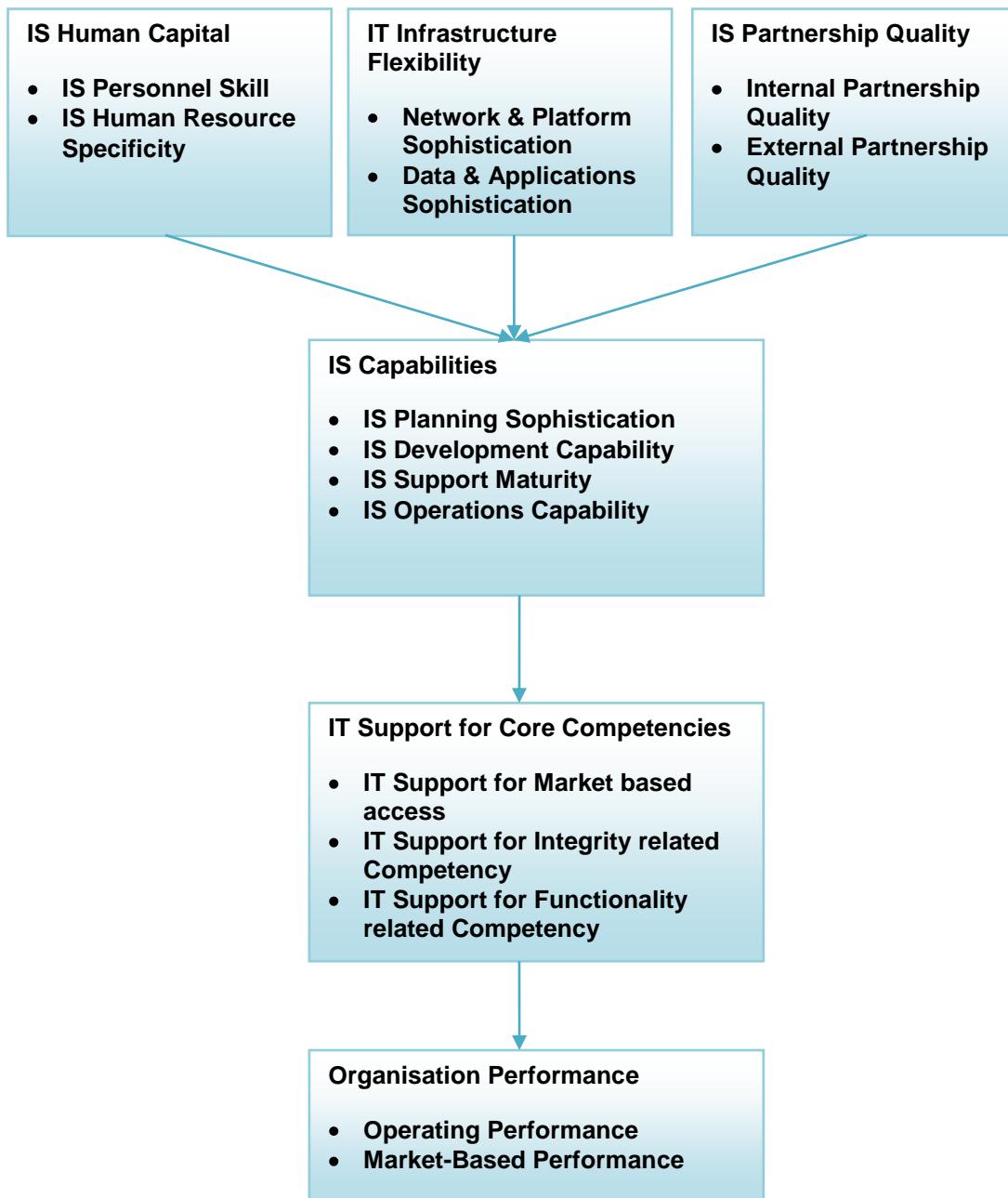
The very nature of a core competence suggests that it is the source of diversification strategies as it reduces risk by transferring knowledge and practices. The literature reveals three fundamental categories of core competencies: Market-based access, Integrity-related Competencies, and Functionality-related Competencies. Ravichandran and Lertwongsatien (2005) describe Market-based access Competencies as those competencies that enable the company to understand its existing captive customer base, as well as recognise new market opportunities. Integrity-related Competencies encompass the ability to produce products and services that are reliable and of superior quality. Functionality-related Competencies include those that deliver value-driven products and services to the customer.

### **2.6.1 IT Support for Core Competencies**

Companies have a limited supply of resources be it assets, knowledge or even IT. It is therefore imperative that careful consideration be given to the deployment of these scarce resources. For instance, IS resources that are deployed in support of core areas of the business are more likely to provide differentiation amongst industry competitors and therefore generate a market advantage that result in improved company performance (Ravichandran and Lertwongsatien, 2005). Deploying IS resources in support of an organisation's core competence will lead to an IT enabled differentiation in the market. This is what makes the IS assets inimitable as opposed to the casual deployment of IT. Ravichandran and Lertwongsatien (2005) further posited that this contribution of IS in support of core competencies, leads to improved organisational performance.

The identification of core competencies is a crucial first step in realising the benefit of IT in support of the competencies. This understanding of the business ensures that IT can be deployed in the areas where it will yield highest value. Thereafter, the management of core competencies is a process that will continue to identify existing core competencies, as well as develop a plan for the acquisition of desired competencies (Torkkeli and Tuominen, 2001).

Figure 2.6-3 illustrates the proposed research model by Ravichandran and Lertwongsatien (2005) that suggests the relationship between IS Resources and Capabilities in support of the Core Competencies leads to Organisation Performance.



**Figure 2.6-2 Research Model (Adopted from Ravichandran and Lertwongsatien, 2005)**

## 2.7 Summary of the Literature Review

The literature review indicated that there has been substantial research conducted to understand the relationship between IT and Company Performances. This study has adopted the approach as suggested by Ravichandran and Lertwongsatien (2005) to review the mechanism by which IS resources and capabilities work in support of the organisation's core competencies, to ultimately manifest in the attainment of company performance. Hence, this study has extended past research performed in the USA by Ravichandran and Lertwongsatien (2005) by conducting an empirical study of the effect of IS Resources and Capabilities on Company Performance within the South African Financial Services context.

In summary, the literature review has identified the following key areas within IT Performance literature. **Table 2.7-1** provides a summarised view of the constructs and variables identified from the literature and serves as an introduction to the hypotheses discussed in section 3.2 . A company possesses human resources, financial resources, and technical resources of which IS resources are a subset. IS resources have been further categorised as IS Human Resources, IT Infrastructure Quality, and IS Partnership Quality. These resources help deliver IS Capabilities in terms of Planning, Systems Development, Support, and Operations. These IT capabilities provide the foundation for the core competencies of companies being market access, integrity related competencies, and functionality related competencies. Figure 2.6-3 presented the research model which depicts that IT support for core competencies influence company performance.



Constructs	Indicators
IS Human Resource Capital	IS Personnel Skill IS Human Resource Specificity
IT Infrastructure Flexibility	Network and Platform sophistication Data and Application sophistication
Partnership Quality	Internal Partnership quality External Partnership quality
IS Capabilities	IS Planning sophistication Systems Development sophistication IS Support Maturity IS Operations capability
IT Support for core competencies	IT Support for market access IT Support for integrity related competencies IT Support for functionality related competencies
Firm Performance	Operating Performance Market-based Performance
Information Intensity	Information Intensity

**Table 2.7-1 Summary of Constructs and Indicator**

### 3 Research Hypotheses

#### 3.1 Introduction

This chapter reflects on the literature as detailed in Chapter 2 to develop a set of hypotheses. Chapter 2 presented a research model that pointed to the fact that IS Resources which include IS Human Resource Capital, IT Infrastructure Flexibility, and IS Partnership Quality, have a role in the development of IS Functional Capabilities. These IS Capabilities in turn provide the necessary foundation for IT to support the Core Competencies of the company. As a result, the company is able to attain superior profits and achieve higher levels of performance. Table 2.7-1 provides a brief summary of the constructs discussed thus far in the literature. It also aims to provide an introduction to the hypotheses presented in section 3.2.

#### 3.2 Hypotheses

The hypotheses listed here in section 3.2 have been adopted from the study conducted by Ravichandran and Lertwongsatien (2005, p. 244) in the USA. This study is a replication of the American study and has been applied to the South African Financial Services Industry.

As discussed in section 2.3, Baradwaj (2000) referred to resources as the building blocks of an organisation's capabilities. Consistent with the argument put forward by Newbert (2008) as well and Ravichandran and Lertwongsatien (2005), this study found a positive relationship between IT resources and IS Functional Capabilities. Ravichandran and Lertwongsatien (2005) categorise IT resources as Human

Resources (Hypothesis 1); IT Infrastructure (Hypothesis 2); and IS Partnership Quality (Hypothesis 3). A positive relationship is stated in a case when an increase in a variable results or is associated with an increase in the related variable in some proportion. A negative relationship is the opposite and is stated in a case where an increase in one variable results or is associated with a decrease in the related variable.

**H1:** There is a positive relationship between IS Human Capital and IS Functional Capabilities.

**H2:** There is a positive relationship between IT Infrastructure Flexibility and IS Functional Capabilities.

**H3:** There is a positive relationship between IS Partnership Quality and IS Functional Capabilities.

Section 2.5 made reference to the study by Kearns and Sabherwal (2007) and Ravichandran and Lertwongsatien (2005) where it is postulated that the ability to exploit the core competencies in an organisation is dependent on the company's IS functional capabilities. Consistent with their findings, this study posited a positive relationship between IS Functional Capabilities and IT Support for Core Competencies.

**H4:** There is a positive relationship between IS Functional Capabilities and IT Support for Core Competencies.

Section 2.6.1 indicated that the directed deployment of IT resources in support of the organisation's core competencies will lead to improved organisational performance. This study has therefore posited a positive relationship between IT Support for Core Competencies and Company Performance.

**H5:** There is a positive relationship between IT Support for Core Competencies and Company Performance.

In order to duplicate the way Ravichandran and Lertwongsatien tested these hypotheses, the various constructs were measured by a questionnaire, and the existence and strengths of the relationships between the constructs were tested statistically using the Partial Least Squares (PLS) technique.

### 3.3 Summary

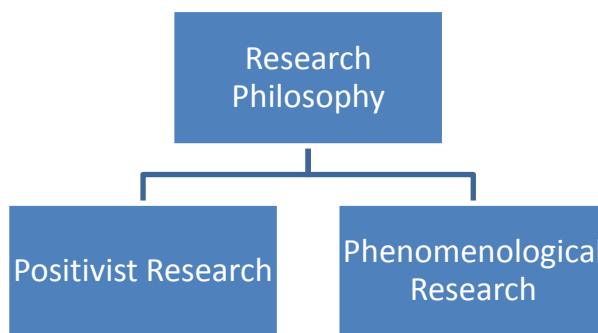
The purpose of this chapter was to detail the Hypotheses identified out of the literature review conducted in Chapter 2. Chapter 4 will detail the research methodology and present the data collection method and analysis. Chapter 5 will then present the results using the PLS technique.

## 4 Research Methodology

### 4.1 Introduction

This chapter will detail the research methodology that will be employed to test the hypotheses mentioned in Chapter 3. The chapter continues with a discussion of the positivist research philosophy that was followed in this study. Section 4.3 outlines the reasons for the appropriateness of the quantitative method. Section 4.4 introduces PLS as the analysis tool. Detailed justification of this research method is provided to demonstrate support for the applicability of PLS in this study. The remaining sections detail the sampling and data collection methods used in the study. The chapter closes with a discussion of the limitations of this study in section 4.11.

### 4.2 Research Philosophy



**Figure 4.2-1 Research philosophy alternatives (Adopted from Tobin, 2006)**

The two primary research alternatives available for this study were the Positivist and the Phenomenological philosophies. The research problem described in Chapter 1

lends itself to the positivist philosophy. The reasons for this are discussed in this section 4.2. Orlikowski and Baroudi (1991) indicated that the positivist paradigm is built upon the fact that there is a pre-existing relationship amongst those phenomena that are to be tested. They went further to describe the positivist philosophy as the dominant alternative within IS research. The motivation for selecting the positivist approach for this study includes the following:

- Firstly, the study developed a set of hypotheses identified from the literature and then went on to test them.
- Secondly, quantifiable measures of variables as a requirement as outlined by Orlikowski and Baroudi (1991) existed.
- Thirdly, the objective was to draw inferences from the sample of the sub groups (banks, investment services and insurance companies) within the financial services industry to generalise to the population as a whole.
- Lastly, the researcher and the object of inquiry are in all aspects independent.

One of the key assumptions of the positivist philosophy is that there is a belief about the relationship between the theory and practice. This ideal further supports the positivist approach adopted in this study by means of the research model presented in Figure 2.6-3, which was developed from the theory and related to the observable world via a set of tested hypotheses.

### 4.3 Quantitative / Qualitative method

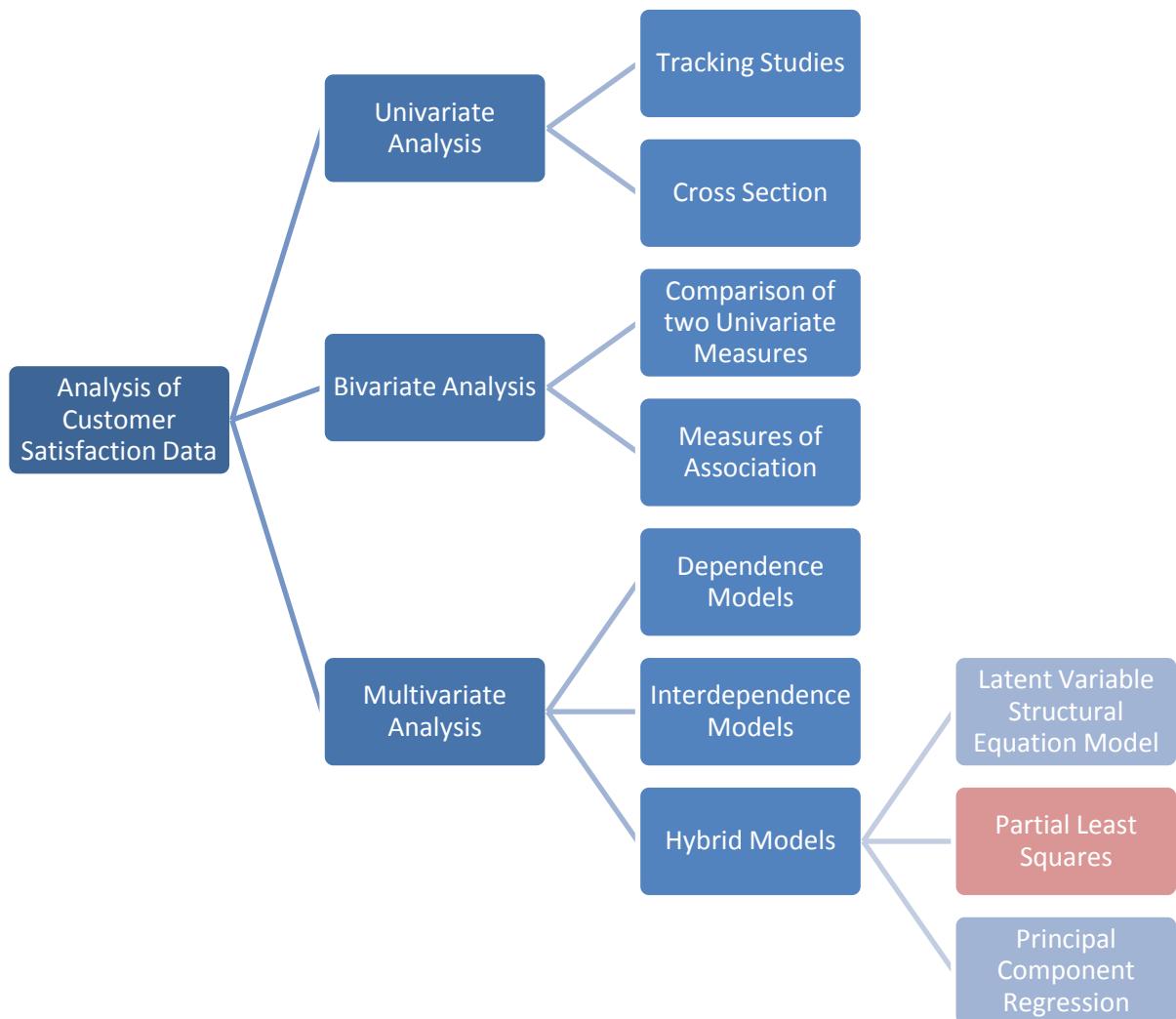
The discussion around the selection of Quantitative methods over Qualitative methods leads on from the discussion in section 4.2, where Kaplan and Duchon (1998) indicated that IT studies have been dominated by the positivist experimental model of research. Their argument followed on to examine the fact that most computer studies result in quantitative outcomes, which can be categorised under technical, economic, and effectiveness or performance measures. This study followed the same approach by adopting the quantitative method to achieve the objective as stated in section 1.4, which was to determine whether business performance in the South African financial services context can in part be explained by the use of IT.

### 4.4 Research Method

The aim of this research was to conduct an empirical study to determine and to understand the effect of IS resources and capabilities in the Financial Services sector within South Africa. PLS was proposed as the data analysis tool because it is capable of measuring latent constructs in situations where data are non-normal and where the sample sizes are relatively small (Pirouz, 2006). In addition, PLS is a components based structural equation modelling methodology, which allows the simultaneous measurement of the structural paths or diagram (i.e. the theoretical relationship between latent constructs established from the literature) and the measurement model (i.e. the relationship between the latent constructs and their indicators or component variables). In other words, it allowed for the testing of the strength of the proposed structural model, whilst at the same time also evaluating the

validity of the latent constructs that were used to create the structural model. The diagram in **Figure 4.4-1** shows that PLS is categorised under the Multivariate Analysis sub section.

The PLS method was designed to deal with multiple regression when data has a small sample, missing values, or multicollinearity (Pirouz, 2006), i.e. when significant correlations exist between the independent or exogenous variables used in the multiple regression model. The popularity of this method was first witnessed in econometric studies. However, application of PLS has proved successful in other areas such as the chemical sciences, and now also in the IS arena. The goal of the PLS technique is to predict the dependent variable from the independent variable, also referred to as the latent variable. PLS allows for the identification of the underlying factors which are a linear combination of the independent variables and are the best predictors of the dependent variable. The terms dependent and independent variables are frequently encountered in causal research. Zikmund (2003) describes a dependent or endogenous variable as a variable that is to be predicted or explained. In this study, it is the Company Performance. An independent or exogenous variable is that which is expected to influence the dependent variable. IT Infrastructure Flexibility is an example of an independent variable in this study.



**Figure 4.4-1 Framework for Customer Data Analysis (Adopted from Allen and Rao, 2000)**

Advantages of the PLS Method: (Pirouz, 2006):

- Ability to model multiple dependent and independent variables
- Ability to handle multicollinearity
- Can be applied to a small sample size
- Can accommodate a range of variables: ordinal, nominal, continuous

As this is a replica research study which was also a quantitative study, the survey questionnaire that was adopted from Ravichandran and Lertwongsatien (2005, p. 269) was used to gather the necessary data. The aim of that study was to research firms across the United States to determine the effect of IS resources and capabilities on company performance. The present study applied that model in the South African Financial Services Industry, to test applicability in the local context.

The Likert Scale survey method was selected because primary data was required for this research (refer to section 5.2 for a further discussion on the Likert Scale). The questionnaires were distributed via mail and an internet survey tool was established to aid the speed of data collection. Refer to section 4.8 for more details regarding the data collection process and appendix 10.1 for the survey questionnaire.

#### **4.5 Population and Sampling**

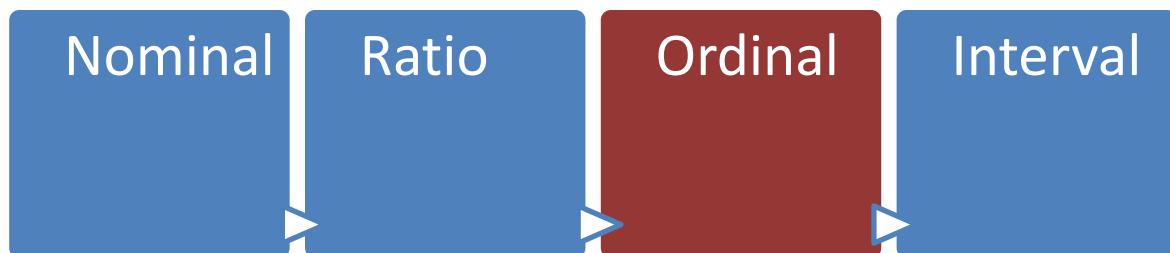
The population definition for this study included all South African companies within the Johannesburg Stock Exchange (JSE) listed under the Financial Services Sector. This industry includes the banks, insurance companies, equity investment companies, investment services, assets managers, and property and speciality finance companies. Since all companies from the JSE list of companies within the financial industry were approached to participate in the study, the full population was used. The survey focussed on the senior and executive level managers from within both business and IT.

