EXPLORING THE INTELLECTUAL CAPITAL CONTRIBUTION TO COMPANY PERFORMANCE IN SOUTH AFRICA

By

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Thesis submitted in fulfillment of the requirements for the degree

DOCTOR IN BUSINESS ADMINISTRATION

Graduate School of Business, Faculty of Management
University of Natal (Durban)

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20 December 2003

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"All men by nature desire knowledge" (Aristotle, 384-322 BC, Metaphysics, Book 1 Chapter 1).

"Whereas at one time the decisive factor of production was land, and later capital, today the decisive factor is increasingly man himself, that is, his knowledge" (Pope John Paul 11, 1991, Centesimus Annus).

"Information and knowledge are the thermonuclear competitive weapons of our times" (Stewart, 1997)

ACKNOWLEDGMENTS

I wish to acknowledge with gratefulness the support and encouragement received from everybody that contributed towards the completion of this study and in particular the following:

- G-d: who granted me the opportunity and tenacity to complete this study;
- Professor Alan Simon: who "taught me the ropes";
- Professor S. Mitchell Williams: without his help, this study would not have been possible;
- Professor Ante Pulic: whose model formed the basis for this study. I had the privilege of meeting him and sharing my ideas with him;
- Professor Lesley Stainbank: my supervisor, for her guidance, support, ongoing comments and review;
- Professor Jeremy Lord : who guided me through the initial stages of my research;
- University of Natal: I would like to thank the staff of the Faculty of Management Studies at the University of Natal, Durban Campus for their support of my dissertation topic;
- Stephen Saunders: who provided me with logistical and continuity guidance throughout my doctoral studies;
- Staff at Monash University South Africa: for moving me from a dazed and confused cacophony of thoughts into an organised thinker and reader. I am forever grateful and intellectually richer for the experience;
- Professor John Anderson: Pro Vice Chancellor Monash University South Africa for financial assistance;
- Monash University: for granting me the freedom and infrastructure to facilitate my studies;
- Karen-Bess Bernstein: for your assistance and guidance in editing this thesis; and
- Desiree, Ma'yan and Yakira: the women in my life, their continued love and support provided me with the freedom, time and perseverance to complete this dissertation.

The opinions expressed in this thesis and the conclusions reached remain my own and should not be ascribed to any of the above-mentioned parties.

Steven Ronald Firer
Johannesburg
December 2003

ABSTRACT OF THE THESIS

Since returning from virtual obscurity following the demise of apartheid in 1994, South Africa has endured eight years of aggressive transition across nearly all aspects of its social, political and economic infrastructure. Historically recognised for its underlying wealth of natural resources, recent efforts in South Africa have sought to develop the nation's intellectual capabilities and productivity. To establish South Africa's advancement in respect its transition, the primary objective of this research study is to empirically investigate whether a firm's intellectual capital can explain organisational performance.

Findings from this research study will assist to determine if South African companies appear to continue to rely on traditional business practices and perceptions, that is a reliance on natural resources for wealth creation, or are shifting toward a greater reliance on intellectual capital factors of production in determining company performance.

The contribution of intellectual capital to company performance in the South African economy was examined using three different models. Model 1 – part A was designed to establish the decisive business resource in creating wealth in the South African economy? Model 1 – part B, Model 2 and Model 3 are proposed on the premise of the Resource Based Theory of the Firm in that, company performance is a function of the organisation's ability to acquire and deploy resources (intellectual capital) in such a way to develop a sustainable competitive advantage. Model 1 – part B, Model 2 and Model 3 were designed to empirically investigate the relationship between a company's intellectual capital and performance. Company performance was examined in three dimensions: productivity, profitability, and market valuation. The primary explanatory independent variable of the analysis was intellectual capital performance.