## 4.6 Unit of Analysis

The unit of analysis is that which is measured to test the hypothesis. This research conducted a perception measurement of senior managers, hence the individual managers formed the unit of analysis for this study. Senior and executive managers from business and IT were selected to participate as they have visibility across business units as well as insight into the strategic issues of IT.

## 4.7 Data Measurement Types and Scaling Options

In essence there are four main types of data measurement which will be discussed here in turn.



**Figure 4.7-1 Types of Data Measurement (Adopted from Allen and Rao, 2000)**

### Nominal Data

Nominal data is referred to as categorical data and aspects of such data include gender, race etc. This data cannot be ordered with scale points, and this type of data measurement is rarely used with perception measurement. The one exception is binary data, which involves a typical yes or no response to a question. However Allen and Rao (2000), found that regression equations made up of binary

explanatory variables, explain less than 50 percent of the outcome variable's variance.

## Ratio Data

Ratio data permits the use of powerful mathematical operations. By accommodating the zero value, this data type allows the respondent to determine the magnitude of options available in a ratio scale (Allen and Rao, 2000).

## Ordinal Data

With Ordinal scales, although it can be determined that one option is higher or bigger than another, the magnitude of the difference cannot be determined. As a result of this limitation, distribution characteristics such as averages and standard deviation cannot be carried out on this type of data (Allen and Rao, 2000). The key differentiation between Ordinal and Ratio data is the ability to gauge the magnitude of the difference between the scale options. The Ordinal scale is ordered from positive to negative and typically has three to five points on a scale. This study made use of Ordinal data collected via a survey which is discussed further in section 4.8.

## Interval Data

Interval data also permits the inference of differences between points in a scale. A five-point Likert scale is the most common interval level scale. However, other scales such as the seven-point and ten-point scales are also available. The five-point scale is generally labelled only with the anchors. Labelling all points tends to imply an ordinal level response (Allen and Rao, 2000). However, there are no fixed rules available to prescribe which option is best suited. The rationale behind the issue of labelling each point on the scale relates to the impact it has on the distribution of the responses. For example, by labelling option 3 “Neutral,” skewness of the data will be lessened. This is a potential limitation with the five-point scale where managers may tend towards neutral responses subjecting the data to Central Response bias.

## Scaling Options

As mentioned in section 4.7, the options available in terms of scaling include the five-point, the seven-point and the ten-point scales, amongst others. Once again there is no firm guideline as to the relative benefit of one type of scale over the other in this regard. The selection is based largely on the degree of maturity, as the ten-point scale permits further granularity to be extracted from the data. However, the five-point scale was adopted for this study due to its simplicity for the respondent and the ease of use.

#### 4.8 Data Collection

A survey questionnaire was mailed to the identified senior IT and business managers from the companies within the survey population. The questionnaire was based on the constructs provided in Table 2.7-1. *Company Performance* was measured by the respondent's assessment of the company's performance over the past three years on two criteria i.e. Operating Performance (four-item scale) and Market-based performance (three-item scale).

A five-item scale was used to measure *IT Support for Market-access* competency, as well as *IT Support for Integrity-related* competency. A seven-item scale was used in the measurement of *IT Support for functionality-related* competency. IS Capabilities, which included: IS Planning Sophistication, Systems Development capability, IS Support Maturity, and IS Operations capabilities were all measured using a six-item scale.

IS Human Capital was defined in terms of IS Personnel Skill, which was measured on a four-item scale, and IS Human Resource Specificity was measured using a six-item scale. IT Infrastructure Flexibility comprised of Network and Planning Sophistication, measure on a six-item scale, and Data and Core Applications was measured with a four-item scale. IS Partnership Quality was defined in terms of the Internal and External Partnership Quality dimensions, both were measured with a six-item scale.

## 4.9 PLS Analysis

There are essentially three levels of analyses available for customer satisfaction and perception data: Univariate, Bivariate, and Multivariate statistics. This study makes use of multivariate analysis techniques. As presented in **Figure 4.4-1**, multivariate analysis can be further categorised into three types of models, which include the Dependence Models, Interdependence Models, and Hybrid Models. Allen *et al.* (2000), promote the Hybrid model which is powerful as it addresses both dependence and interdependence simultaneously. As such, this study has selected the PLS method (described in section 4.4) as the most appropriate method for analysis.

The PLS model is analysed in two stages (Ravichandran and Lertwongsatien, 2005). Firstly, the measurement model (**Figure 5.3-1**) is evaluated and adjusted until it is validated and then the overall structural relationship or model (**Figure 5.5-1**) is evaluated. The PLS technique has the same assumptions as ordinary linear regression but has significantly softer assumptions:

- There should be at least three manifest variables for a latent variable.
- Loadings on the paths between constructs and variables should be  $> .55$ .
- The  $R^2$  or variance explained for endogenous variables should be  $> .10$ .
- A predictor variable should account for at least 1.5% of the variance in a predicted variable.
- The p-value should be  $< 0.1$ . (Given the significance level of 0.1 or, 90% level of significance)

## 4.10 Questionnaire

The questionnaire is included in Appendix 10.1 for reference. The questions were adopted from the study by Ravichandran and Lertwongsatien (2005, p. 269).

## 4.11 Limitations of the Study

The limitations of the study relate to the following areas:

- A longitudinal study may identify other relationships that have not been explored in this study with cross sectional data.
- The study surveyed IT and Business Managers, which could lead to response bias as they have a vested interest in the delivery of key IT projects.
- The number of variables should have been reduced using factor analysis.
- Due to the focus on a specific and defined population, namely the Financial Services Industry, generalisation to other industries cannot be justified.

The PLS technique has the following limitations:

- Difficulty of interpreting the loadings of the latent constructs.
- Although models can be fitted to small amounts of data, determining significance of the estimated model may require the use of bootstrapping.
- There are no model test statistics available within this technique.

## 4.12 Summary

This chapter has detailed the research methodology and approach adopted for this study. The primary justification for following the positivist philosophy was due to the fact that there was a pre-existing relationship that this study is examining within the South African context. The researched body of literature favoured a quantitative method as this was a causal study. A derivation of the multivariate statistical analysis technique known as Partial Least Squares was referenced as the preferred method for this research study, due to its applicability on small sample sizes as well as its handling of multiple independent and dependant variables with the occurrence of multicollinearity. The sample selected for this study was defined as the full list of companies within the Financial Industry of the JSE. The data for the study was collected using the survey method with a Likert scale. Chapter 5 presents the results from the data obtained during the survey, and the analysis and observations are discussed in Chapter 6.

## 5 Presentation of Results

### 5.1 Introduction

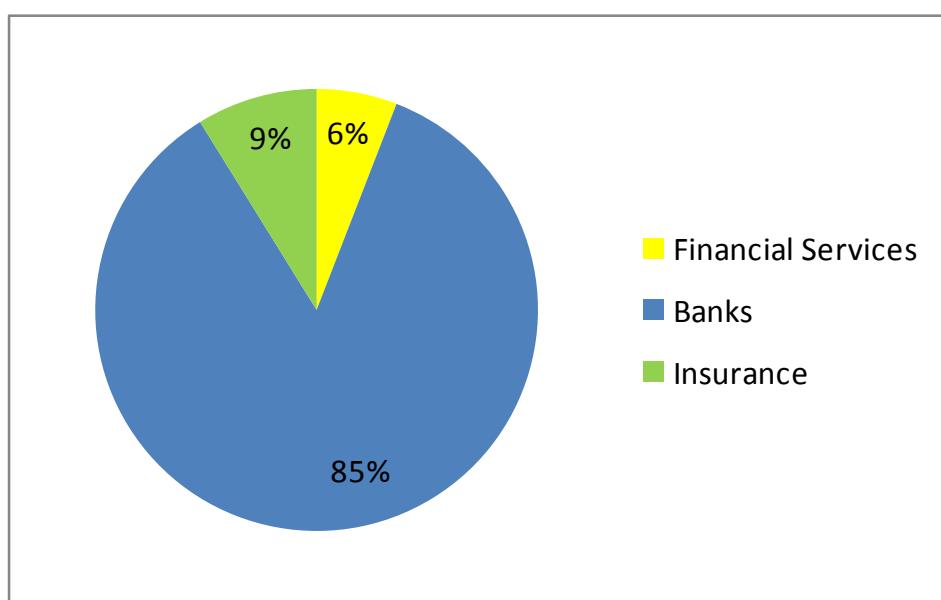
Chapter 5 provides a description and profile of the respondents who participated in this study. An in-depth analysis of the measurement and structural models for PLS is then carried out on the observed data. This analysis is done for each of the exogenous and endogenous variables that have been identified out of the literature. Subsequently, each hypothesis as listed in Chapter 3 will be tested to determine whether it is supported by the findings or not. The discussion of these findings will be presented in Chapter 6.

### 5.2 Respondent Profile

The data was collected using the survey method as discussed in section 4.8. The survey questions were mailed to senior executives and management working within Financial Service companies. JSE listed companies were selected due to the ease of access to information as listed companies are required to publish financial information. The Financial Services sector of the JSE was selected due to the fact that it had the largest number of listed companies within a single sector. Three companies were omitted from the sample as they were suspended from trade on the JSE at the time. Seventy questionnaires were sent out and thirty four responses were received, resulting in a forty eight percent response rate. A hundred percent of the responses received were usable and therefore none were rejected due to incomplete information. Although a fairly high response rate was achieved, the number of respondents in this study was considerably smaller than that achieved by Ravichandran and Lertwongsatien (2005). This was due to the limited number of

listed Financial Services companies within South Africa. In order to compensate for relatively small number of respondents, the statistician assisting with the analysis of the survey results, used the missing value imputation statistical method to extend the usable survey size. Additional sample responses were developed with the same data and distribution characteristics as the received responses, to ultimately increase the sample to 238.

Eighty five percent of the companies that responded to the survey belong to the Banking sub group within the Financial Services sector. The remaining fifteen percent was made up of the sub groups such as Investment Services, Property and Causality Insurance, and Life Insurance. The average market capitalisation of the companies surveyed was approximately R13bn. These companies had staff numbers ranging between 180 and 42 000 employees. All but one of the responding companies had the head office located in Johannesburg, South Africa.



**Figure 5.2 1 Profile of Responding Companies in the Financial Subsectors**

The job profiles of the respondents were concentrated at the senior or executive level within the respective companies. Some of the job titles of the respondents included: Chief Information Officer (CIO), Senior IT Manager and Senior Financial Manager. The survey was targeted at these levels to ensure that the respondent had sufficient visibility across business units as well as knowledge about the strategy of the business. Forty one percent of the respondents were senior or executive IT managers with the remaining fifty nine percent from business. Seventy four percent of the respondents were male, whilst twenty six percent were female. The respondents were identified either via known personnel within the Financial Services companies or via the Datamonitor key personnel search.

### **Likert Survey**

The Likert Scale was used to develop a perception measure amongst senior managers towards how information systems influence company performance. The benefit of using such a scale is that it simplifies the survey by providing the respondent with a grounding point for his/her answer. However, the five-point scale in particular has a drawback in that it does not force the respondent to choose a positive or negative response, and therefore allows central tendency bias. The distributed survey included a total of 53 measurement indicators and 5 latent constructs. However, due to the number of observed responses received, the measurement indicators were revised down to 15 and all the latent constructs were maintained. A definition of each indicator is provided in Table 5.2-1. The descriptors provided in Table 5.2-1 reflect the actual indicators that were measured with the survey.

Indicator	Definition
1_1	Measured the ability of IS staff to acquire the skills and knowledge for new technologies and to manage IT projects in the current business environment.
1_2	Measured IS staff knowledge of the business and awareness of the core beliefs and values.
2_1	Measured the availability of Infrastructure to electronically link the various business units in a company.
2_2	Measured whether the company had the appropriate technology infrastructure in place today. i.e. including to link with external suppliers and / or customers via an appropriate network.
2_3	Measured the standardisation of various components of technology together with an evaluation of the modularity of the systems permitting data re-use across business unit boundaries.
3_1	Measured the transparency of information flow between the IS department and the business units.
3_2	Measured the collaboration of the IS and Business departments to jointly develop the goals and plans for IT projects.
3_3	Measured the existence of conflicts between business and IT or external vendors.
3_4	Measured the existence of a trusting relationship between IT, the vendor and business.
4_1	Measured the frequency of IS planning and the involvement of business in the development of IT plans
4_2	Measured the maturity of the systems development and support processes.
4_3	Measured the level of automation of IT systems and infrastructure as well the maturity of planning for system outages.
5_1	Measured the ability to identify and meet customer requirements through tailored products.
5_2	Measured the ability of the business processes to integrate the supply chain and ensure speedy delivery of new products into the market.
5_3	Measured the ability to identify new market opportunities.
6_1	Measured the speed of delivery of new products against competitors.
6_2	Measured the financial performance of the company against that of their competitors.

**Table 5.2-1 Definition of Indicators**

## Scale Validation

The scale used for this study was developed by Ravichandran and Lertwongsatien (2005). The scale was assessed for convergent validity by ensuring all items load highly on one factor. This scale was merely modified to reflect applicability within the South African context.

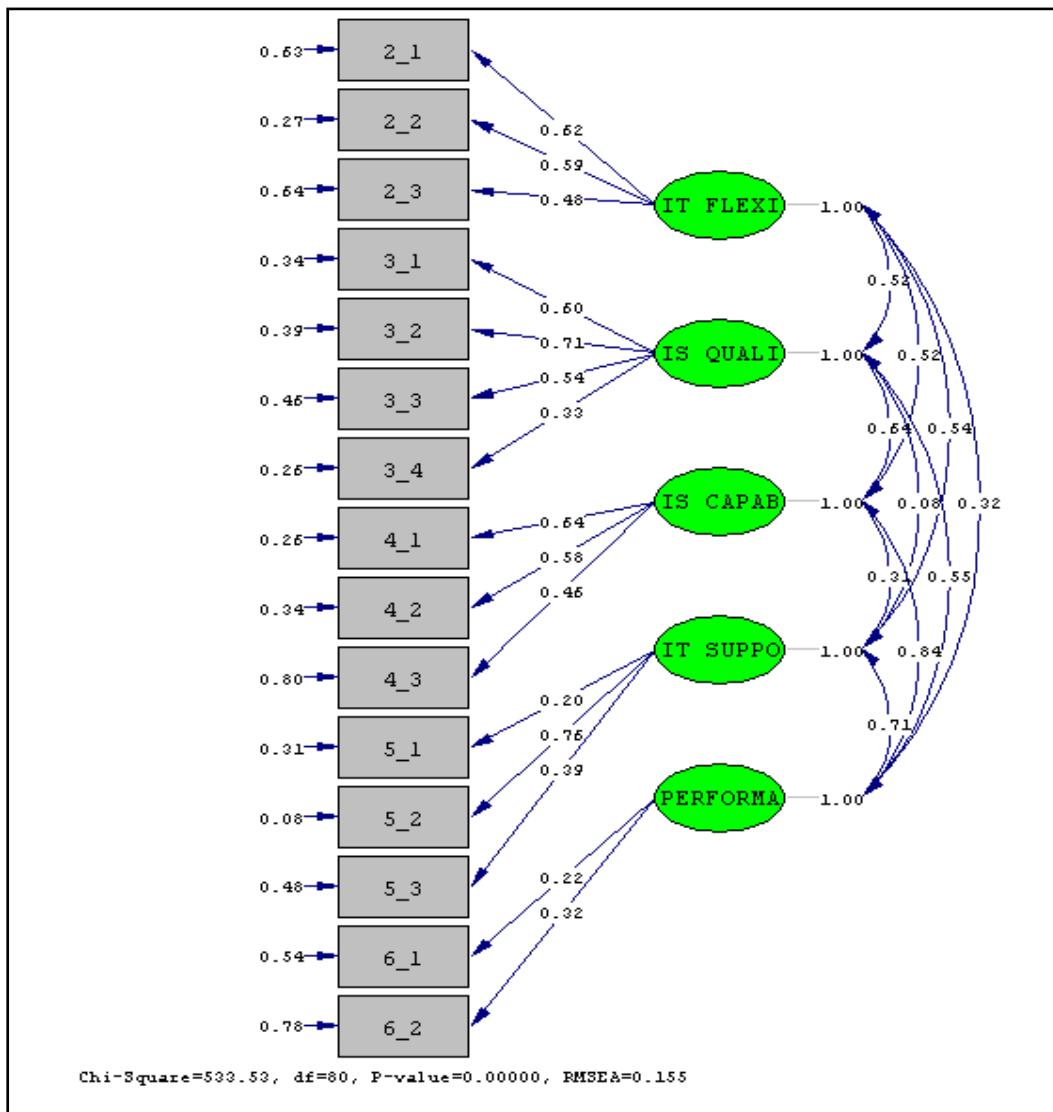
### 5.3 Analysis of Measurement Model

As outlined in the PLS Analysis section 4.9, PLS is interpreted in two stages. The first step evaluates the measurement model and the second step in the analysis examines the structural model as a whole. “The measurement model subsumes the composition of the latent variables while the structural model depicts how the latent variables are interrelated” (Allen and Rao, 2000, p.186). **Figure 5.3-1** is the graphical output of the measurement model for this study. The square blocks represent the exogenous variables which were modelled as indicators of the latent constructs, represented by the oval shaped figures. The analysis was done with the help of a statistician, and the model was generated using the LISREL software tool developed by Joreskog and Sorbom in 2006, using a 90% confidence interval. LISREL has become the established tool in structural equation modelling with latent variables.

The first iteration of the model included IS Human Resources as an exogenous variable together with IT Infrastructure Flexibility and IS Partnership Quality. However, the effect of the relationship between IS Human Capital and IS Capability



was found to be negative and therefore the effects of this variable were constrained and removed in the attempt to improve the overall model. The model was run for a second time in an attempt to improve the overall validity. This resulted in a revision of the model which is presented in **Figure 5.3-1**.



**Figure 5.3-1 The Measurement Model**

**Table 5.3-1** provides a different view of the loading between the 15 variables and the 5 latent constructs. It provides a quick reference for each of the latent constructs and the indicators that relate to each factor. The indicator variables will be reviewed in turn under section 5.4 to determine the level of significance in relation to the latent constructs.

	Latent Constructs					
		IT_Flexibility	IS Quality	IS_Capability	IT_Support	Performance
<b>Independent Variables</b>	<b>2_1</b>	X	0	0	0	0
	<b>2_2</b>	X	0	0	0	0
	<b>2_3</b>	X	0	0	0	0
	<b>3_1</b>	0	X	0	0	0
	<b>3_2</b>	0	X	0	0	0
	<b>3_3</b>	0	X	0	0	0
	<b>3_4</b>	0	X	0	0	0
	<b>4_1</b>	0	0	X	0	0
	<b>4_2</b>	0	0	X	0	0
	<b>4_3</b>	0	0	X	0	0
	<b>5_1</b>	0	0	0	X	0
	<b>5_2</b>	0	0	0	X	0
	<b>5_3</b>	0	0	0	X	0
	<b>6_1</b>	0	0	0	0	X
	<b>6_2</b>	0	0	0	0	X

**Table 5.3-1 Tabular representation of the Measurement Model**

	IT Flexibility	IS Quality	IS Capability	IT Support	Performance
IT Flexibility	1.00				
IS Quality	0.52	1.00			
IS Capability	0.52	0.64	1.00		
IT Support	0.54	0.08	0.31	1.00	
Performance	0.32	0.55	0.84	0.71	1.00

**Table 5.3-2 Correlation Matrix of Independent Variables**

The correlation matrix presented in Table 5.3-2 can be interpreted using the following general guideline: Resulting values can range from a positive 1 (+1) to a negative 1 (-1). The closer the value moves towards +1 or -1, the closer the two variables are related. If the value is zero or close to zero, there is no relationship between the variables. A value between 0 and 0.55 is a weak positive; a value between 0.55 and 1 is a strong positive. A value between 0 and -0.55 is a weak negative; and finally a value between -0.55 and -1 is a strong negative.

The correlation between IS Partnership Quality as well IS Capability with IT Infrastructure Flexibility yielded the same result at 0.52, which is a moderately strong positive. The correlation between IS Capability and IS Partnership Quality is a strong positive at 0.64. IT Support for Core Competencies has a strong correlation with IT Infrastructure Flexibility at 0.54, a weak positive correlation with IS Partnership Quality at 0.08, and another weak positive with IS Capability at 0.31. Finally, Firm Performance has the strongest positive correlation with IS Capability at 0.84, a strong positive correlation with IT Support for Core Competencies and IS Quality at 0.71 and 0.55 respectively, and a weak positive with IT Infrastructure

Flexibility at 0.32. All relationships are positive and statistically significant at the 90% significance level with the exception of IT Support for Core Competencies and IS Partnership Quality which reflects a weak positive relationship at 0.08.

### Measurement Equations

2\_1 = 0.62\*IT FLEXI, Errorvar = 0.63, R<sup>2</sup> = 0.38

(0.069)	(0.073)
8.96	8.69

2\_2 = 0.59\*IT FLEXI, Errorvar = 0.27, R<sup>2</sup> = 0.57

(0.053)	(0.045)
11.13	6.03

2\_3 = 0.48\*IT FLEXI, Errorvar = 0.64, R<sup>2</sup> = 0.26

(0.065)	(0.067)
7.32	9.63

3\_1 = 0.60\*IS QUALI, Errorvar = 0.34, R<sup>2</sup> = 0.51

(0.053)	(0.043)
11.35	7.95

3\_2 = 0.71\*IS QUALI, Errorvar = 0.39, R<sup>2</sup> = 0.56

(0.059)	(0.054)
11.96	7.37

3\_3 = 0.54\*IS QUALI, Errorvar = 0.46, R<sup>2</sup> = 0.39

(0.057)	(0.054)
9.58	9.14

3\_4 = 0.33\*IS QUALI, Errorvar = 0.26, R<sup>2</sup> = 0.30

(0.041)	(0.027)
8.23	9.71

4\_1 = 0.64\*IS CAPAB, Errorvar = 0.26, R<sup>2</sup> = 0.61

(0.053)	(0.045)
12.01	5.72

4\_2 = 0.58\*IS CAPAB, Errorvar = 0.34, R<sup>2</sup> = 0.49

(0.054)	(0.045)
10.70	7.60

4\_3 = 0.46\*IS CAPAB, Errorvar = 0.80, R<sup>2</sup> = 0.21

(0.070)	(0.079)
6.55	10.08

5\_1 = 0.20\*IT SUPP, Errorvar = 0.31, R<sup>2</sup> = 0.12

(0.041)	(0.029)
4.87	10.56

5\_2 = 0.76\*IT SUPP, Errorvar = 0.082, R<sup>2</sup> = 0.88

(0.068)	(0.085)
11.22	0.97

5\_3 = 0.39\*IT SUPP, Errorvar = 0.48, R<sup>2</sup> = 0.24

(0.057)	(0.050)
6.84	9.71

6\_1 = 0.22\*PERFORMA, Errorvar = 0.54, R<sup>2</sup> = 0.085

(0.083)	(0.058)
2.69	9.30

6\_2 = 0.32\*PERFORMA, Errorvar = 0.78, R<sup>2</sup> = 0.11

(0.11)	(0.094)
2.83	8.30

**Table 5.3-3 Measurement Equations**

**Table 5.3-3** presents the measurement equations derived from the model in **Figure 5.3-1**. All of the factor loadings are highly positive. This represents the first step of the PLS analysis, indicating whether these measures should be included in the model. The factor loadings indicate how the individual indicators contribute to the construct, whereas the path coefficients (discussed in section 5.5) indicate how they contribute to the overall relationships between the constructs.

The estimated factor loadings for IT Infrastructure Flexibility are highly positive for 2\_1, 2\_2 and 2\_3, at 0.62, 0.59 and 0.48 respectively and significant at  $P < 0.1$  (90% significance level).

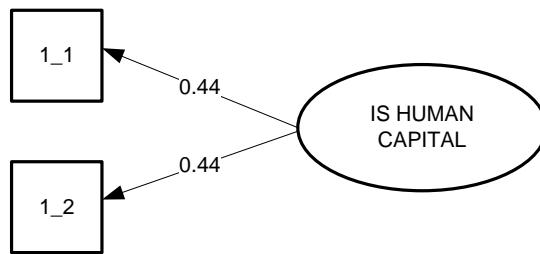
IS Partnership Quality is also well measured by 3\_1, 3\_2, 3\_3, 3\_4 with all factor loads highly positive at 0.60, 0.71, 0.54, 0.33 respectively and significant at the 90% significant level in contrast with their small standard errors.

IT Support for Core Competencies construct is also well measured by 5\_2 with a factor loading at 0.76, with 5\_3 and 5\_1 following as measures with a factor loading at 0.39 and 0.20 respectively.

The P-values for all variables are less than 0.1 with the exception of 6\_2 which was marginally higher. The  $R^2$  or variances explained for endogenous variables are all greater than .10 with once again the exception being the Performance Indicator 6\_1.

Given the tenability of the measurement model reflected in section 5.4, the structural model can be assessed to focus on the structural causal relationships among IT Infrastructure Flexibility, IS Partnership Quality, IT Support for Core Competencies and Business Performance.

## 5.4 Measures



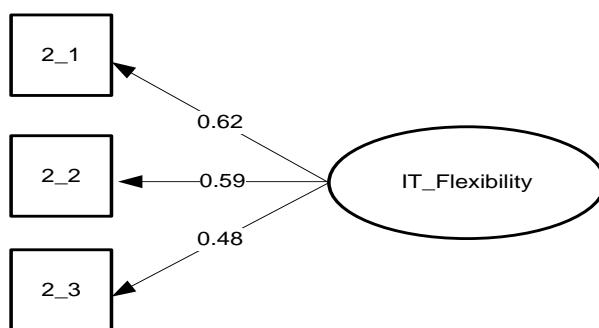
**Figure 5.4-1 Factor Loadings for IS Human Capital**

Indicator	Definition	Factor Loading	P-Value	R <sup>2</sup>
1_1	Measured the ability of IS staff to acquire the skills and knowledge for new technologies and to manage IT projects in the current business environment.	0.44	0.064	0.28
1_2	Measured IS staff knowledge of the business and awareness of the core beliefs and values.	0.44	0.063	0.29

**Table 5.4-1 IS Human Capital**

1\_1 has a positive factor loading on IS Human Capital at 0.44. The p-value is less than 0.1 at 0.064, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.28 indicates that it explains (or accounts for) 28% of the variance in IS Human Capital.

1\_2 has a positive factor loading on IS Human Capital at 0.44. The p-value is less than 0.1 at 0.063, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.29 indicates that it explains (or accounts for) 29% of the variance in IS Human Capital.



**Figure 5.4-2 Factor Loadings for IT Infrastructure Flexibility**

Indicator	Definition	Factor Loading	P-Value	$R^2$
2_1	Measured the availability of Infrastructure to electronically link the various business units in a company.	0.62	0.069	0.38
2_2	Measured whether the company had the appropriate technology infrastructure in place today, including the link with external suppliers and / or customers via an appropriate network.	0.59	0.053	0.57
2_3	Measured the standardisation of various components of technology together with an evaluation of the modularity of the systems permitting data re-use across business unit boundaries.	0.48	0.065	0.26

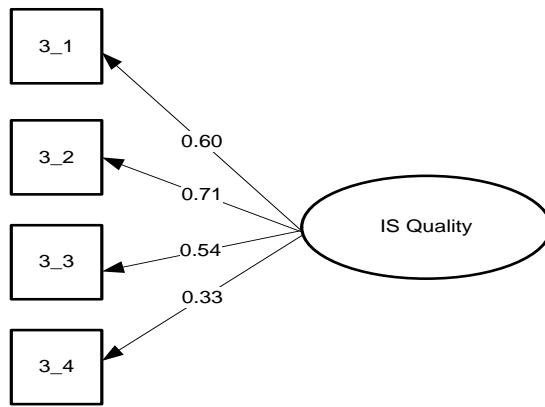
**Table 5.4-2 IT Infrastructure Flexibility**

The observed data revealed that:

2\_1 has a strong positive factor loading on IT Infrastructure Flexibility at 0.62. The p-value is less than 0.1 at 0.069, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.38 indicates that it explains (or accounts for) 38% of the variance in IT Flexibility.

2\_2 has a strong positive factor loading on IT Infrastructure Flexibility at 0.59. The p-value is less than 0.1 at 0.053, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.57 indicates that it explains (or accounts for) 57% of the variance in IT Flexibility.

2\_3 has a strong positive factor loading on IT Infrastructure Flexibility at 0.48. The p-value is less than 0.1 at 0.065, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.26 indicates that it explains (or accounts for) 26% of the variance in IT Flexibility.



**Figure 5.4-3 Factor Loadings for IS Partnership Quality**

Indicator	Definition	Factor Loading	P-Value	R <sup>2</sup>
3_1	Measured the transparency of information flow between the IS department and the business units.	0.60	0.053	0.51
3_2	Measured the collaboration of the IS and Business departments to jointly develop the goals and plans for IT projects.	0.71	0.059	0.56
3_3	Measured the existence of conflicts between business and IT or external vendors.	0.54	0.057	0.39
3_4	Measured the existence of a trusting relationship between IT, the vendor and business.	0.33	0.041	0.30

**Table 5.4-3 IS Partnership Quality**

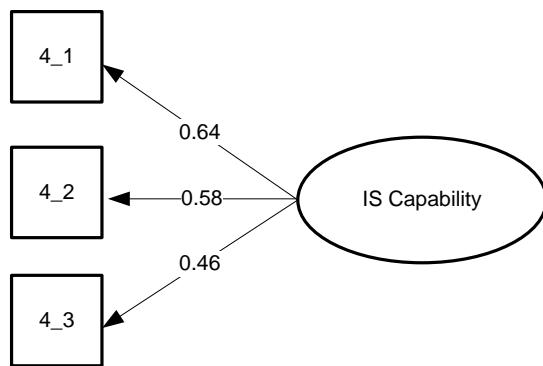
The observed data revealed that:

3\_1 has a strong positive factor loading on IS Partnership Quality at 0.60. The p-value is less than 0.1 at 0.053, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.51 indicates that it explains (or accounts for) 51% of the variance in IS Partnership Quality.

3\_2 has a strong positive factor loading on IS Partnership Quality at 0.71. The p-value is less than 0.1 at 0.059, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.56 indicates that it explains (or accounts for) 56% of the variance in IS Partnership Quality.

3\_3 has a strong positive factor loading on IS Partnership Quality at 0.54. The p-value is less than 0.1 at 0.057, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.39 indicates that it explains (or accounts for) 39% of the variance in IS Partnership Quality.

3\_4 has a weak positive factor loading on IS Partnership Quality at 0.33. The p-value is less than 0.1 at 0.0041, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.30 indicates that it explains (or accounts for) 30% of the variance in IS Partnership Quality.



**Figure 5.4-4 Factor Loadings for IS Capability**

Indicator	Definition	Factor Loading	P-Value	R <sup>2</sup>
4_1	Measured the frequency of IS planning and the involvement of business in the development of IT plans	0.64	0.053	0.61
4_2	Measured the maturity of the systems development and support processes.	0.58	0.054	0.49
4_3	Measured the level of automation of IT systems and infrastructure as well the maturity of planning for system outages.	0.46	0.070	0.21

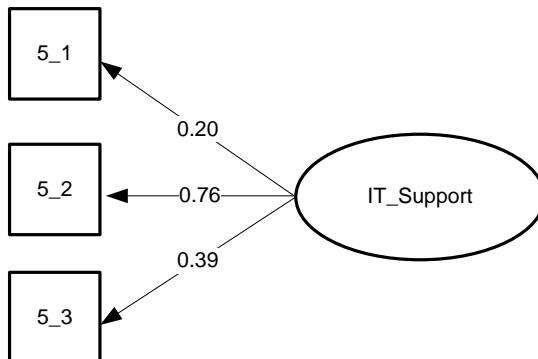
**Table 5.4-4 IS Capability**

The observed data revealed that:

4\_1 has a strong positive factor loading on IS Capability at 0.64. The p-value is less than 0.1 at 0.053, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.61 indicates that it explains (or accounts for) 61% of the variance in IS Capability.

4\_2 has a strong positive factor loading on IS Capability at 0.58. The p-value is less than 0.1 at 0.054, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.49 indicates that it explains (or accounts for) 49% of the variance in IS Capability.

4\_3 has a positive factor loading on IS Capability at 0.46. The p-value is less than 0.1 at 0.070, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.21 indicates that it explains (or accounts for) 21% of the variance in IS Capability.



**Figure 5.4-5 Factor Loadings for IT Support for Core Competencies**

Indicator	Definition	Factor Loading	P-Value	R <sup>2</sup>
5_1	Measured the ability to identify and meet customer requirements through tailored products.	0.20	0.041	0.12
5_2	Measured the ability of the business processes to integrate the supply chain and ensure speedy delivery of new products into the market.	0.76	0.068	0.88
5_3	Measured the ability to identify new market opportunities.	0.39	0.057	0.24

**Table 5.4-5 IT Support for Core Competence**

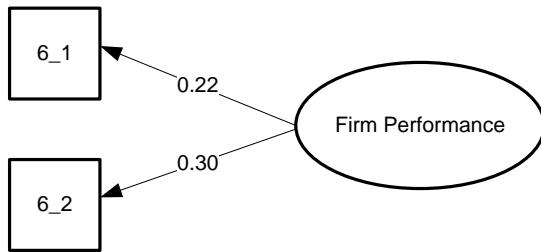
The observed data revealed that:

5\_1 has a weak positive factor loading on IT Support for Core Competencies at 0.20.

The p-value is less than 0.1 at 0.041, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.12 indicates that it explains (or accounts for) 12% of the variance in IT Support for Core Competencies.

5\_2 has a strong positive factor loading on IT Support for Core Competencies at 0.76. The p-value is less than 0.1 at 0.068, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.88 indicates that it explains (or accounts for) 88% of the variance in IT Support for Core Competencies.

5\_3 has a positive factor loading on IT Support for Core Competencies at 0.39. The p-value is less than 0.1 at 0.057, therefore this loading is significant at the 90% significance level, and the  $R^2$  value of 0.24 indicates that it explains (or accounts for) 24% of the variance in IT Support for Core Competencies.



**Figure 5.4-6 Factor Loading on Firm Performance**

Indicator	Definition	Factor Loading	P-Value	R <sup>2</sup>
6_1	Measured the speed of delivery of new products against competitors.	0.22	0.083	0.085
6_2	Measured the financial performance of the company against that of their competitors.	0.32	0.11	0.11

**Table 5.4-6 Firm Performance**

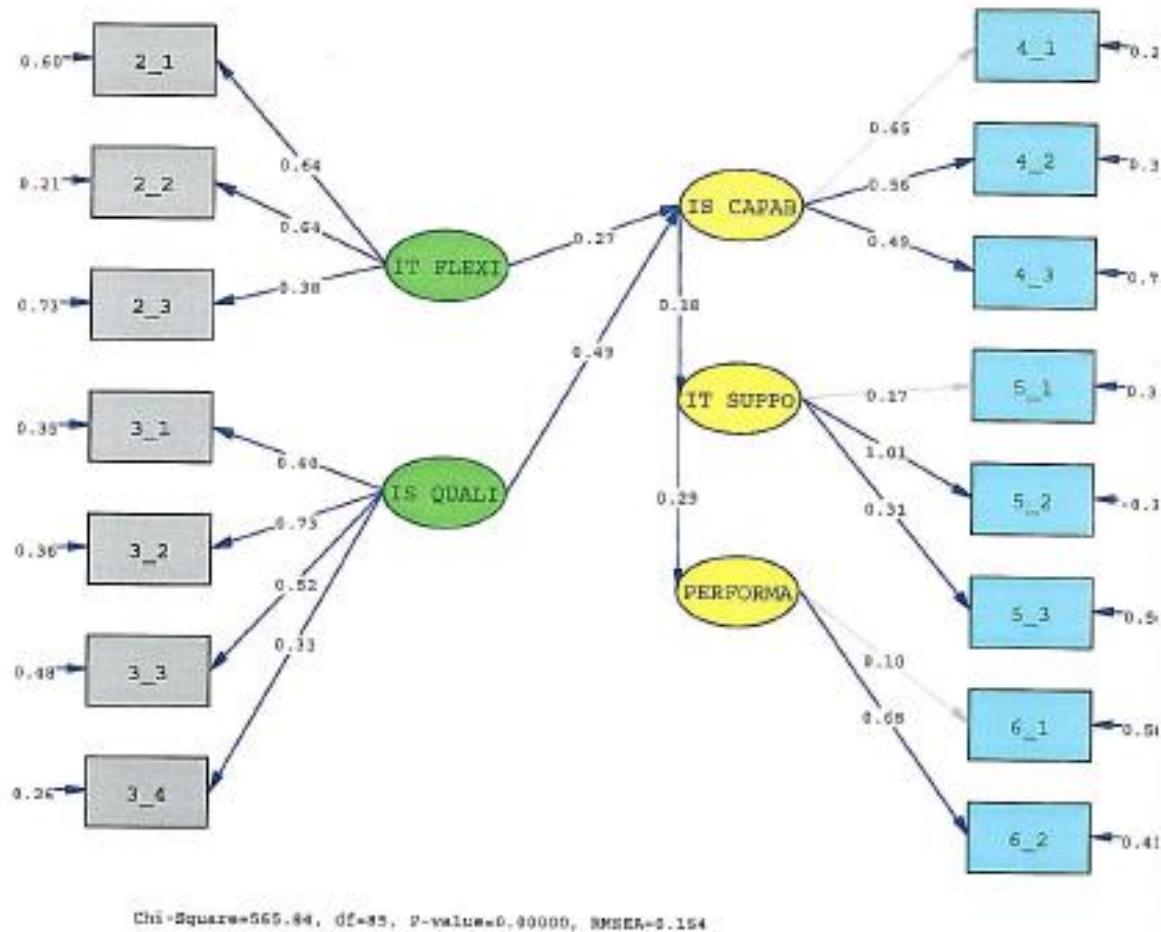
The observed data revealed that:

6\_1 has a positive factor loading on Firm Performance at 0.22. The p-value is less than 0.1 at 0.083, therefore this loading is significant at the 90% significance level, and the R<sup>2</sup> value of 0.085 indicates that it explains (or accounts for) 8.5% of the variance in Firm Performance.

6\_2 has a positive factor loading on Firm Performance at 0.32. The p-value is marginally greater than 0.1 at 0.11, therefore this loading is not statistical significant at the 90% significance level, and the R<sup>2</sup> value of 0.11 indicates that it explains (or accounts for) 11% of the variance in Firm Performance.



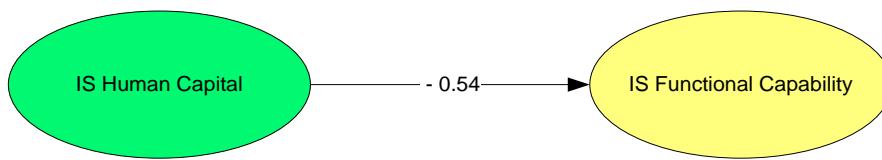
## 5.5 Structural Model



**Figure 5.5-1 The Structural Model**

The structural model describes the dependencies amongst the latent constructs. In this study there are five latent constructs as reflected in **Figure 5.5-1**. Two of these constructs are exogenous (IT Flexibility and IS Quality), with the remaining three (IS Capability, IT Support, Performance) endogenous. Thus far the relationships that are posited in this study have been specified in the measurement model. The test to determine whether the structural model was consistent with the observed data was done with the use of the software LISREL. Allen and Rao (2000) indicated the importance of noting the fact that the causal model is never explicitly proven. On the

other hand, it can be tested that the relationships hypothesised in the measurement and structural model are consistent with what was reflected in the data. The path coefficient in the causal analysis reflects the values of the direct contribution of a given variable on another variable, given the effects of the other variables are also taken into account.



**Figure 5.5-2 Hypothesis 1**

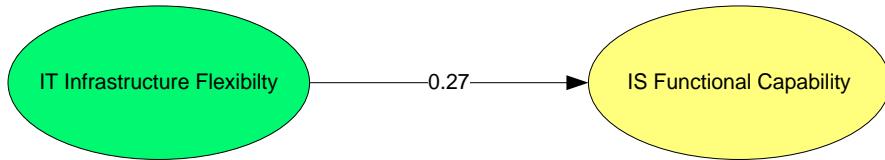
**Structural Equation:**

$$\text{IS CAPAB} = -0.54 \cdot \text{IS HUMAN} + 1.10 \cdot \text{IS QUAL}, \text{ Errorvar.} = 0.53, R^2 = 0.47$$

(0.34)	(0.32)
-1.59	3.41

**Equation 5.5-1**

The path coefficient between IS Human Capital and IS Capability is negative at -0.54. The p-value is greater than 0.1 at 0.34 and therefore not significant at the 90% level. The structural equation model therefore does not provide support for Hypothesis 1 which stated that there is a positive relationship between IS Human Capital and IS Functional Capabilities.



**Figure 5.5-3 Hypothesis 2**

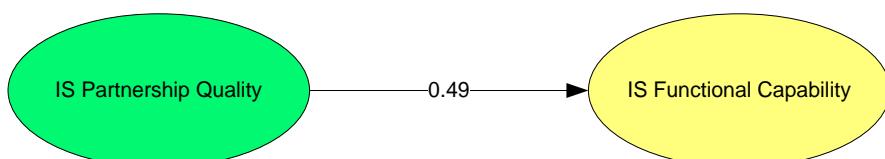
**Structural Equation:**

$$IS\ CAPAB = 0.27 * IT\ FLEXI + 0.49 * IS\ QUALI, \text{ Errorvar} = 0.55, R^2 = 0.45$$

(0.097)	(0.097)	(0.12)
2.84	5.01	4.66

**Equation 5.5-2**

The path coefficient between IT Infrastructure Flexibility and IS Capability is positive at 0.27. The p-value is less than 0.1 at 0.097 and therefore significant at the 90% level. The structural equation model therefore provides support for Hypothesis 2 which stated that there is a positive relationship between IT Infrastructure Flexibility and IS Functional Capabilities.