For Model 1 part B and Model 2 a within industry analysis was designed. Two groups of companies were defined for contrasting multiple regression analysis using the different performance measures defined as the dependent variables. Group membership was determined by the company's primary source of value creation. The low-knowledge base group derives its value from raw resource (material) extraction, fixed capital investment and the efforts of physical labour. The high knowledge-base group derives its value exclusively from the efforts of people (human capital) and the collective routine systems, processes and information within the organisation (structural capital).

For Model 3 an analysis was carried out across industries and proposed, that certain industries rely more heavily upon the use of knowledge and intellectual capital in producing a company's goods or services.

Model 1, empirical results suggested that the dominant business resource in the South African economy is physical and not human capital or structural capital. These results imply that South Africa has not yet manifested the primary characteristics of the Knowledge Economy. Model 2, empirical results indicated only one significant positive relationship, between intellectual capital performance and profitability. This applied to the high and low knowledge-base group. This finding indicated that the appropriate management and measurement of intellectual capital would improve company profitability. Model 3, empirical results did not support the hypothesis, that the knowledge-base of an industry had a positive effect on the relationship between intellectual capital performance and company performance.

Overall, the empirical findings, based on correlation and linear multiple regression analysis indicates, that the contribution of intellectual capital to company performance are informative, but mixed. In general, empirical findings on the one hand suggest that although physical capital is the dominant business resource in the South African economy, the more intensive a company manages and measures its intellectual capital, improved in profitability can result. On the other hand intellectual capital performance does not have a positive influence on productivity in a company nor does it have a positive influence on analysts or investors.

As a result, despite efforts to improve its intellectual capital base the business environment and market in South Africa still appears to place greater weight to corporate performance based on physical capital assets.

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CHAPTER 1

INTRODUCTION

1.1 Background to the research topic

"Research in intellectual capital involves the quest for understanding the roots of a company's value, the measurement of the hidden dynamic factors that underlie the visible company" (Edvinsson and Malone, 1997, p. 11).

This study aims to explore the contribution of intellectual capital – a primary root of a company's value – to company performance in the South African economy. In particular, the study focuses on whether intellectual capital is the decisive business resource in the South African economy and is associated with or can explain company performance. The theoretical framework adopted is that of the resource-based theory of the firm. The resource-based theory of the firm derives its strength from its ability to explain, in clear managerial terms, why some competitors are more profitable than others. This theory sees companies as different collections of physical and intangible assets and capabilities. No two companies are alike because no two companies have had the same set of experiences, acquired the same assets and skills, or built the same organisational cultures. The assets and capabilities of a company determine how efficiently and effectively it performs its functional activities.

The corollary to this is that a company will be positioned to succeed if it has the best and most appropriate stocks of resources for its business and strategy.

Valuable resources can take a variety of forms. In the resource-based theory of the firm, resources are generally categorised into physical capital resources, human capital resources, and organisational capital resources.

The resource-based theory of the firm helps one to understand how and why strategic resources such as intellectual capital affect organisational performance (Barney, 1991).

The role of intellectual capital in creating value has become crucial in achieving competitive advantage in the market place (Usoff, 2002). This role is highlighted by Drucker's (1993, p.54) statement that "knowledge has become the key economic resource and the dominant and perhaps even the only source of competitive advantage".

Intellectual capital as a source of competitive advantage has attracted much attention among academics and managers (Edvinsson and Malone, 1997; Sveiby, 1997; Stewart, 1997). The need to manage, assess and control resources that are not on the balance sheet has become critical in today's market place (Kjellstrom, 2000).

Creation, management, and maintenance of intellectual capital fall within a field that is generally known as knowledge management. Knowledge management has become the new mantra of modern organisations seeking to compete in an increasingly turbulent and competitive world. It is increasingly accepted that the only true competitive advantage for organisations over the long term is knowledge i.e. how organisations create or acquire knowledge, how organisations retain and store knowledge, how organisations disseminate and use knowledge, and how organisations protect and manage the knowledge that they have (Dzinkowski, 2000).