**Figure 5.5-4 Hypothesis 3**



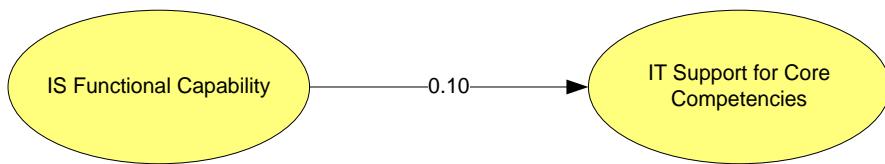
**Structural Equation:**

IS CAPAB = 0.27 \* IT FLEXI + 0.49 \* IS QUALI, Errorvar = 0.55, R<sup>2</sup> = 0.45

(0.097)	(0.097)	(0.12)
2.84	5.01	4.66

**Equation 5.5-3**

The path coefficient between IS Partnership Quality and IS Functional Capability is positive at 0.49. The p-value is less than 0.1 at 0.097 and therefore significant at the 90% level. The structural equation model therefore provides support for Hypothesis 3 which stated that there is a positive relationship between IS Partnership Quality and IS Functional Capabilities.



**Figure 5.5-5 Hypothesis 4**

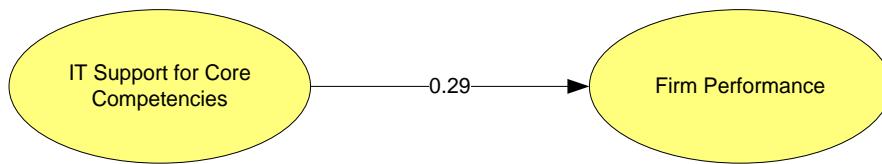
**Structural Equation:**

IT SUPP = 0.10 \*IS CAPAB, Errorvar = 0.55, R<sup>2</sup> = 0.033

(0.096)	(0.49)
1.89	1.96

**Equation 5.5-4**

The path coefficient between IS Functional Capability and IT Support for Core Competencies is positive at 0.10. The p-value is less than 0.1 at 0.096. However,  $R^2$  of 0.033 is very low. Although the path coefficient therefore seems to be statistically significant, the low  $R^2$  value indicates that the IS Functional Capability does not seem to account for a sufficient portion of the variation in IT Support for Core Competencies. It does therefore not seem to provide sufficient support to Hypothesis 4.



**Figure 5.5-6 Hypothesis 5**

**Structural Equation:**

$$\text{PERFORMA} = 0.29 * \text{IT SUPP}, \text{Errorvar} = 0.91, R^2 = 0.087$$

(0.38)	(1.38)
0.78	0.66

**Equation 5.5-5**

The path coefficient between IT Support for Core Competencies and Firm Performance is positive at 0.29. However, the p-value is greater than 0.1 at 0.38, indicating that the coefficient is not statistically significant, and the  $R^2$  value of 0.087 is also very low. The structural equation model therefore does not seem to provide

support for Hypothesis 5 which stated that there is a positive relationship between IT support for Core Competencies and Company Performance.

A positive and significant path coefficient was witnessed between the latent constructs. IT Infrastructure Flexibility and IT Partnership Quality both have a strong positive path coefficient to IT Capabilities. However, the path coefficient between IT Capabilities and IT Support for Core Competencies is moderate, but still positive. Finally, IT Support for Core Competencies presents a positive path coefficient with Business Performance.

	IT Flexibility	IS Quality
IT Flexibility	1.00	
IS Quality		1.00
(0.07)	0.52	
7.29		

**Table 5.5-1 Correlation Matrix of Independent Variables**

The correlation between the independent / exogenous variables, IS Partnership Quality and IT Infrastructure Flexibility yielded a moderately strong positive result at 0.52, with a p-value of 0.07 which was significant as it was less than 0.1.

	IS Capability	IT Support	Performance	IT Flexibility	IS Quality
IS Capability	1.00				
IT Support	0.18	1.00			
Performance	0.05	0.29	1.00		
IT Flexibility	0.53	0.10	0.03	1.00	
IS Quality	0.63	0.11	0.03	0.52	1.00

**Table 5.5-2 Covariance Matrix of Independent Variables**

The covariance matrix indicated that the highest covariance occurred between IS Partnership Quality and IS Functional Capability, whereas the lowest occurred between IT Infrastructure Flexibility and Firm Performance

After reviewing the path coefficients in the structural model, the next step was to evaluate the model using the goodness of fit indices. Whilst the Chi-square value has historically been touted as the measure of fit, the Root mean square error of approximation (RMSEA) has increased in popularity in recent years to assess the fit of models with small data samples (Chou and Su, 2007). The critical aspect about goodness of fit is that it is the single decision criteria that leads to the acceptance or rejection of the hypothesised causal model. The RMSEA for the model in this study is 0.15 with a 90 % confidence interval between 0.14 and 0.17. An RMSEA at 0.05 shows a very close fit. At greater than 0.05 and less than 0.1 is a fair fit. RMSEA at greater than 0.10 is poor fit. This model achieved an RMSEA which was marginally greater than 0.10 suggesting that this model is not the best model to fully explain the performance of the company. This is to be expected, given that some of the path coefficients were not significant and that there are a lot of other factors that also contribute to company performance.

## 5.6 Summary

Chapter 5 has presented the results from the survey using the PLS technique. The findings show support for Hypothesis 2 and 3, but support for Hypotheses 1, 4 and 5 could not be determined. Chapter 6 will discuss the results presented in Chapter 5 and Chapter 7 will conclude this study by applying the findings within the South African context by looking at the implications for the surveyed companies.

## 6 Discussion of Results

### 6.1 Introduction

This chapter will discuss and analyse the results detailed in Chapter 5. Each of the Hypotheses will be interrogated by reviewing the results of the survey questionnaire posed to the respondents and contrasting this against the findings obtained by Ravichandran and Lertwongsatien (2005).

### 6.2 Discussion per Hypothesis

#### 6.2.1 Hypothesis 1

**There is a positive relationship between IS Human Capital and IS Functional Capabilities.**

Support for this hypothesis could not be proven given the findings from the data relating to IS Human Capital and IS Functional Capabilities. IS Human Capital was measured using the following three key indicators:

- 1\_1 Measured the ability of IS staff to acquire the skills and knowledge for new technologies and to manage IT projects in the current business environment.
- 1\_2 Measured IS staff knowledge of the business and awareness of the core beliefs and values.

In Appendix 10.3, the frequency graph indicated that there was agreement amongst the respondents that IS staff have the knowledge and ability to manage IT projects.

It was interesting to note that 67% of respondents indicated that IS staff had an awareness of the company values and beliefs.

The IS Functional Capabilities construct looked at the maturity levels of the Planning, Development, Support and Operations processes. This construct is also referenced in Hypothesis 3 and 4 and was measured using the following three indicators:

- 4\_1        The frequency of IS planning and the involvement of business in the development of IT plans
- 4\_2        The maturity of the systems development and support processes.
- 4\_3        The level of automation of IT systems and infrastructure as well the maturity of planning for system outages.

In Hypothesis 1, the relationship between IS Human Capital and IS Functional Capability is negative. This means that an increase in human resources results in decrease in the effectiveness of processes such as planning, development, operations and support. This finding is in disagreement with Ravichandran and Lertwongsatien (2005) who present this relationship as positive. Their finding suggested that a lack of investment in IS resources will manifest in a lack of capacity to leverage IT to create and sustain competitive positioning in the market.

The finding in this study does not concur with what has been achieved by proponents of Resource Based theory such as Baradwaj (2000) and Newbert (2008).

It would therefore suggest that this relationship be further investigated to understand if other indicators may be more reflective of the association between IS Resources and IS Functional Capabilities within the South African context.

### **6.2.2 Hypothesis 2**

**There is a positive relationship between IT Infrastructure Flexibility and IS Functional Capabilities.**

Support for this hypothesis was achieved via an analysis of the data received from the questionnaire relating to IT Infrastructure Flexibility and IS Functional Capabilities. IT Infrastructure Flexibility was measured with the following three key indicators:

- 2\_1 The availability of Infrastructure to electronically link the various business units in a company.
- 2\_2 Whether the company had the appropriate technology infrastructure in place today. i.e. including to link with external suppliers and / or customers via an appropriate network.
- 2\_3 The standardisation of various components of technology together with an evaluation of the modularity of the systems permitting data re-use across business unit boundaries.

Appendix 10.3 illustrates that over 64% of respondents indicated that the underlying technology infrastructure to link the various business units in the company exists today. Similar results were observed when respondents were asked if they were able to link to customers and suppliers. This is despite the high cost and lack of networking capacity available within South Africa. However, given the context of the study within the Financial Services Industry, it is understandable that the majority of respondents have the necessary infrastructure networks in place to conduct business with customers and suppliers electronically, to which the network is the foundation for communication. The re-use of data across business unit boundaries has two significant implications. The first is that cost is reduced as the data is captured once instead of each time when required. Secondly, the integrity of the data is maintained. The effect of standardisation of technology components also has the effect of reducing maintenance and overhead costs. Over 60% of respondents agreed that data was shareable across divisions. The response to the modularity of the applications to facilitate re-use was evenly split around 50%. There is also an awareness of the benefits of standardisation with over half the respondents following this route.

The IS Functional Capabilities construct looked at the maturity levels of the Planning, Development, Support and Operations processes. This construct is also referenced in Hypothesis 3 and 4 and was measured using the following three indicators:

- 4\_1        The frequency of IS planning and the involvement of business in the development of IT plans

- 4\_2      The maturity of the systems development and support processes.
- 4\_3      The level of automation of IT systems and infrastructure as well the maturity of planning for system outages.

The frequency graphs relating to 4\_1 show strong agreement and support for the fact that the IT planning process is mature in the companies that were surveyed. This is to be expected given the nature of business in the Financial Services sector.

The analysis of indicator 4\_2 shows that the systems development process is not as matured as one would expect in the financial institutions surveyed. These companies are trusted with the significant investment portfolios and therefore it is prudent to expect that the systems development process is rigorous. This has not been confirmed with the observed data.

It is interesting to note that despite the perceived lack of maturity in the systems development process, there is a considerable amount of automation of routine tasks, minimising manual intervention. The results for 4\_3 could explain the fact explain the observation regarding the systems development processes. As a result of most tasks being automated, there might not need to be as much focus placed on development as one would typically anticipate.

There is a heavy reliance on IT to enable businesses and failure to plan may result in a lack of capacity or availability, which could translate into significant revenue losses. The observed data confirms that there is substantial effort directed towards ensuring that tested plans are in place to enable the company to recover from a disaster. This is in all likelihood due to the understanding that unplanned outages can translate directly into a loss of revenue. Furthermore, the surveyed companies are all subject to stringent fiduciary laws and governance requirements.

This study provided support to the findings of Ravichandran and Lertwongsatien (2005) which showed a positive causal link between IT Infrastructure Flexibility and IS Functional Capabilities. This is evidenced by the path coefficient of 0.27 between these two constructs. The analysis of this is such that the IT Infrastructure (which in this instance includes the data network, business systems and information) provides the foundation upon which the IT processes of planning, development and support can be established.

### 6.2.3 Hypothesis 3

#### There is a positive relationship between IS Partnership Quality and IS Functional Capabilities

Support for this hypothesis was achieved via an analysis of the data received from the questionnaire relating to IS Partnership Quality and IS Functional Capabilities. IS Partnership Quality was measured using the following four key indicators:

- 3\_1      The transparency of information flow between the IS department and the business units.
- 3\_2      The collaboration of the IS and Business departments to jointly develop the goals and plans for IT projects.
- 3\_3      The existence of conflicts between business and IT or external vendors.
- 3\_4      The existence of a trusting relationship between IT, the vendor and business.

In Appendix 10.3, the frequency graph indicated that over 55% of respondents were either in disagreement or were neutral about the flow of information from the IS department to the business units. This could be a result of two reasons: Firstly, there could just be a lack of infrastructure. This however, would be in contradiction to response 2\_1 where 64% indicated that the necessary infrastructure was in place. The second reason points to the fact that there is simply a lack of understanding of business functions from IT. This is often the underlying reason that leads to a breakdown in communication between the two functions, resulting in a lack of

information flow and awareness. This statement is confirmed by the fact that 73% felt that there was a lack of understanding between business and IT.

Business unit participation in IT plans is significant. However, it is strange to then observe that the rate of conflicts between IT and business is still significantly high. Furthermore, it appears that most relationships are long term partnerships with IT providers and vendors, with 55% indicating that this is the case in their company. This would therefore raise questions as to the source of conflict or lack of understanding, given the nature of their partnership. This is raised as a suggestion for further research in section 7.3.

This hypothesis involved the construct IS Functional Capabilities as discussed in under Hypothesis 2. Therefore, the indicators and measures that relate to this construct will make reference to section 6.2.2 when necessary.

The path coefficient from IS Partnership Quality to IS Capabilities reflected at 0.49. As mentioned in section 5.5 this is a strong positive relationship. The implication of this observation is that strategic partnerships and trusting relationships between the business and IT provider is of considerable importance. This finding is in agreement with the view put forward by Ravichandran and Lertwongsatien (2005) as well as Finney *et al.* (2008) that a lack of strategic direction from business can cause IT investments to be misdirected.

#### 6.2.4 Hypothesis 4

#### **There is a positive relationship between IS Functional Capabilities and IT Support for Core Competencies.**

Support for this hypothesis could not be proven given the findings from the data relating to IS Functional Capabilities and IT Support for Core Competencies. IS Functional Capabilities was measured using the following three key indicators:

- 4\_1      The frequency of IS planning and the involvement of business in the development of IT plans
- 4\_2      The maturity of the systems development and support processes.
- 4\_3      The level of automation of IT systems and infrastructure as well the maturity of planning for system outages.

This hypothesis involved the construct IS Functional Capabilities as discussed in under Hypothesis 2. Therefore, the indicators and measures that relate to this construct will make reference to section 6.2.2 when necessary.

The IT Support for Core Competencies construct was measured in terms of the following three key measures:

- 5\_1      The ability to identify and meet customer requirements through tailored products.
- 5\_2      The ability of the business processes to integrate the supply chain and ensure speedy delivery of new products into the market.
- 5\_3      The ability to identify new market opportunities.

The analysis of the observations relating to measure 5\_1 indicates that IT underpins a significant component of the communication with the customer. The frequency graphs in Appendix 10.3 illustrate that the use of IT is critical in responding to customer by providing feedback on progress of requests and issues. However, it is interesting to note that IT plays a lesser role in the identification of customer requirements.

The need for flexible business processes is reflected in the frequency results presented in Appendix 10.3. The growing trend of agile business processes is supported by the observed data. The observed data also provided support for the use of IT in integrating the company's supply chain and the speedy delivery of new products and services into the market.

Most surprising was the use of IT in improving the speed of business to respond to threats and opportunities faster and more effectively. This is confirmed by the fact that over 85% of respondents indicated that IT facilitated the redefinition of the scope of their business. This highlights the increasingly strategic role of IT as viewed by the surveyed companies.

The finding relating to Hypothesis 4 differs from the results presented by Ravichandran and Lertwongsatien (2005). Their study found support for the argument that an organisation's ability to leverage IT to support its core competencies is reliant on IS Capabilities. This does not imply that the relationship does not exist, however it does point to the fact that IT Support for Core Competencies could be better explained by other indicators that are more appropriate in the South African Financial Services context.

### 6.2.5 Hypothesis 5

#### There is a positive relationship between IT Support for Core Competencies and Company Performance

Support for this hypothesis could not be proven given the findings from the data relating to IT Support for Core Competencies and Firm / Company Performance. Company Performance was measured using the following two key indicators:

- 6\_1        The speed of delivery of new products against competitors.
- 6\_2        The financial performance of the company against that of their competitors

The data did not provide compelling evidence that the responding companies were able to introduce products and services into the market faster than their competitors. This holds true for the financial performance as well, but there was approximately 11% of respondents who indicated strong agreement with the statement that their productivity and financial performance far exceeded that of their competitors.

The findings in this study relating to Hypothesis 5 differ from those attained by Ravichandran and Lertwongsatien (2005). Their study found that the targeted use of IT to develop unique competencies has the potential to improve company performance. This does not imply that the relationship does not exist. However it does point to the fact that Company Performance could be better explained by other indicators that are more suitable in the South African Financial Services context.

### 6.3 Summary

This chapter has discussed the results as presented in Chapter 5. Hypothesis 2 and 3 were supported and discussed in section 6.2.2 and section 6.2.3 respectively. These two hypotheses concur with the findings presented by Ravichandran and Lertwongsatien (2005). However, the results do not seem to provide support for Hypothesis 1, 4 and 5. Chapter 7 will conclude this research by providing a summary of the contribution of this study and the implications for business managers.

## 7 Conclusion

### 7.1 Contribution of this study

According to a report published by Gartner (Tracy, Guevara, and Stegman, 2008) the average IT spend is highest in the Financial Sector at around 12.6% of operating expenditure. Whilst there are numerous examples of successful IS investments, there are probably equally as many IS projects that have not yielded value. The latter investments have often not been able to realise the expected value and have failed to translate into any sustained business level performance. This has sparked the interest in understanding the mechanisms by which IS contributes to company performance in the South African context.

This study extended the research conducted by Ravichandran and Lertwongsatien (2005) by using Resource Based theory to explain how company performance can in part be explained by IS resources and capabilities. The research model presented in this study provided support in particular for the positive influence that a flexible IT infrastructure and partnerships at the right level, deliver to the business. Given the findings presented in this study as the results of the empirical research, the implications for business managers are listed in section 7.2.

## 7.2 Implication for Business Managers

The growing importance of IT as part of the business strategy has prompted the need to address the issue of corporate governance for IT. The King 3 report (Liell-Cock, Graham, and Hill, 2009) has therefore for the first time placed a direct focus on the governance of IT. As per King 3 “The board is responsible for ensuring that IT resources facilitate the achievement of the company’s strategic objectives and that IT should add value by enabling the company’s performance and sustainability” (Cock, Graham, and Hill, 2009, p.26). Given the increased role of governance of IT, the findings from this research study has several implications for business managers:

- Hypothesis 3 in section 6.2.3 discussed the role of partnerships both internal and external to the business. The internal partnerships focussed on the collaboration of business and IT to jointly develop the goals and plans for IT projects. The King report specifies that company executives must become more involved in IT steering committees. It is also categorically stated in the King report, that it is the responsibility of the Board to provide leadership and delegate accountability to the CIO to make certain that the structures and processes are put in place. This is done to allow the company to leverage its IT capabilities to ensure that the corporate sustainability objectives and performance goals are achieved. With regard to external partnerships, King acknowledges that even though outsourcing is common place, it still places accountability with the Board to ensure that IT enhances and sustains the company performance objectives.

- Hypothesis 2 in section 6.2.2 outlined the importance of a flexible IT infrastructure and the ability to re-use information assets across business unit boundaries. The finding in this study presented a positive relationship between IT Infrastructure Flexibility and IS Capabilities, and to illustrate how IT infrastructure underpins the processes of planning, development and operations which are regarded as critical to the business. King supported these findings by emphasising the importance of value delivery delivered by the approach of continuous learning and the re-use of IT assets. It is therefore imperative that managers place emphasis on establishing reusable IT assets in their business, rather than approach IT as a commoditised offering.
- This study posited that core competencies are a source for competitive advantage. Issues such as responsiveness to customer requests, integration of the supply chain, delivery of new products all contribute to a company's superior market positioning. The empirical findings from this study illustrate the importance of IT in the development of core competencies with the objective of enhancing overall company performance. Managers must bear this in mind when making decisions on the deployment of IT as it should be done in support of the organisation's core competencies.

### 7.3 Future research ideas

- Marchand, Kettinger, and Rollins (2001, p. 283) are quoted as saying that "*The technique of path analysis, is not a method of discovering causal laws, but a procedure for giving a quantitative interpretation of an assumed theoretical causal system as it operates within a given environment. Over-interpretation and generalisation of the findings should be avoided. However, for practical and prescriptive purposes they represent a valuable starting point of discussion.*" Future research could look at the same area of study using a different method and approach that will extend the findings of this study.
- One of the limitations of this study was the ability to generalise the findings across industries and sectors. This study focussed on the Financial Services sector of listed companies on the JSE. It would be useful to determine the results of a study that investigates the performance effect of IS resources and capabilities across other industries such as retail, mining and telecommunications.
- The influence of King 3 on IT governance needs to be further understood for South African companies. King has raised the visibility of IT governance and IT deliverables at the Board level to ensure performance objectives are achieved. This has several implications, some of which have been explored in section 7.2. This area of study warrants further investigation.

- A longitudinal study of the effects of IS resources and capabilities on company performance within the South African context will help confirm the relationships and causal linkages drawn in this study.
  
- Due to the constraints of the questionnaire length, it is highly probable that some of the key measurement items for the latent constructs were omitted. Future researchers in this area could look at refining these variables which will be able to build and extend on the findings from this study.
  
- With a large enough sample, the data can be split to contrast the views of business managers against IS managers. This may provide further insight into some dynamics of the relationships discussed in this study.

Given the importance of the Financial Services sector to South Africa, it is imperative that the effect of IS resources and IT capabilities on company performance receive further attention, which can in part be supported by the research presented here.

## 8 References

- Allen, D. and Rao, T.R. (2000) *Analysis of Customer Satisfaction Data*. Milwaukee: ASQ Quality Press Publications.
- Baradwaj, A.S. (2000) A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation. *MIS Quarterly*, 24(1), 169-196.
- Byrd, A.T., Lewis, B.R. and Bryan, R.W. (2006) The leveraging influence of strategic alignment on IT investment: An empirical examination. *Information & Management*, 43(3), 308-321.
- Carr, N.G. (2003) IT Doesn't Matter. *Harvard Business Review*, 81(5), 41-49.
- Chou, T. and Su, H. (2007) A LISREL Investigation of the Relationships Among Religiousness, Mental Health and Prosocial Behavior. Australian Association of Educational Research Annual Meeting 2007, Fremantle Western Australia, 1-24.
- Finney, R.Z., Lueg, J.E. and Campbell, N.D. (2008) Market pioneers, late movers, and the resource-based view (RBV): A conceptual model. *Journal of Business Research*, 61(9), 925-932.
- Garg, A.K., Joubert, R.J.O. and Pellissier, R. (2005) Information systems environmental alignment and business performance: A case study. *South African Journal of Business Management*, 36(4), 33-53.

Jarvenpaa, S.L. and Leidner, D. (1998) An Information Company in Mexico: Extending the Resource-Based View of the Firm to a Developing Country Context. *Information Systems Research*, 9(4), 342-358.

Kaplan, B. and Duchon, D. (1988) Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly*, 12(4), 571-586.

Kearns, G.S. and Sabherwal, R. (2006) Strategic Alignment Between Business and Information Technology: A Knowledge-Based View of Behaviors, Outcome, and Consequences. *Journal of Management Information Systems*, 23(3), 129-162.

Kohli, R. and Devaraj, S. (2003) Measuring Information Technology Payoff: A Meta-analysis of Structural Variables in Firm-Level Empirical Research. *Information Systems Research*, 14(2), 127-145.

Lee, S.T., Gholami, R. and Tong, T.Y. (2005) Time series analysis in the assessment of ICT impact at the aggregate level – lessons and implications for the new economy. *Information & Management*, 42(7), 1009-1022.

Liell-Cock, S., Graham, J. and Hill, P. (2009) *IT Governance linked to King 3[online]*. Available from <http://www.itgovernance.co.za/00/index.php/king3/download-king-3-report> (accessed 11/02/2009).

Marchand, D.A., Kettinger, W.J. and Rollins, J.D. (2001) *Information Orientation: The Link to Business Performance*, USA: Oxford University Press.

Melville, N., Kraemer, K.L. and Gurbaxani, V. (2004) Information Technology and Organisational Performance: An Integrative Model of IT Business Value. *Management Information Systems Quarterly*, 28(2), 283-322.

Mitra, S. (2005) Technology as an Enabler of Growth in Firms: An Empirical Assessment. *Journal of Management Information Systems*, 22(2), 279-300.

Morris, S.A. & Strickland, T.H. (2008) Exploration of Information System Process Improvements and Firm Performance. *Journal of Computer Information Systems*, 49(2), 86-91.

Nakata, C., Zhu, Z. and Kraimer, M. (2008) The complex contribution of Information Technology Capability to Business Performance. *Journal of Managerial Issues*, 20(4), 485-506.

Newbert, S. (2008) Value, Rareness, Competitive Advantage, and Performance: A conceptual level empirical investigation of the Resource based view of the firm. *Strategic Management Journal*, 29(7), 745-768.

Oerlemans, L., Rooks, G. and Pretorius, T. (2005) Does Technology and Innovation Management Improve Market Position? Empirical Evidence from Innovating Firms in South Africa. *Knowledge, Technology and Policy*, 18(3), 38-55.

Orlikowski, W.J. and Baroudi, J.J. (1991) Studying Information Technology in Organisations: Research Approaches and Assumptions. *Information Systems Research*, 2(1), 1-28.

Orlikowski, W.J. and Lacono, C.S. (2001) Research Commentary: Desperately Seeking the 'IT' in IT Research--A Call to Theorizing the IT Artifact. *Information Systems Research*, 12(2), 121-134.

Peppard, J. and Ward, J. (2004) Beyond strategic information systems: towards an IS capability. *The Journal of Strategic Information Systems*, 13(2), 167-194.

Pirouz, M.D. (2006) *An Overview of Partial Least Squares*. Ph.D. thesis, University of California.

Prahalad, C.K. and Hamel, G. (1990) The core competence of the corporation. *Harvard Business Review*, May-June, 79-91.

Priem, R.L. and Butler, J.E. (2001) Is the Resource-Based View a useful perspective for Strategic Management Research? *Academy of Management Review*, 26(1), 22-40.

Quan, J., Hu, Q. and Hart, P.J. (2003) Information Technology Investments and Firms' Performance - A Duopoly Perspective. *Journal of Management Information Systems*, 20(3), 121-158.

Ravichandran, T. and Lertwongsatein, C. (2005) Effect of Information Systems Resources and Capabilities of Firm Performance: A Resourced-Based Perspective. *Journal of Management Information Systems*, 21(4), 237-276.

Rivard, S., Raymond, L. and Verreault, D. (2006) Resource-based view and competitive strategy: An integrated model of the contribution of information

technology to firm performance. *Journal of Strategic Information Systems*, 15(15), 29-50.

Schreyogg, G. & Kliesch-Eberl, M. (2007) How dynamic can organisational Capabilities be? Towards a dual-process model of capability dynamization. *Strategic Management Journal*, 28(9), 913-933.

Sircar, S., Turnbow, J.L. and Bordoli, B. (2000) A framework for assessing the relationship between Information Technology Investments and Firm Performance. *Journal of Management Information Systems*, 16(4), 69-97.

Stoel, M.D. and Muhanna, W.A. (2009) IT capabilities and firm performance: A contingency analysis of the role of industry and IT capability type. *Information and Management*, 46(3), 181-189.

Tallon, P.P. and Kraemer, K.L. (2007) Fact or Fiction? A Sensemaking Perspective on the Reality behind Executives' Perceptions of IT Business Value. *Journal of Management Information Systems*, 24(1), 13-54.

Tobin, P.K.J. (2006) *The use of stories and storytelling as knowledge sharing practices: a case study in the South African mining industry*. Ph.D. thesis, University of Pretoria.

Torkkeli, M. and Tuominen, M. (2002) The contribution of technology selection to core competencies. *International Journal of Production Economics*, 77(3), 271-284.

Tracy, L., Guevara, J.K., Stegman, E. (2008) *IT Key Metrics Data 2009: Key Industry Measures: Multi Industry Spending Overview*. Stamford: Gartner. G00163959.

Zhang, M. (2007) Assessing the performance impacts of Information Systems from the Resourced Based Perspective: An empirical test of the indirect effect of IS. *Journal of Business Strategies*, 24(2), 141-164.

Zikmund, W.G. (2003) *Business Research Methods*. Ohio: Thomson, South-Western.

## 9 Abbreviations

IT	Information Technology
IS	Information Systems
RBV	Resource Based View
PLS	Partial Least Squares
JSE	Johannesburg Stock Exchange
CIO	Chief Information Officer
CMM	Capability Maturity Model
HR	Human Resources



## 10 Appendix

### 10.1 Survey Questions

#### IT- Business Performance Survey

All information will be treated as confidential. Time required to complete this survey is approximately 10 mins.

Kindly answer all questions. Please mark the appropriate rating with an X.

Section 1: IS Human Resource Skills and Specificity	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Our IS staff has the ability to quickly learn and apply new technologies as they become available.					
Our IS staff the skills and knowledge to manage IT projects in the current business environment.					
Our IS staff has excellent business knowledge; they have a deep understanding of the business priorities and goals of our organisation.					
Our IS staff is aware of the core beliefs and values of our organisation.					
Our IS staff is conversant with the routines and methods used in the IS department.					

Section 2: IT Infrastructure Flexibility	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The technology infrastructure needed to electronically link our business units is present and in place today.					
The technology infrastructure needed to electronically link our company with external business partners (i.e. key customers, suppliers, alliances) is present and in place today.					
The technology infrastructure needed for current business operations is present and in place today.					
The capacity and speed of our corporate network infrastructure adequately meets our current business needs.					
Corporate data is currently shareable across business units and organisational boundaries.					
Our application systems are very modular; most program modules can be easily reused in other business applications.					
We have standardised the various components of our technology infrastructure (i.e. hardware, operating systems, network, database).					

Section 3: IS Partnership Quality	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Critical information and knowledge that affect IT projects are shared freely between our business units and IS department.					
Our IS department and business units understand the working environment of each other very well.					
There is a high degree of trust between our IS department and business units.					
The goals and plans for IT projects are jointly developed by both the IS department and the business units.					
Conflicts between IS departments and business units are rare and few in our organisation.					
We seldom have conflicts with our IT vendors and service providers.					
We get timely information from our IT vendors and service providers to respond to our IT needs in a timely and effective manner.					
A very trusting relationship exists between the IS department and our key IT vendors and service providers.					
We have a long-term partnership with our key IT vendors and service providers.					

Section 4: IS Capability	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
IS planning is an ongoing process in our organisation; planning is not a once a year activity.					
Business units' participation in the IS planning process is very high.					
Our planning methodology has many guidelines to ensure that critical business, organisational and technological issues are addressed in evolving an IS plan.					
We try to be very comprehensive in our planning, our IS plans cover every facet of IT needs of our					
The systems development process is continuously improved using formal measurement and feedback systems					
Our systems development process is flexible to allow quick infusion of new development methodology, tools, and techniques.					
We have a mature systems development process, the process is well defined and documented					
We have clear guidelines on how to prioritise service requests from users.					
We have well-defined service quality criteria for all IS support tasks.					
We have well established service level agreements with all user groups for IS support.					
We have automated most systems operation tasks; very little manual intervention is required to our computer systems.					
We use automated tools to monitor and fine-tune the performance of our computer systems, networks, databases, and telecommunication infrastructure.					
We have detailed procedures for responding to unplanned systems outages.					
We periodically do mock trials to test our disaster recovery plans.					



Section 5: IT Support for Core Competencies	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<i>The basic premise is that the performance of a company can be explained by the effective use of IT to support and augment its core competencies. This section looks at the extent of use of IT and the Internet in support of the following areas:</i>					
Enhancing the responsiveness to customer service requests.					
Providing necessary information to customers.					
Identifying groups of customers whose needs are not being met.					
Determining customer requirements (i.e. products, preference, pricing, and quantity).					
Tailoring the products/services to match customers' needs.					
Re-engineering business processes.					
Enhancing business process flexibility.					
Integrating the firms supply chain.					
Integrating internal business units.					
Increasing the speed of logistics activities.					
Developing new products/services.					
Improving the speed of product development.					
Improving the speed of product delivery.					
Improving the speed of responding to business opportunities/threats.					
Identifying new market segments.					
Redefining the scope our business.					
Entering new markets.					

Section 6: Firm Performance: (Evaluated over the past 3 years)	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
We have entered new markets very quickly.					
We have brought new products and services to the market faster than our competitors.					
The success rates of our new products and services have been very high.					
Our productivity has exceeded that of our competitors.					
Our financial performance has been outstanding.					
Our financial performance has exceeded that of our competitors.					

<b>Your Profile</b> <i>Please note: All information will be kept confidential. No names or companies will be revealed.</i>	
---	--

Your Full Name	
----------------	--

Your Company Name	
-------------------	--

Your role in the company	CEO	CIO	Snr Business Manager	Snr IT Manager
--------------------------	-----	-----	----------------------	----------------

Total Number of staff in your company	Fewer than 100	101-500	501-1000	More than 1000
---------------------------------------	----------------	---------	----------	----------------

Annual Turnover	R0-R100 million	R101-R500 million	R501-R1000 million	More than R1000 million
-----------------	-----------------	-------------------	--------------------	-------------------------

Thank You for your time.

-----  
Yashil Narandas  
GIBS MBA 2009  
Cell: 083 645 5151

## 10.2 LISREL Output

### Model 2 excluding Human Capital

DATE: 10/20/2009

TIME: 22:38

LISREL 8.80

BY

Karl G. Jöreskog and Dag Sörbom

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The following lines were read from file C:\Users\gtower\Desktop\Data\YASHIL2.SPJ:

Latent Variables 'IS QUALITY' 'IS CAPABILIT' 'IT SUPPORT' PERFORMANCE IT FLEXIBILI'

Relationships

2\_1 = 'IT FLEXIBILI'

2\_2 = 'IT FLEXIBILI'

2\_3 = 'IT FLEXIBILI'

3\_1 = 'IS CAPABILIT'

3\_2 = 'IS CAPABILIT'

3\_3 = 'IS CAPABILIT'

3\_4 = 'IS CAPABILIT'

4\_1 = 'IT SUPPORT'

4\_2 = 'IT SUPPORT'

4\_3 = 'IT SUPPORT'

5\_1 = PERFORMANCE

5\_2 = PERFORMANCE

5\_3 = PERFORMANCE

6\_1 = 'IT FLEXIBILI'

6\_2 = 'IT FLEXIBILI'

Path Diagram

Admissibility Check = 25000

Iterations = 25000

End of Problem

Sample Size = 238

Covariance Matrix

	2_1	2_2	2_3	3_1	3_2	3_3
2_1	1.01					
2_2	0.41	0.62				
2_3	0.21	0.26	0.87			
3_1	0.27	0.27	0.09	0.71		
3_2	0.12	0.25	0.00	0.44	0.89	

3_3	0.26	0.15	0.16	0.32	0.38	0.75
3_4	0.12	0.09	-0.01	0.15	0.28	0.16
4_1	0.28	0.17	0.04	0.27	0.31	0.23
4_2	0.12	0.15	0.18	0.24	0.22	0.21
4_3	0.42	0.26	0.24	0.15	0.00	0.00
5_1	-0.03	0.16	0.16	0.03	0.11	-0.05
5_2	0.19	0.19	0.43	0.06	0.07	-0.02
5_3	0.05	0.13	0.30	0.03	-0.05	-0.01
6_1	0.13	0.05	0.08	0.18	0.06	0.13
6_2	-0.09	0.02	0.19	0.00	0.10	0.07

Covariance Matrix

	3_4	4_1	4_2	4_3	5_1	5_2
3_4	0.37					
4_1	0.18	0.66				
4_2	0.15	0.36	0.68			
4_3	0.18	0.31	0.27	1.01		
5_1	0.09	-0.04	0.19	0.12	0.35	
5_2	--	0.10	0.17	0.19	0.16	0.66
5_3	-0.07	0.17	0.05	0.10	-0.06	0.30
6_1	0.04	0.17	0.15	0.19	0.02	0.06
6_2	0.09	0.10	0.19	-0.15	0.15	0.23

Covariance Matrix

	5_3	6_1	6_2
5_3	0.63		
6_1	0.08	0.59	
6_2	0.03	0.07	0.88

Number of Iterations = 20

#### LISREL Estimates (Maximum Likelihood)

##### Measurement Equations

2\_1 = 0.46\*IT FLEXI, Errorvar.= 0.80 , R<sub>y</sub> = 0.21

(0.070) (0.079)  
6.67 10.07

2\_2 = 0.47\*IT FLEXI, Errorvar.= 0.40 , R<sub>y</sub> = 0.35

(0.053) (0.044)  
8.78 9.12

2\_3 = 0.58\*IT FLEXI, Errorvar.= 0.53 , R<sub>y</sub> = 0.39

(0.063) (0.061)  
9.30 8.73

3\_1 = 0.60\*IS CAPAB, Errorvar.= 0.35 , R<sub>y</sub> = 0.51

(0.053) (0.044)  
11.23 7.96

3\_2 = 0.70\*IS CAPAB, Errorvar.= 0.40 , R<sub>y</sub> = 0.55

(0.059) (0.054)  
11.85 7.37

3\_3 = 0.55\*IS CAPAB, Errorvar.= 0.45 , R<sub>y</sub> = 0.40

(0.057) (0.050)  
9.72 9.02

3\_4 = 0.33\*IS CAPAB, Errorvar.= 0.26 , R<sub>y</sub> = 0.30

(0.041) (0.027)

8.20	9.69
4_1 = 0.63*IT SUPPO, Errorvar.= 0.26 , R <sub>y</sub> = 0.61	
(0.054)	(0.046)
11.80	5.71
4_2 = 0.58*IT SUPPO, Errorvar.= 0.35 , R <sub>y</sub> = 0.49	
(0.055)	(0.046)
10.56	7.53
4_3 = 0.47*IT SUPPO, Errorvar.= 0.79 , R <sub>y</sub> = 0.22	
(0.070)	(0.079)
6.74	9.98
5_1 = 0.20*PERFORMA, Errorvar.= 0.31 , R <sub>y</sub> = 0.12	
(0.042)	(0.029)
4.87	10.51
5_2 = 0.71*PERFORMA, Errorvar.= 0.16 , R <sub>y</sub> = 0.75	
(0.059)	(0.061)
11.94	2.68
5_3 = 0.41*PERFORMA, Errorvar.= 0.47 , R <sub>y</sub> = 0.27	
(0.055)	(0.048)
7.45	9.70
6_1 = 0.20*IT FLEXI, Errorvar.= 0.55 , R <sub>y</sub> = 0.064	
(0.055)	(0.052)
3.54	10.69
6_2 = 0.26*IT FLEXI, Errorvar.= 0.81 , R <sub>y</sub> = 0.074	
(0.067)	(0.076)
3.81	10.66

#### Correlation Matrix of Independent Variables

IS CAPAB IT SUPPO PERFORMA IT FLEXI

IS CAPAB	1.00
IT SUPPO	0.64 (0.06) 10.33
PERFORMA	0.08 (0.08) 0.94
IT FLEXI	0.51 (0.08) 6.38
	0.59 (0.08) 7.51
	0.81 (0.07) 11.74

#### Goodness of Fit Statistics

Degrees of Freedom = 84

Minimum Fit Function Chi-Square = 654.97 (P = 0.0)

Normal Theory Weighted Least Squares Chi-Square = 562.61 (P = 0.0)

Estimated Non-centrality Parameter (NCP) = 478.61

90 Percent Confidence Interval for NCP = (407.25 ; 557.45)

Minimum Fit Function Value = 2.76

Population Discrepancy Function Value (F0) = 2.02  
90 Percent Confidence Interval for F0 = (1.72 ; 2.35)  
Root Mean Square Error of Approximation (RMSEA) = 0.16  
90 Percent Confidence Interval for RMSEA = (0.14 ; 0.17)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00

Expected Cross-Validation Index (ECVI) = 2.68  
90 Percent Confidence Interval for ECVI = (2.38 ; 3.01)  
ECVI for Saturated Model = 1.01  
ECVI for Independence Model = 7.20

Chi-Square for Independence Model with 105 Degrees of Freedom = 1676.33

Independence AIC = 1706.33

Model AIC = 634.61

Saturated AIC = 240.00

Independence CAIC = 1773.42

Model CAIC = 795.61

Saturated CAIC = 776.67

Normed Fit Index (NFI) = 0.61

Non-Normed Fit Index (NNFI) = 0.55

Parsimony Normed Fit Index (PNFI) = 0.49

Comparative Fit Index (CFI) = 0.64

Incremental Fit Index (IFI) = 0.64

Relative Fit Index (RFI) = 0.51

Critical N (CN) = 43.36

Root Mean Square Residual (RMR) = 0.082

Standardized RMR = 0.11

Goodness of Fit Index (GFI) = 0.76

Adjusted Goodness of Fit Index (AGFI) = 0.66

Parsimony Goodness of Fit Index (PGFI) = 0.53

Time used: 0.094 Seconds

### Model 1 with IS Human Capital

TIME: 23:24

LISREL 8.80

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Latent Variables 'IS CAPAB' 'IT SUPP' 'PERFORMA' 'IS HUMAN' 'IS QUAL'  
Relationships

4\_1 = 'IS CAPAB'

4\_2 = 'IS CAPAB'

4\_3 = 'IS CAPAB'

5\_1 = 'IT SUPP'

5\_2 = 'IT SUPP'

5\_3 = 'IT SUPP'

6\_1 = 'PERFORMA'

6\_2 = 'PERFORMA'

1\_1 = 'IS HUMAN'

1\_2 = 'IS HUMAN'

3\_1 = 'IS QUAL'

3\_2 = 'IS QUAL'

3\_3 = 'IS QUAL'

3\_4 = 'IS QUAL'

'IT SUPP' = 'IS CAPAB'

'PERFORMA' = 'IT SUPP'

'IS CAPAB' = 'IS HUMAN' 'IS QUAL'

Path Diagram

End of Problem

Sample Size = 238

#### Covariance Matrix

	4_1	4_2	4_3	5_1	5_2	5_3
4_1	0.66					
4_2	0.36	0.68				
4_3	0.31	0.27	1.01			
5_1	-0.04	0.19	0.12	0.35		
5_2	0.10	0.17	0.19	0.16	0.66	
5_3	0.17	0.05	0.10	-0.06	0.30	0.63
6_1	0.17	0.15	0.19	0.02	0.06	0.08
6_2	0.10	0.19	-0.15	0.15	0.23	0.03
1_1	0.11	0.11	-0.01	0.11	0.36	0.19
1_2	0.14	0.03	0.18	0.03	0.34	0.25
3_1	0.27	0.24	0.15	0.03	0.06	0.03
3_2	0.31	0.22	0.00	0.11	0.07	-0.05

3_3	0.23	0.21	0.00	-0.05	-0.02	-0.01
3_4	0.18	0.15	0.18	0.09	--	-0.07

Covariance Matrix

	6_1	6_2	1_1	1_2	3_1	3_2
6_1	0.59					
6_2	0.07	0.88				
1_1	0.14	0.03	0.69			
1_2	0.13	0.18	0.19	0.66		
3_1	0.18	0.00	0.21	0.30	0.71	
3_2	0.06	0.10	0.28	0.24	0.44	0.89
3_3	0.13	0.07	0.29	0.17	0.32	0.38
3_4	0.04	0.09	0.07	0.12	0.15	0.28

Covariance Matrix

	3_3	3_4
3_3	0.75	
3_4	0.16	0.37

W\_A\_R\_N\_I\_N\_G: THETA-EPS is not positive definite

W\_A\_R\_N\_I\_N\_G: The solution was found non-admissible after 50 iterations.