Sveiby (2000) defines knowledge management as the creation of value from an organisation's intangible assets and is concerned with the maintenance, development, and dissemination of knowledge in organisations. In other words, knowledge management is concerned with the management of intellectual capital that an organisation controls (Petty and Guthrie, 2000).

The primary role of knowledge management involves the management of organisational learning flows and intellectual capital stocks (Bontis, Dragonetti, Jacobson, and Roos, 1999).

While knowledge and intellectual capital are conceptually linked, the term knowledge organisation is increasingly being used to describe companies that focus on leveraging their intellectual capital (Reed, 2000).

In today's knowledge-based economy, three of the most hidden dynamic factors of an organisation are its knowledge and know-how, which is created by and stored in its people (human capital), its relationships (social capital), and its organisational information technology systems and processes (organisational capital) (Edvinsson and Malone, 1997).

Proponents of intellectual capital research suggest that it is the leveraging of these three components that allows an organisation to create and sustain a competitive advantage (Edvinsson and Malone, 1997; Stewart, 1997). An essential feature of knowledge-based companies is their heavy reliance on intellectual capital (Johnson, Neave, and Pazderka, 2001).

Studies, both theoretical and empirical, of how the implementation of a knowledge management strategy has benefited companies, are prevalent in the current academic literature. Because intellectual capital is intangible by nature, knowledge management has been moving toward developing metrics for measuring and reporting intellectual capital for both internal and external users of accounting information (Sveiby, 2000; Sveiby, 2001; Brooking, 1996; Bontis, 1998; Bontis, 1999; Bontis, 2001; Edvinsson and Malone, 1997; Petty and Guthrie, 2000; Pulic, 1998).

Two hundred years after Adam Smith recognised the potential role of manufacturing in economic society; the world has entered an era in which the new wealth of nations is tied directly to the creation, transformation, and capitalisation of knowledge. Knowledge-based industries are expanding faster than most other industries and are transforming the economic infrastructures of many countries. International trade in the knowledge sector is reported to be growing five times faster than in natural resource-intensive industries (IFAC, 1998).

As the burgeoning demand for knowledge-based products and services is changing the structure of the global economy, the role of intellectual capital in achieving competitive advantage is becoming an important management issue in all sectors. While there is little consensus as to what intellectual capital actually is, many do accept that (IFAC, 1998):

- Intellectual capital is a primary competitive resource in business today; and
- Intellectual capital is a non-traditional, intangible asset; and its accumulation, transformation, and valuation lie at the heart of knowledge management.

1.2 The aim and rationale of the study

The major task that faces researchers is to convince users of accounting information of the usefulness of the quantitative measures of intellectual capital. Bontis (1998) argues that for accounting researchers, intellectual capital may prove to be an important item of disclosure in the future.

Bontis (1998) goes on to state that another interesting calculation for accounting and finance academics is to examine a company's utilisation of their intellectual capital.

Thus, for example, one might calculate a company's "exploitation" ratio (i.e. by comparing the value of a company's intellectual capital with overall company performance).

This would suggest how effective the organisation has been in making the causal link from intellectual capital to performance. Once managers realise the importance of measuring and developing their intellectual capital, they will invariably want to increase their intellectual capital since it has a positive effect on company performance. Unfortunately, methods of measuring and evaluating intellectual capital have been slow to develop (Petty and Guthrie, 2000).

There is a limited literature available on the study of managing and measuring intellectual capital (Bontis, 1998). Walker (2001) states that, despite its theoretical importance, there has, likewise, been little empirical research into the importance of intellectual capital, especially in the relationship between intellectual capital and company performance.

The purpose of this research study is to attempt to convince the users and compilers of accounting information that intellectual capital is one of the primary resources a company possesses. The methodology that this research study has adopted to prove this is (1) to establish empirically whether intellectual capital is a decisive business resource; and (2) whether intellectual capital performance and the business or financial, performance of a company, are related.