The following solution is preliminary and is provided only

for the purpose of tracing the source of the problem.

Setting AD> 50 or AD=OFF may solve the problem

LISREL Estimates(Intermediate Solution)

Measurement Equations

$$4\_1 = 0.68 * \text{IS CAPAB}, \text{Errorvar.} = 0.19, R_y = 0.71 \\ (0.047) \\ 4.14$$

$$4\_2 = 0.54 * \text{IS CAPAB}, \text{Errorvar.} = 0.39, R_y = 0.43 \\ (0.099) \\ 5.49 \\ (0.049) \\ 7.87$$

$$4\_3 = 0.44 * \text{IS CAPAB}, \text{Errorvar.} = 0.82, R_y = 0.19 \\ (0.11) \\ 4.02 \\ (0.080) \\ 10.20$$

5\_1 = 0.14\*IT SUPP, Errorvar.= 0.33 , R<sub>y</sub> = 0.056  
 (0.029)  
 11.41

5\_2 = 1.27\*IT SUPP, Errorvar.= -0.91 , R<sub>y</sub> = 2.31  
 (2.54) (0.41)  
 0.50 -2.21

W\_A\_R\_N\_I\_N\_G : Error variance is negative.

5\_3 = 0.26\*IT SUPP, Errorvar.= 0.57 , R<sub>y</sub> = 0.10  
 (0.22) (0.054)  
 1.15 10.55

6\_1 = 0.095\*PERFORMA, Errorvar.= 0.58 , R<sub>y</sub> = 0.015  
 (0.052)  
 11.19

6\_2 = 0.79\*PERFORMA, Errorvar.= 0.29 , R<sub>y</sub> = 0.68  
 (4.78) (0.38)  
 0.17 0.77

1\_1 = 0.44\*IS HUMAN, Errorvar.= 0.50 , R<sub>y</sub> = 0.28  
 (0.064) (0.058)  
 6.82 8.62

1\_2 = 0.44\*IS HUMAN, Errorvar.= 0.47 , R<sub>y</sub> = 0.29  
 (0.063) (0.055)  
 6.97 8.45

3\_1 = 0.60\*IS QUAL, Errorvar.= 0.34 , R<sub>y</sub> = 0.51  
 (0.053) (0.043)  
 11.43 8.10

3\_2 = 0.72\*IS QUAL, Errorvar.= 0.37 , R<sub>y</sub> = 0.59  
 (0.057) (0.050)  
 12.71 7.33

3\_3 = 0.54\*IS QUAL, Errorvar.= 0.47 , R<sub>y</sub> = 0.38  
 (0.056) (0.049)  
 9.64 9.55

3\_4 = 0.33\*IS QUAL, Errorvar.= 0.26 , R<sub>y</sub> = 0.29  
 (0.041) (0.028)  
 7.97 9.54

### Structural Equations

$$IS\ CAPAB = -0.54*IS\ HUMAN + 1.10*IS\ QUAL, \text{ Errorvar.} = 0.53, R^2 = 0.47$$

(0.34)	(0.32)	(0.071)
-1.59	3.41	7.52

$$IT\ SUPP = 0.080*IS\ CAPAB, \text{ Errorvar.} = 0.99, R^2 = 0.0064$$

(0.015)	(0.0071)	
5.27	140.62	

$$PERFORMA = 0.18*IT\ SUPP, \text{ Errorvar.} = 0.97, R^2 = 0.031$$

(0.11)	(0.0061)	
1.67	158.86	

#### Reduced Form Equations

$$IS\ CAPAB = -0.54*IS\ HUMAN + 1.10*IS\ QUAL, \text{ Errorvar.} = 0.53, R^2 = 0.47$$

(0.34)	(0.32)	
-1.59	3.41	

$$IT\ SUPP = -0.043*IS\ HUMAN + 0.088*IS\ QUAL, \text{ Errorvar.} = 1.00, R^2 = 0.0030$$

(0.025)	(0.025)	
-1.71	3.54	

$$PERFORMA = -0.0075*IS\ HUMAN + 0.015*IS\ QUAL, \text{ Errorvar.} = 1.00, R^2 = 0.00$$

(0.0059)	(0.011)	
-1.27	1.45	

#### Correlation Matrix of Independent Variables

	IS HUMAN	IS QUAL
IS HUMAN	1.00	
IS QUAL	0.87	1.00
(0.08)		
10.73		

#### Covariance Matrix of Latent Variables

	IS CAPAB	IT SUPP	PERFORMA	IS HUMAN	IS QUAL
IS CAPAB	1.00				
IT SUPP	0.08	1.00			
PERFORMA	0.01	0.18	1.00		
IS HUMAN	0.42	0.03	0.01	1.00	
IS QUAL	0.63	0.05	0.01	0.87	1.00

#### Goodness of Fit Statistics

Degrees of Freedom = 72

Minimum Fit Function Chi-Square = 719.15 (P = 0.0)  
Normal Theory Weighted Least Squares Chi-Square = 501.31 (P = 0.0)  
Estimated Non-centrality Parameter (NCP) = 429.31  
90 Percent Confidence Interval for NCP = (362.05 ; 504.05)

Minimum Fit Function Value = 3.03  
Population Discrepancy Function Value (F0) = 1.81  
90 Percent Confidence Interval for F0 = (1.53 ; 2.13)  
Root Mean Square Error of Approximation (RMSEA) = 0.16  
90 Percent Confidence Interval for RMSEA = (0.15 ; 0.17)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00

Expected Cross-Validation Index (ECVI) = 2.39  
90 Percent Confidence Interval for ECVI = (2.11 ; 2.71)  
ECVI for Saturated Model = 0.89  
ECVI for Independence Model = 6.45

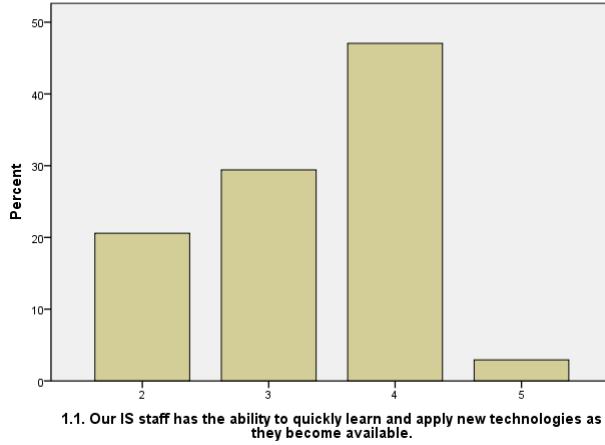
Chi-Square for Independence Model with 91 Degrees of Freedom = 1501.20  
Independence AIC = 1529.20  
Model AIC = 567.31  
Saturated AIC = 210.00  
Independence CAIC = 1591.81  
Model CAIC = 714.89  
Saturated CAIC = 679.59

Normed Fit Index (NFI) = 0.52  
Non-Normed Fit Index (NNFI) = 0.42  
Parsimony Normed Fit Index (PNFI) = 0.41  
Comparative Fit Index (CFI) = 0.54  
Incremental Fit Index (IFI) = 0.55  
Relative Fit Index (RFI) = 0.39  
Critical N (CN) = 34.88  
Root Mean Square Residual (RMR) = 0.095  
Standardized RMR = 0.14  
Goodness of Fit Index (GFI) = 0.77  
Adjusted Goodness of Fit Index (AGFI) = 0.66  
Parsimony Goodness of Fit Index (PGFI) = 0.52  
Time used: 0.031 Seconds

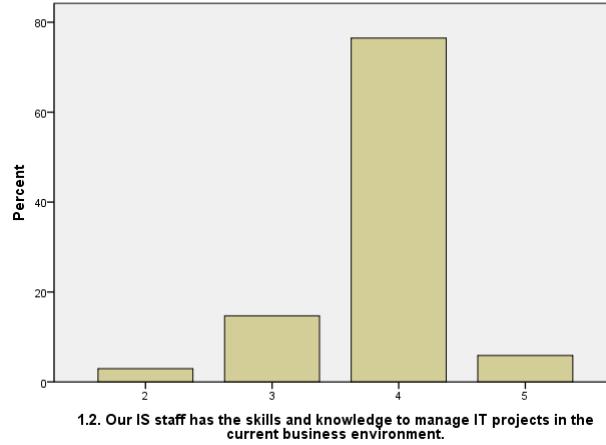


## 10.3 Frequency Graphs

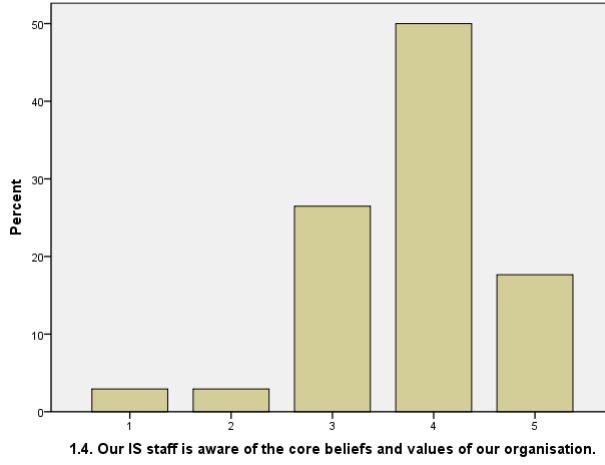
1.1. Our IS staff has the ability to quickly learn and apply new technologies as they become available.



1.2. Our IS staff has the skills and knowledge to manage IT projects in the current business environment.

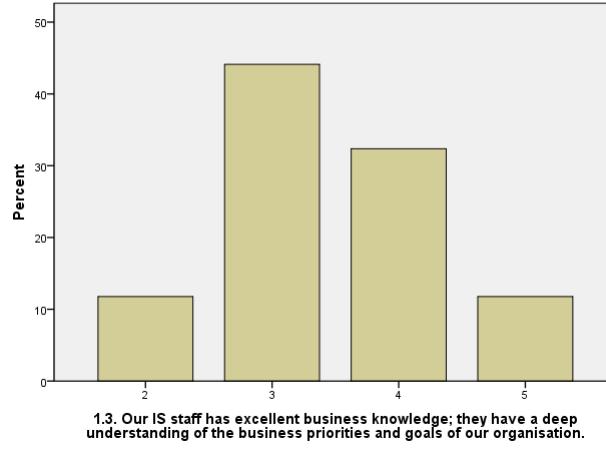


1.4. Our IS staff is aware of the core beliefs and values of our organisation.



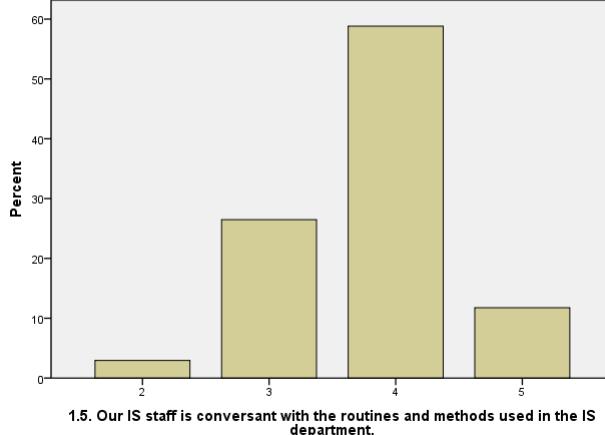
1.4. Our IS staff is aware of the core beliefs and values of our organisation.

1.3. Our IS staff has excellent business knowledge; they have a deep understanding of the business priorities and goals of our organisation.



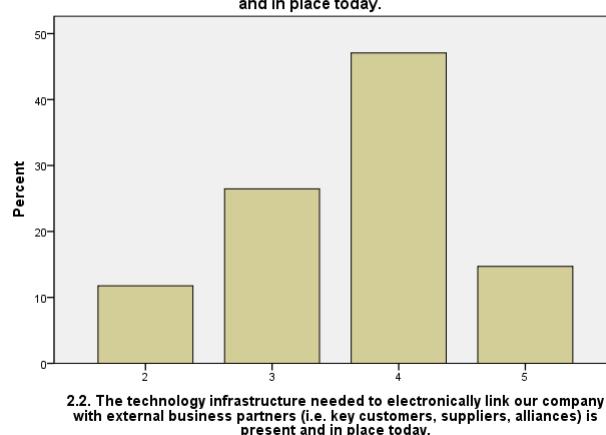
1.3. Our IS staff has excellent business knowledge; they have a deep understanding of the business priorities and goals of our organisation.

1.5. Our IS staff is conversant with the routines and methods used in the IS department.



1.5. Our IS staff is conversant with the routines and methods used in the IS department.

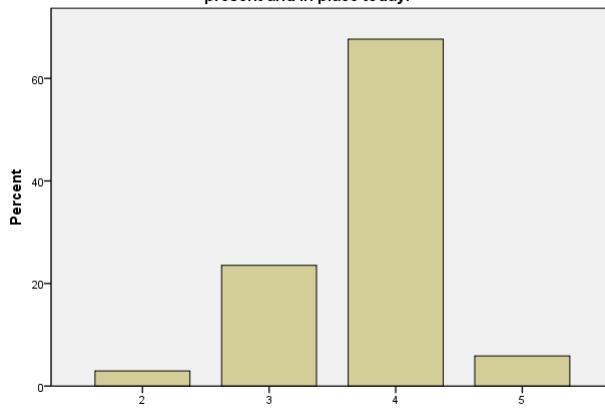
2.2. The technology infrastructure needed to electronically link our company with external business partners (i.e. key customers, suppliers, alliances) is present and in place today.



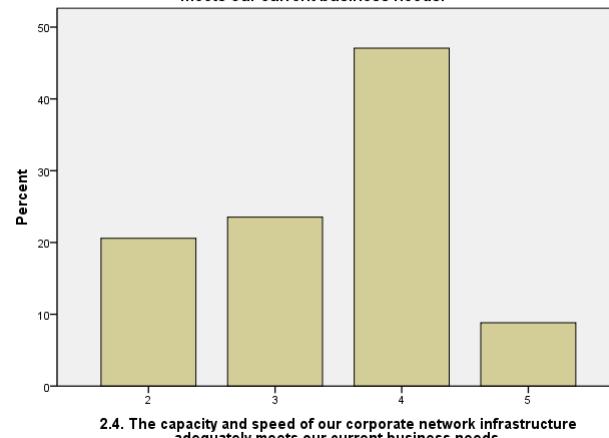
2.2. The technology infrastructure needed to electronically link our company with external business partners (i.e. key customers, suppliers, alliances) is present and in place today.



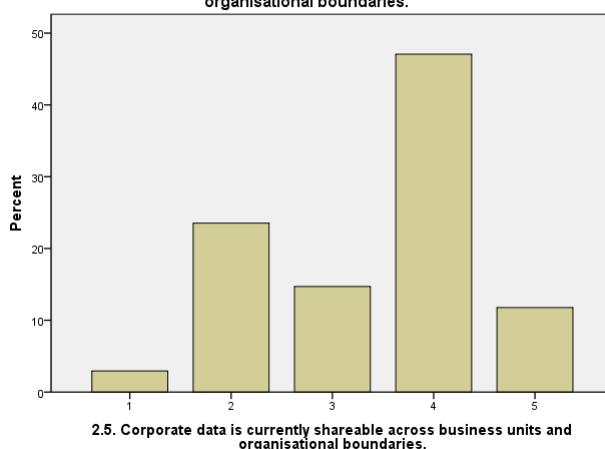
2.3. The technology infrastructure needed for current business operations is present and in place today.



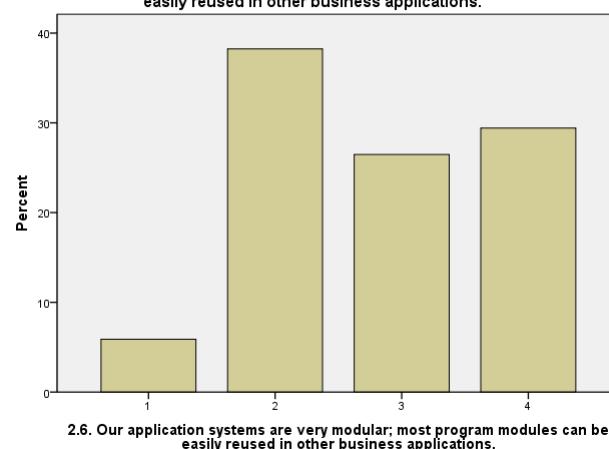
2.4. The capacity and speed of our corporate network infrastructure adequately meets our current business needs.



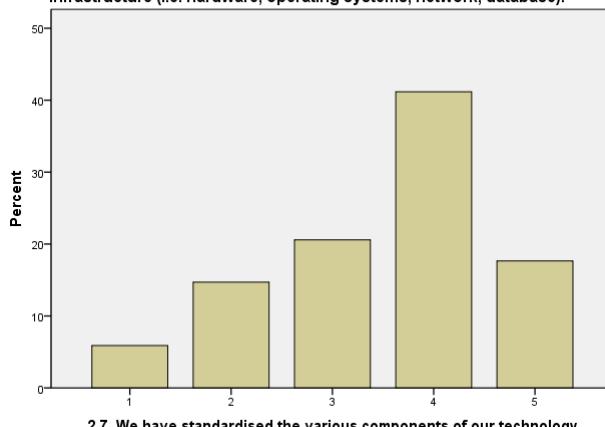
2.5. Corporate data is currently shareable across business units and organisational boundaries.



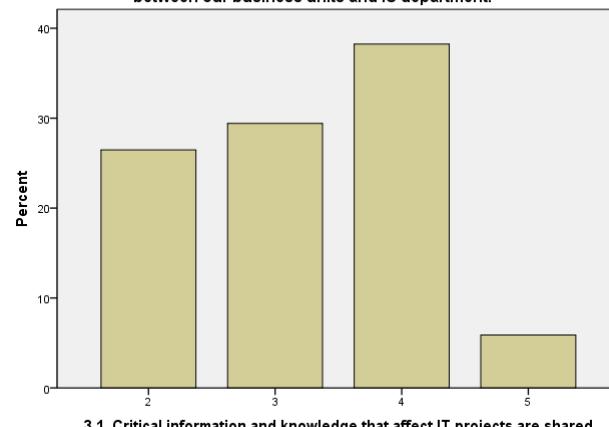
2.6. Our application systems are very modular; most program modules can be easily reused in other business applications.



2.7. We have standardised the various components of our technology infrastructure (i.e. hardware, operating systems, network, database).

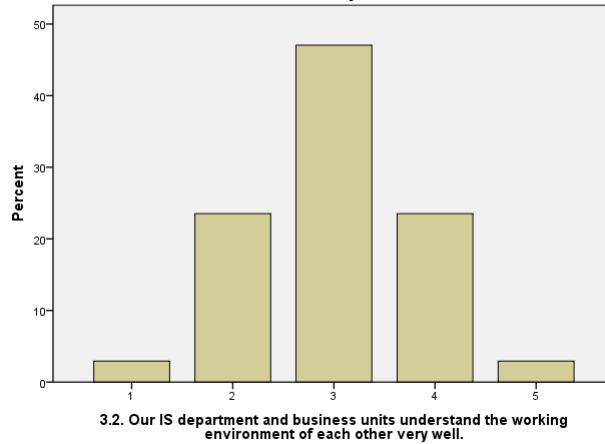


3.1. Critical information and knowledge that affect IT projects are shared freely between our business units and IS department.

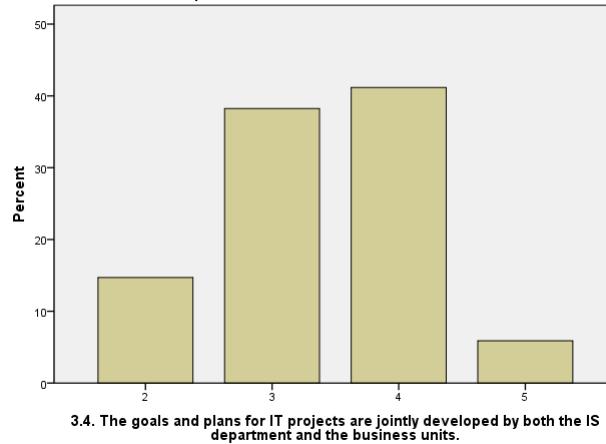




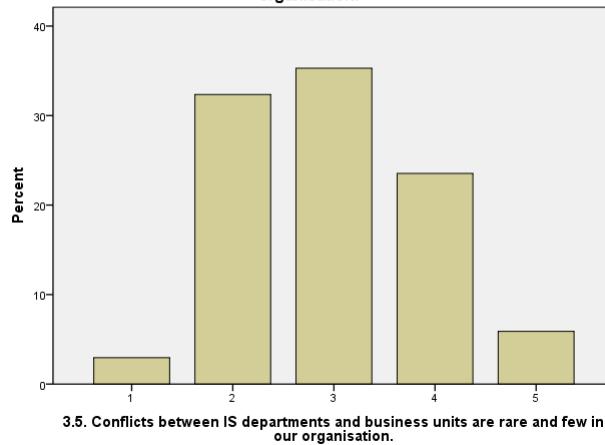
3.2. Our IS department and business units understand the working environment of each other very well.



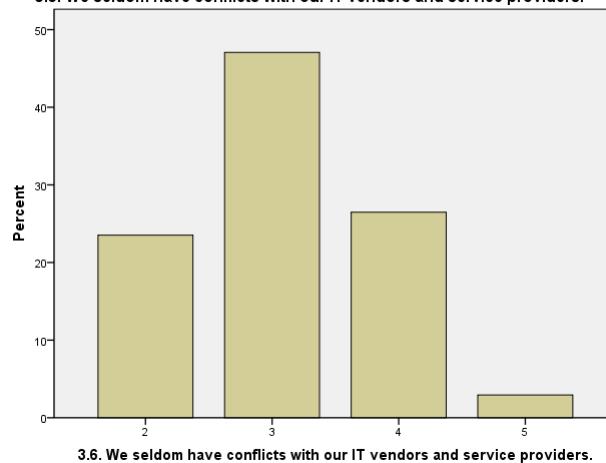
3.4. The goals and plans for IT projects are jointly developed by both the IS department and the business units.



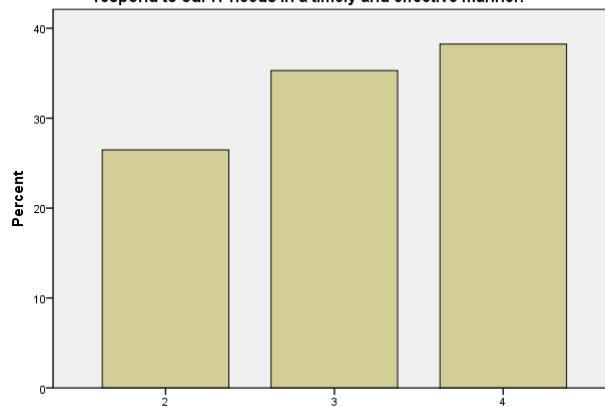
3.5. Conflicts between IS departments and business units are rare and few in our organisation.



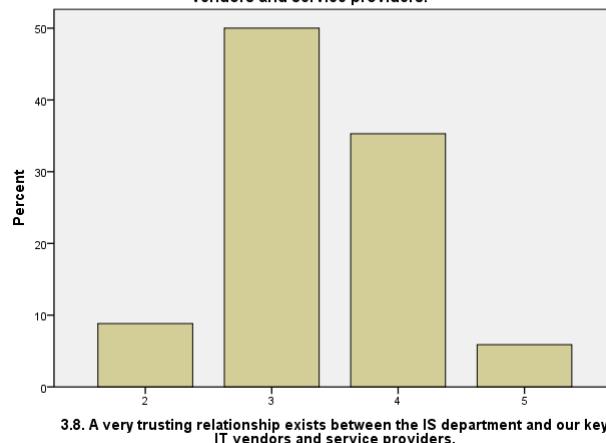
3.6. We seldom have conflicts with our IT vendors and service providers.



3.7. We get timely information from our IT vendors and service providers to respond to our IT needs in a timely and effective manner.

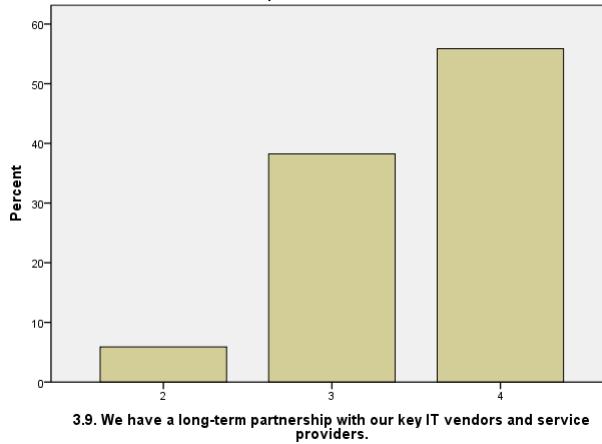


3.8. A very trusting relationship exists between the IS department and our key IT vendors and service providers.

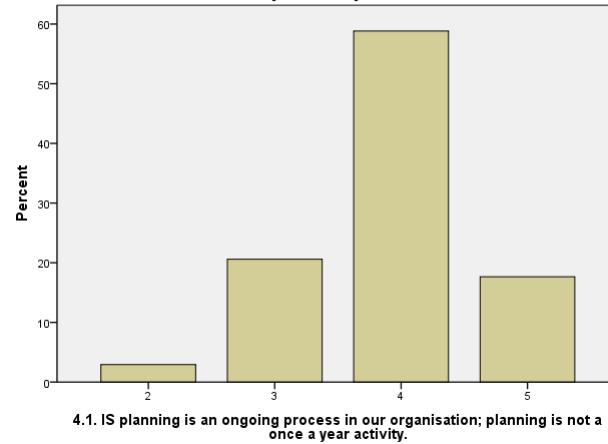




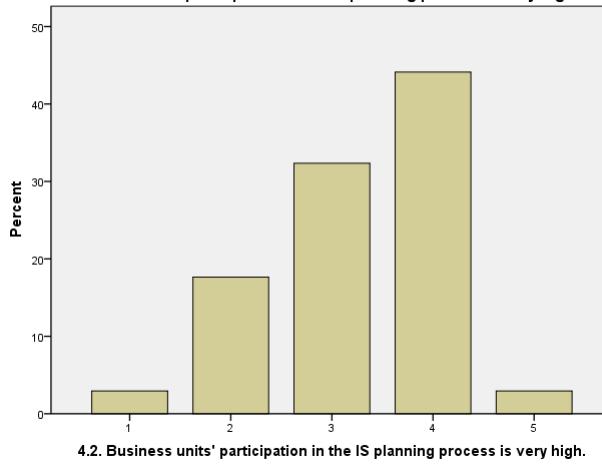
3.9. We have a long-term partnership with our key IT vendors and service providers.



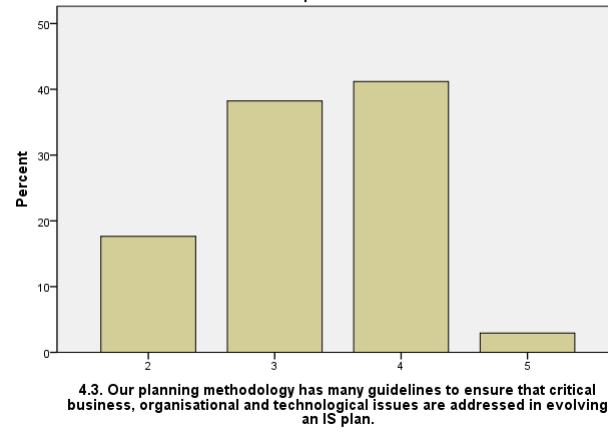
4.1. IS planning is an ongoing process in our organisation; planning is not a once a year activity.



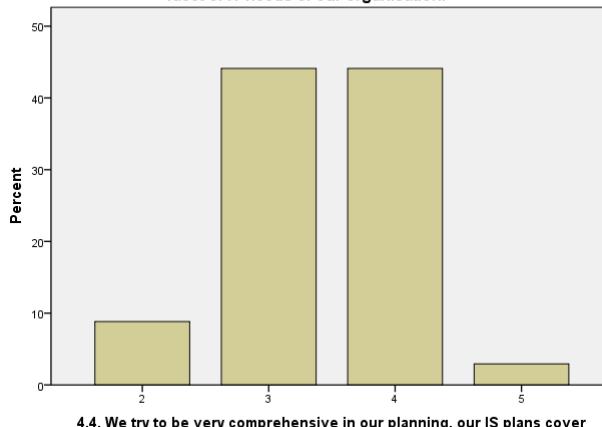
4.2. Business units' participation in the IS planning process is very high.



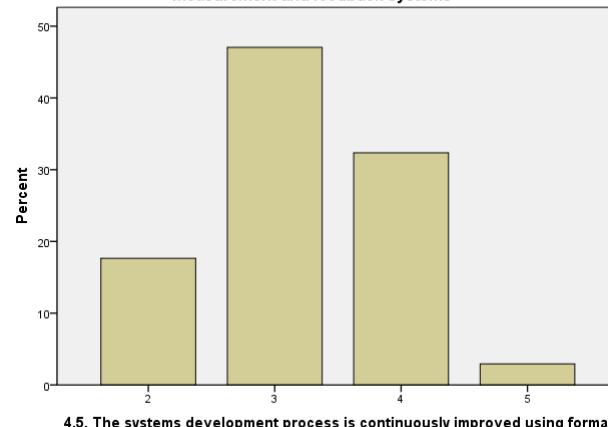
4.3. Our planning methodology has many guidelines to ensure that critical business, organisational and technological issues are addressed in evolving an IS plan.



4.4. We try to be very comprehensive in our planning, our IS plans cover every facet of IT needs of our organisation.

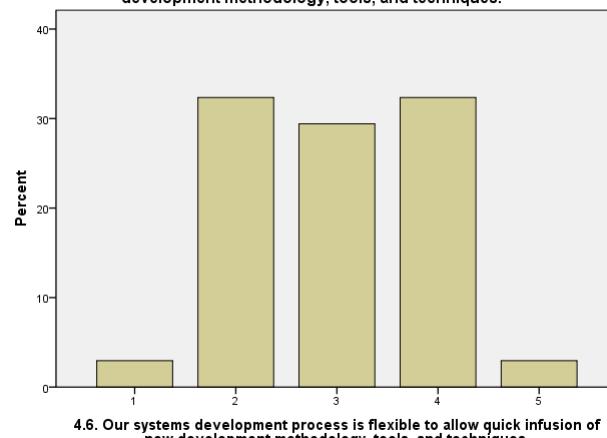


4.5. The systems development process is continuously improved using formal measurement and feedback systems

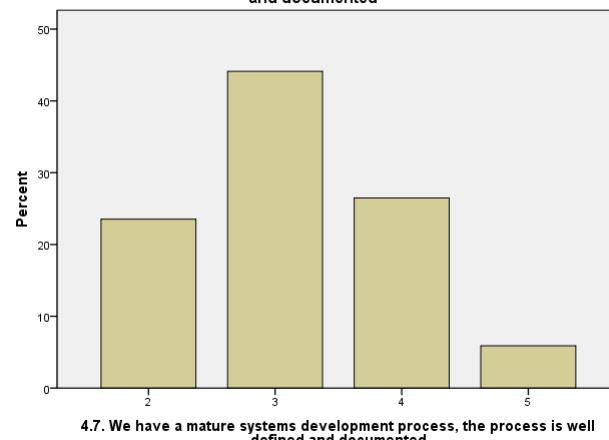




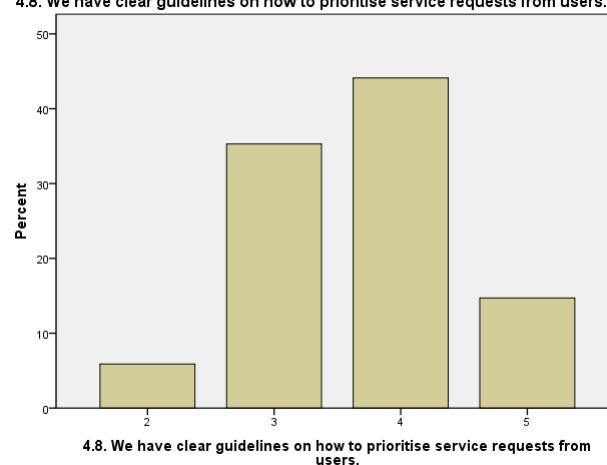
4.6. Our systems development process is flexible to allow quick infusion of new development methodology, tools, and techniques.



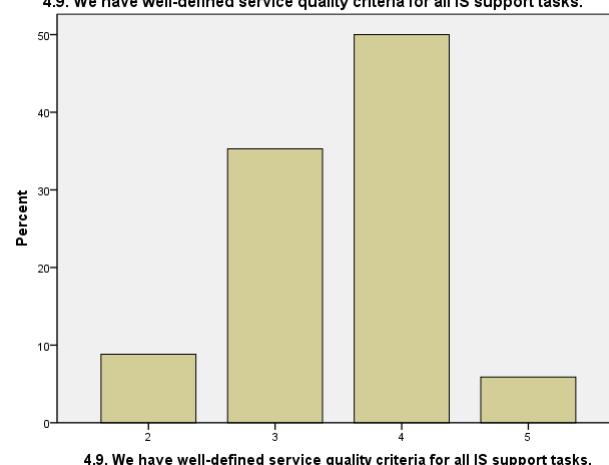
4.7. We have a mature systems development process, the process is well defined and documented



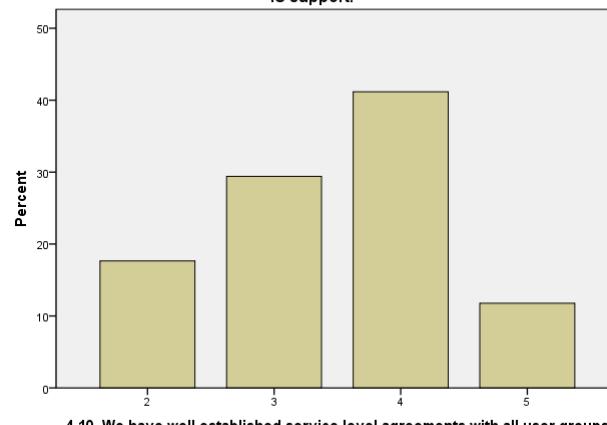
4.8. We have clear guidelines on how to prioritise service requests from users.



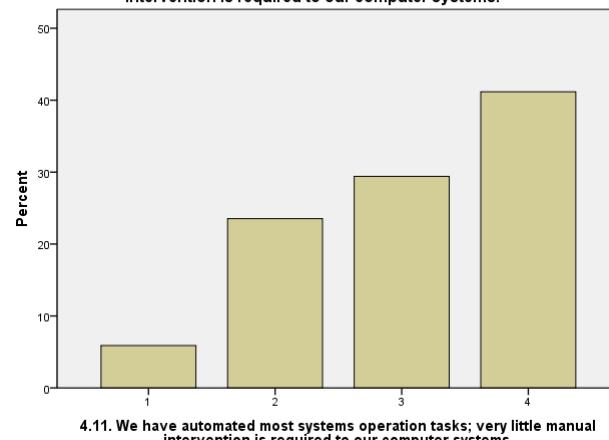
4.9. We have well-defined service quality criteria for all IS support tasks.



4.10. We have well established service level agreements with all user groups for IS support.

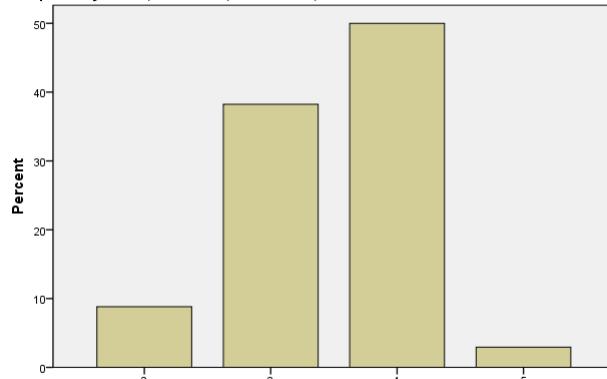


4.11. We have automated most systems operation tasks; very little manual intervention is required to our computer systems.



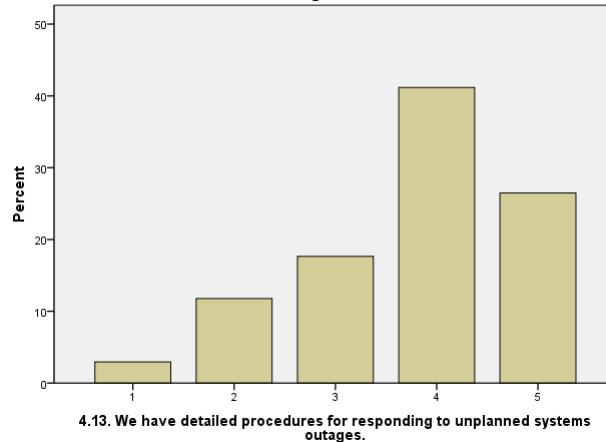


4.12. We use automated tools to monitor and fine-tune the performance of our computer systems, networks, databases, and telecommunication infrastructure

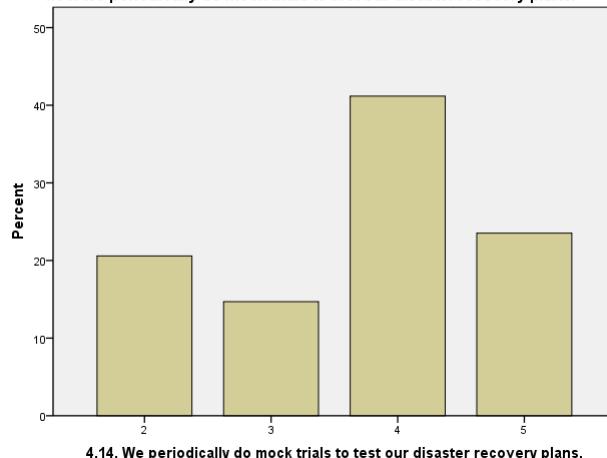


4.12. We use automated tools to monitor and fine-tune the performance of our computer systems, networks, databases, and telecommunication infrastructure.

4.13. We have detailed procedures for responding to unplanned systems outages.

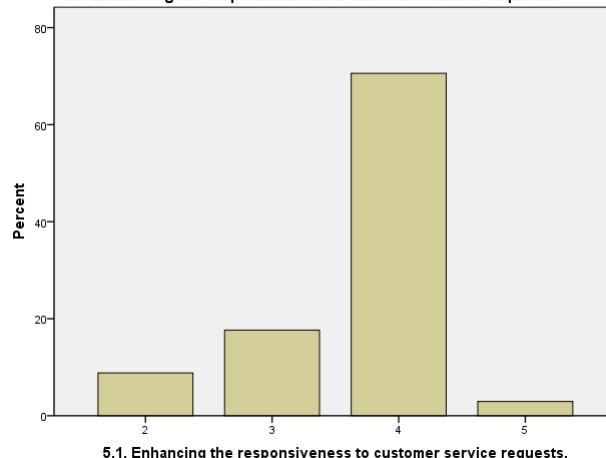


4.14. We periodically do mock trials to test our disaster recovery plans.



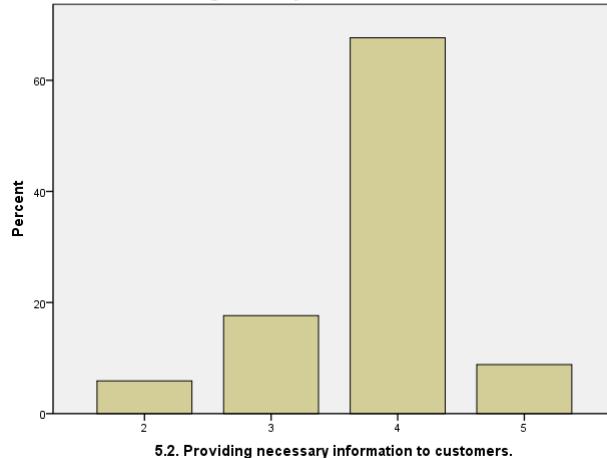
4.14. We periodically do mock trials to test our disaster recovery plans.