1.3 Importance of the research

A major feature of this study is its focus on South Africa. Data is drawn South African sources, rather than data from developed Western economies, has been utilised. A number of key reasons support this focus: intellectual capital research initially evolved in Scandinavia and in particular Sweden before taking root, more recently, in other developed nations such as Canada and the United States of America. Knowledge of the understanding and impact of intellectual capital in developing economies such as South Africa is, in contrast, still in its infancy.

Given the significance of emerging economies to the overall well-being and balance of the global economy, it is important to establish an understanding of the development of intellectual capital in different socio-political and economic settings (Firer and Williams, 2003).

Since emerging from virtual obscurity following the demise of apartheid in 1994, South Africa has endured eight years of aggressive transition across nearly all aspects of its social, political and economic infrastructure.

Historically, South Africa was recognised for its underlying wealth of natural resources, but recent efforts have sought to develop the nation's intellectual capabilities and productivity.

Results of this research study will be of interest to numerous parties. These include shareholders, institutional investors, academic researchers and policy makers, whether in government or in management.

Policy makers, for example, given their influence on the direction and nature of the South African business environment, could utilise the findings of this study to determine whether amendments to present policies are required in order to promote further the development of the nation's intellectual capital, rather than merely its physical capital resources. The findings will also assist investors to understand better the changing face of South African business and will provide a method for evaluating the impact of such change on company value.

Furthermore, findings from this research study will help to determine whether South African companies remain reliant on traditional business practices and perceptions (in other words, on natural resources) for wealth creation, or are beginning to acknowledge and utilise intellectual capital factors of production in creating value.

To date, no work of a substantial nature has been published to provide an understanding of how South African companies compare internationally with regard to the management, measurement and reporting of intellectual capital. The literature nevertheless presents overwhelming evidence to support the notion that there are benefits to managing, measuring and reporting intellectual capital.

It is believed that this research study will make several unique contributions to the literature. First, it will provide evidence of the association between intellectual capital management, measurement and reporting on the one hand, and productivity, profitability and market valuation in a major emerging economy on the other hand.

Second, this research study seeks to go beyond the ongoing debate regarding the measurement of intellectual capital by providing empirical and practical evidence of the possible utility of a proposed technique to predict the appropriate value of a company in an economy where physical capital has been the dominant resource.

Third, it aims to provide evidence that the South African economy is developing beyond its status of an emerging economy, by recognising and establishing intellectual capital as well as physical capital.

Finally, if the link between intellectual capital performance and business performance can be validated and replicated, it will represent a major breakthrough in the understanding of how intellectual capital measures relate to company performance.

At present, the vast bulk of research on intellectual capital can be broadly categorised into two major streams: (1) definition and description; and (2) management, measurement and reporting (Guthrie and Petty, 2000). While there are a number of unanswered empirical questions surrounding the definition and description of the concept of intellectual capital, this study focuses on management and measurement.

Until now, research generally has not sought to investigate empirically the relationship between new proposed measures of intellectual capital and established mainstream measures of company performance. Empirical research of such links is important for various reasons. For example, the determination of any such associations better assists in the cognitive understanding of intellectual capital, its importance and measurability, and reduces uncertainty amongst stakeholders (such as users of financial information) about dealing conceptually and practically with intellectual capital.

The empirical research that forms the central part of this study will, in addition, assist in the development of better accounting, finance and valuation models than those that are currently based on traditional business models and that usually ignore, or have vague impressions of, the relevant components of intellectual capital.

In terms of age, the discipline of intellectual capital is relatively young. It has, however, already developed a prosperous history. According to Petty and Guthrie (2000), the battle for recognition as an individual and separate discipline has already been won and the second stage of growth (measurement and reporting practices) is being forged.

A potentially unfortunate by-product of the battle for acceptance as an individual and separate discipline is that distinctive lines have been drawn with established mainstream business practices.