5.1. Enhancing the responsiveness to customer service requests.



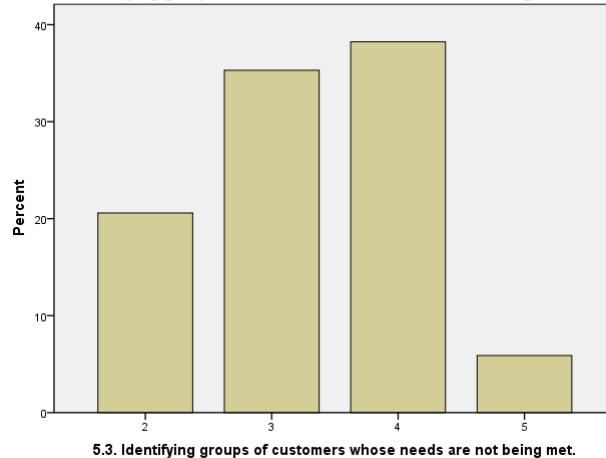
5.1. Enhancing the responsiveness to customer service requests.

5.2. Providing necessary information to customers.



5.2. Providing necessary information to customers.

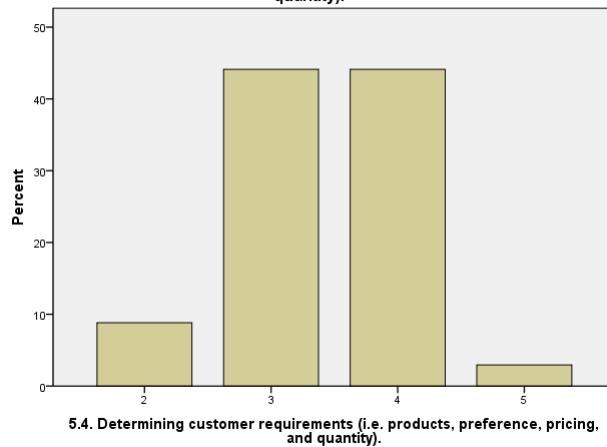
5.3. Identifying groups of customers whose needs are not being met.



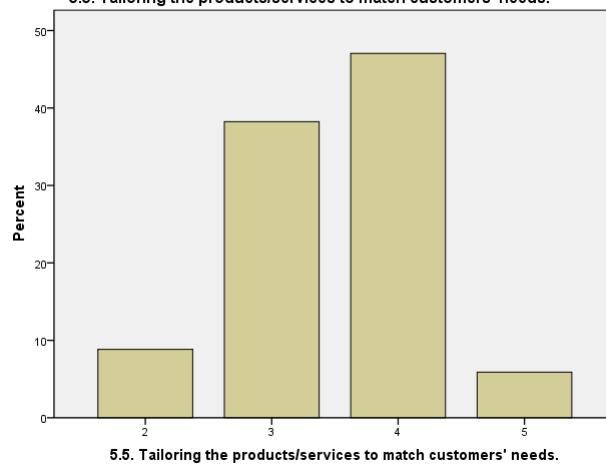
5.3. Identifying groups of customers whose needs are not being met.



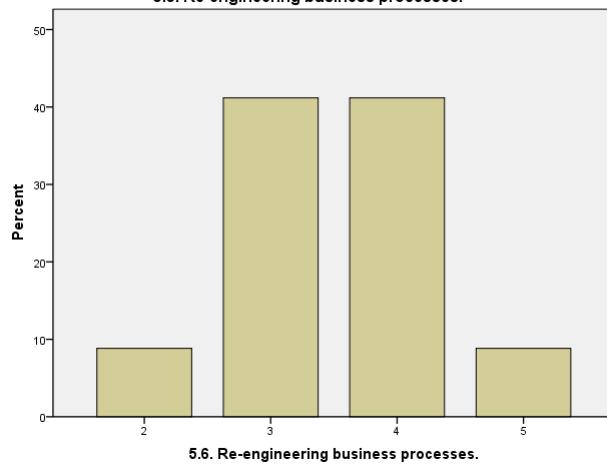
5.4. Determining customer requirements (i.e. products, preference, pricing, and quantity).



5.5. Tailoring the products/services to match customers' needs.

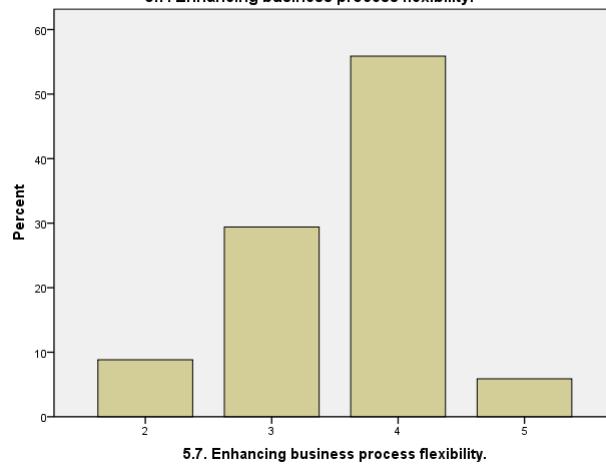


5.6. Re-engineering business processes.



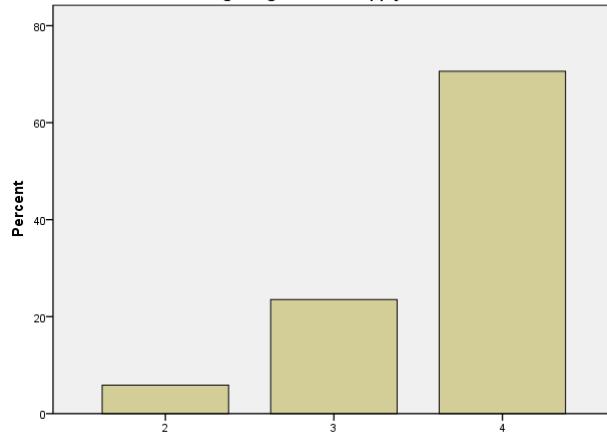
5.6. Re-engineering business processes.

5.7. Enhancing business process flexibility.



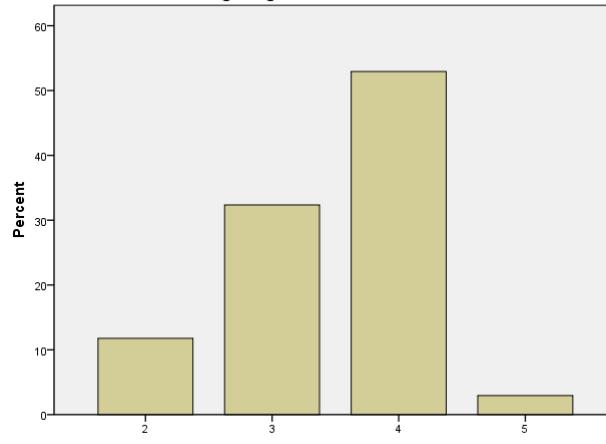
5.7. Enhancing business process flexibility.

5.8. Integrating the firms supply chain.



5.8. Integrating the firms supply chain.

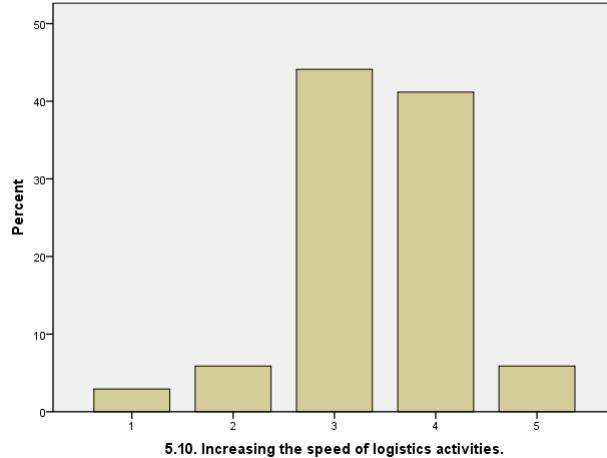
5.9. Integrating internal business units.



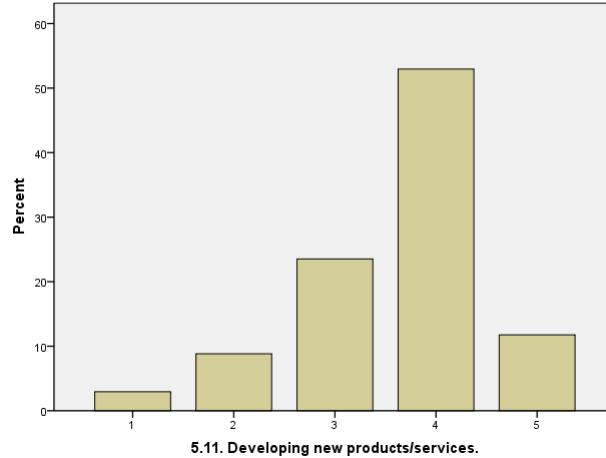
5.9. Integrating internal business units.



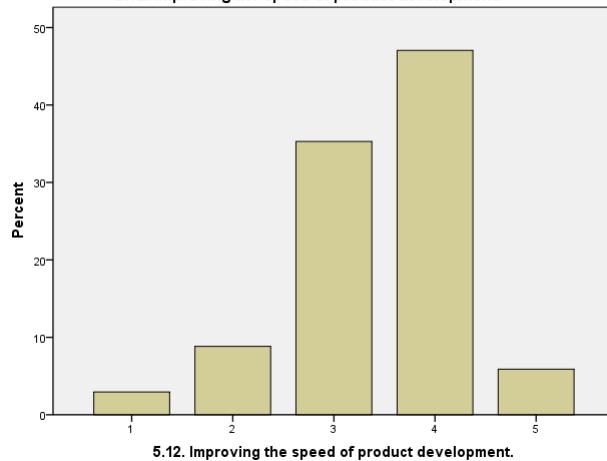
5.10. Increasing the speed of logistics activities.



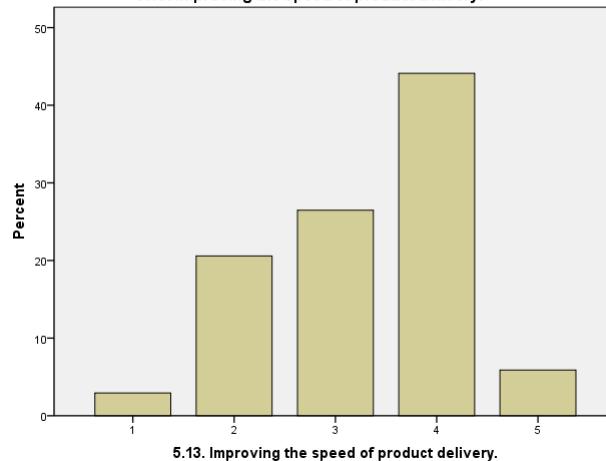
5.11. Developing new products/services.



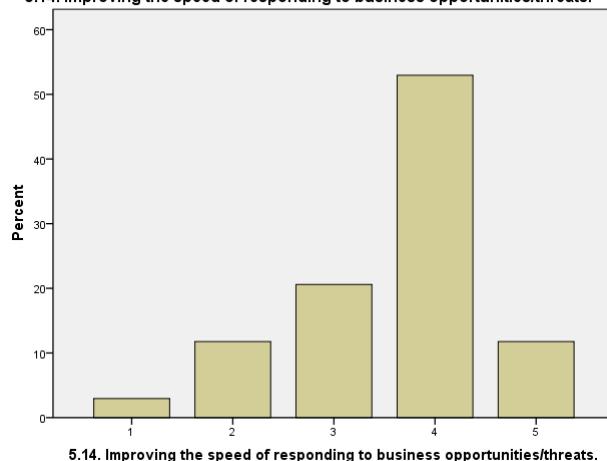
5.12. Improving the speed of product development.



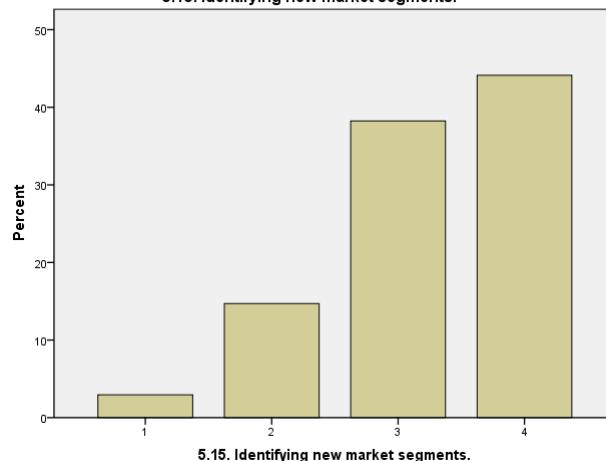
5.13. Improving the speed of product delivery.



5.14. Improving the speed of responding to business opportunities/threats.

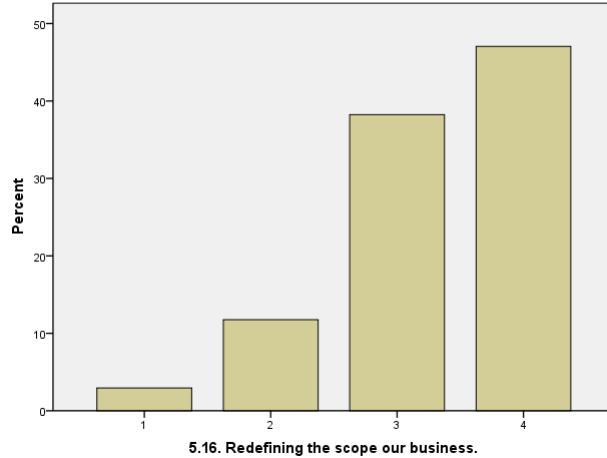


5.15. Identifying new market segments.

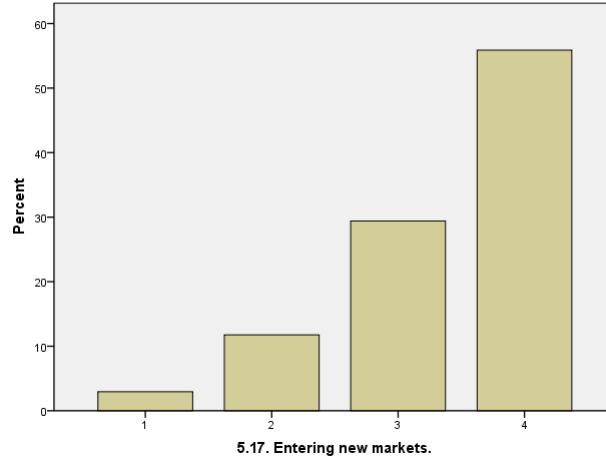




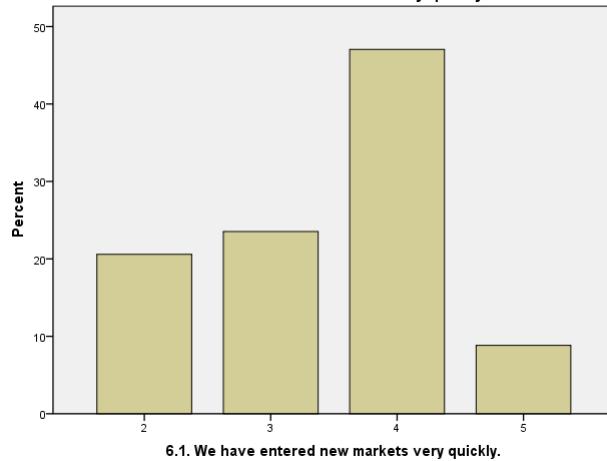
5.16. Redefining the scope our business.



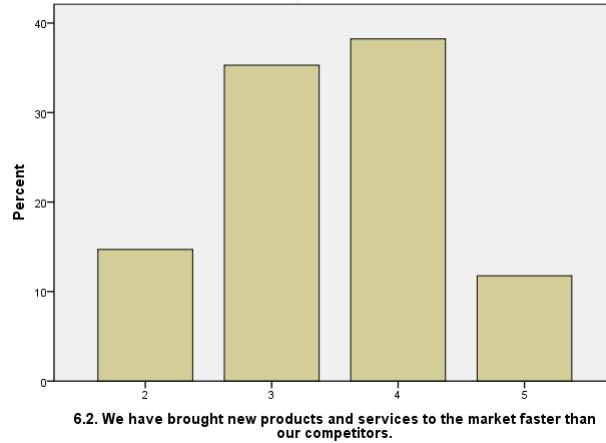
5.17. Entering new markets.



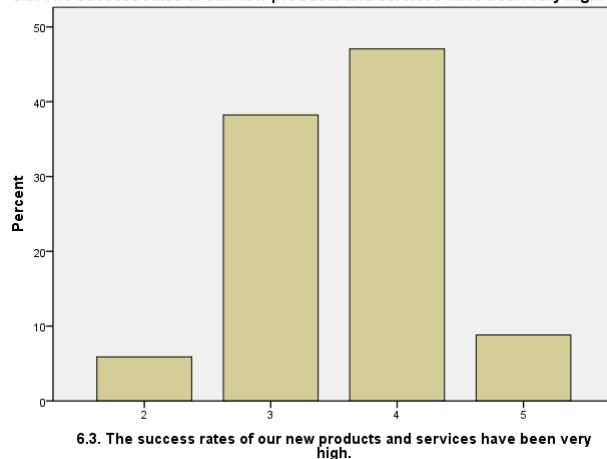
6.1. We have entered new markets very quickly.



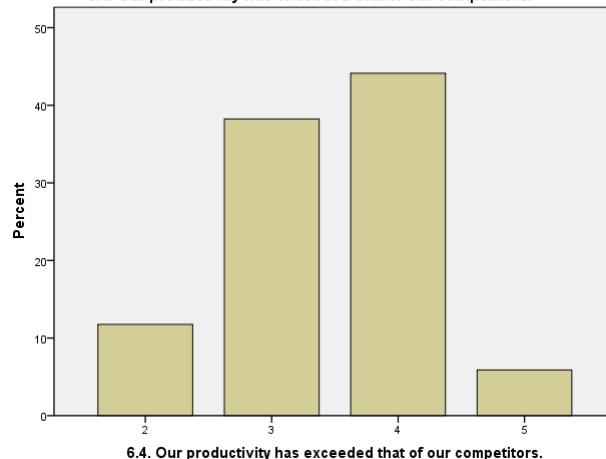
6.2. We have brought new products and services to the market faster than our competitors.



6.3. The success rates of our new products and services have been very high.

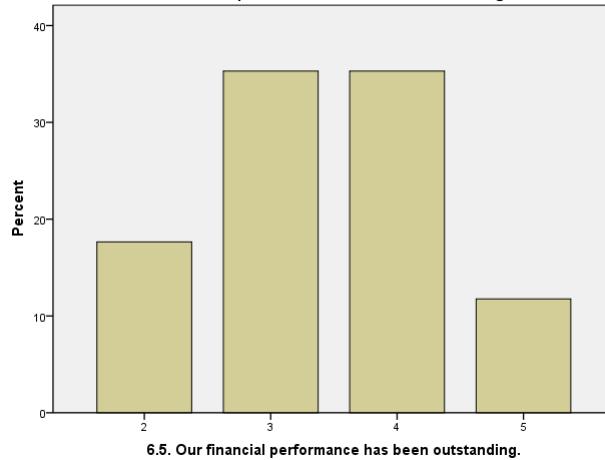


6.4. Our productivity has exceeded that of our competitors.

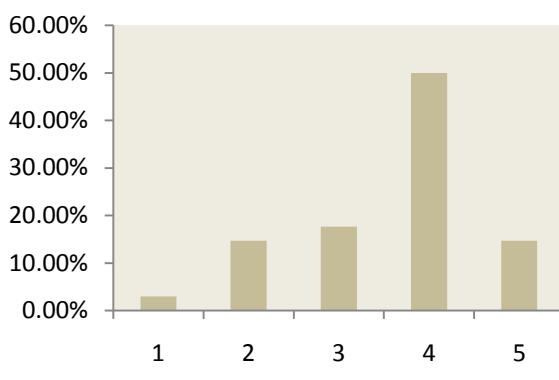
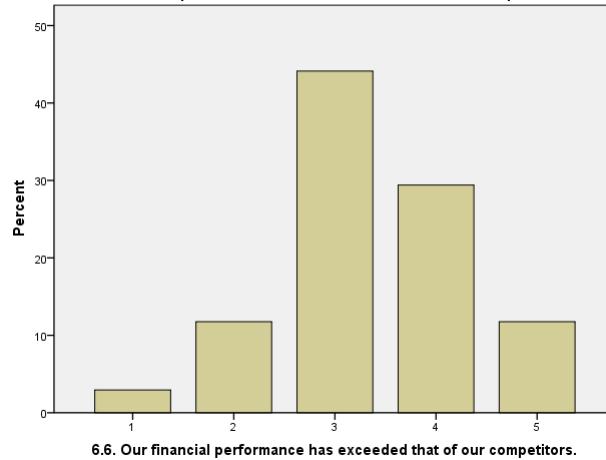




6.5. Our financial performance has been outstanding.



6.6. Our financial performance has exceeded that of our competitors.



2.1 The technology infrastructure needed to electronically link our business units is present and in place today



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