Consequently, while they may acknowledge the existence of intellectual capital, mainstream business and other related circles of influence (such as politics and unions) refrain from fully accepting it without evidence of any relevant link to current mainstream practices.

1.4 Research questions

With the above issues in mind the following research questions are formulated:

- What is the decisive business resource in the South African economy?
- Does intellectual capital have significant explanatory and predictive power in determining company performance? and
- Is the relationship between the value of intellectual capital in a company and company performance moderated by the importance of knowledge and intellectual capital in the production of goods and services?

The contribution of intellectual capital to company performance in the South African economy will be determined by answering these three research questions.

In an attempt to answer the above research questions, intellectual capital is measured using information obtained from the audited 2001 financial statements from companies listed on the JSE Securities Exchange and statistically tested against selected indicators of company performance – productivity, profitability, and market valuation. The literature documents various accounting and market-based measures that may be utilised as a proxy measure designed to capture the respective properties of the three dependant variables. Presently, there is no specific theoretical perspective or empirical evidence supporting any one specific proxy measure over another. It has been decided, therefore, that for the purposes of the present study, to use proxy measures used widely in the prior literature (for example Firer and Williams, 2003; Walker, 2001;Kotha, Rajgopal and Rindova, 2000; Short and Keasey, 1999). Statistical analysis takes the form of correlation and multiple regression analysis.

1.5 Summary and research approach

This study was prompted by a recognition of the increasing importance of intellectual capital as a decisive business resource that results in competitive advantage. Without evidence of the usefulness of intellectual capital, the continued management, measurement, and reporting of intellectual capital can be seen as a waste of time and resources for both internal (management) and external (investors, analysts, and providers of capital) users of accounting information.

If the results of the study indicate that intellectual capital contributes to company performance, users – internal and external – would definitely benefit from the management, measurement, and reporting of intellectual capital. Therefore, the study aims to contribute towards improved management and financial reporting by providing empirical evidence that through the management, measurement and reporting of intellectual capital, the requirements of the users of accounting information – internal and external – are fulfilled.

The research questions in this study will propose functional relationships among multiple constructs. Consequently, correlation and multiple regression analysis will be used to test the hypotheses derived from the research questions.

Any transformations necessary to meet the assumptions of normality is be made after examining the data. Any evidence of multicollinearity among independent variables is reported along with statistical results. Statistical significance is assessed at the ρ=0.05 level.

1.6 Organisation of the study

The remainder of this research study is organised as follows: Chapter 2 consists of a detailed discussion on the nature and historical development of intellectual capital measurement.

This discussion is concentrated in four different areas: (1) comparison of the Industrial and Information Ages; (2) the hidden roots of value, and the deficiencies of the current accounting model; (3) a detailed analysis of the conceptual framework – the resource–based theory of the firm – upon which this research study is based; (4) a review of the history of intellectual capital measurement in selected countries, together with the definition, importance, measurement, and classification of intellectual capital, and the statutory aspects of intellectual capital.

Chapter 3 consists of a review of existing literature, a systematic analysis of what has already been noted regarding intellectual capital, and serves as a springboard for the empirical research conducted. Chapters 2 and 3 provide the theoretical background of intellectual capital and investigates studies on the usefulness of intellectual capital.

Chapter 4 defines the constructs and develops the rationale for the hypotheses. A description of the ideas specifically developed for this research study is detailed here, with a precise reasoning in respect of the propositions advanced (hypotheses).

Chapter 5 introduces the principles and concepts of the research framework that are employed in this research study.

Chapter 6 describes the research design and methodology: a detailed description of the strategy and plan for the study, and the methods and procedures for the collection, measurement and analysis of the data are specified.

Chapter 7 provides a detailed analysis of the interpretations and implications of the research results.

Chapter 8 explores the implications that intellectual capital management and measurement have for the business environment in South Africa and suggestions are made as to how companies in South Africa should adapt to the knowledge economy; what strategies they should adopt and how management must change its perceptions and methods of company reporting.

Chapter 9 summarises and draws conclusions in respect of the research study, discusses the potential limitations of this research study and provides future research ideas.

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CHAPTER 2

THE NATURE AND HISTORICAL DEVELOPMENT OF INTELLECTUAL CAPITAL MANAGEMENT AND MEASUREMENT

2.1 Introduction

This chapter describes four different aspects of the nature and historical development of the management and measurement of intellectual capital. The first aspect is the turn of the ages. This section depicts the transformation from the industrial age to the information age, the age that gave rise to the concept of intellectual capital. The second aspect deals with the development of intellectual capital in three stages: Stage 1 describes the limitations of the current accounting model; Stage 2 recounts the evolution of the definition of intellectual capital; Stage 3 describes, in theoretical terms, why intellectual capital is part of the resource-base of an organisation. Third, the history of Intellectual Capital Movement is discussed. Finally, intellectual capital is defined and classified for the purposes of this research study. The importance of intellectual capital, the various measurement techniques of intellectual capital and the statutory implications of intellectual capital are also addressed.

2.2 Societal ages in perspective

2.2.1 Introduction

Knowledge has always been important. Throughout history, success has come to people on the cutting edge of knowledge, now, at the beginning of the 21st century, knowledge has greater value as a commodity than ever before (Stewart, 1997).

To understand what intellectual capital is, why it is so important, how to grow and manage it, it is crucial to understand what the Information Age means. It is also important to compare the Information Age to the Industrial Age. The reason for this is to sense the sheer magnitude of the transformation from the Industrial Age to the Information Age.

2.2.2 The Industrial Age

An important characteristic of industrial age businesses is that they are focused on mass production (Tjaden, 1995). The technology of this age, oriented toward the mechanical automation of labour intensive activities, and requiring large capital investments forces this focus (Attrill, 1998). In order for workers in an industrial age business to produce large amounts of identical goods, they must adhere to strict procedures. Variance from these procedures would ripple through the production line, creating huge disruptions (Tjaden, 1995).

Any notions the workers might have for changes to these procedures are of little interest to management, because changing any part of the process would usually affect all of the process (Tjaden, 1995).

Workers in the industrial age were never encouraged, and were powerless, to use their "brainpower" in furthering the aims of the industrial age company. Success in an industrial age business requires great skill in acquiring large amounts of investment capital, and in managing activities so as to make these investments worthwhile (Tjaden, 1995).

2.2.3 The Information Age

The period from the industrial revolution up to the mid-1970s is described as the Industrial Age (Attrill, 1998).

Since the mid-1970s, the world economy has changed dramatically (Mustard, 1993). Deregulation, greater competition, rapidly changing technology and the growing sophistication of information systems have resulted in a much less stable environment within which companies must operate (Attrill, 1998). This new economic era is described as the Information Age (Toffler, 1981).

The Information Age demands from companies new reasoning and strategy to keep ahead of their rivals (Partanen, 1998). It has been argued (Stewart, 1997;Hope, 1998;Sveiby, 2000) increasingly that competitive advantage is gained through exploiting the knowledge base of the company.

Knowledge has become the critical factor in achieving success (Van Buren, 1999). The successful companies are those which exploit the knowledge and abilities of employees most effectively (Sveiby, 2001). Knowledge is the invisible asset that produces the innovative products, high quality service and satisfied customers necessary for success (Guthrie, 2001). Companies must, therefore give priority to developing and managing the knowledge base formed by its employees in order to create value.

The growing importance of knowledge means that physical assets such as plant and equipment will play a less decisive role in determining success (Cahill, 2000). The Chief Executive of Merck has said (Attrill, 1998, p.1): "A low value product can be made by anyone anywhere. When you have knowledge no one else has access to – that's dynamite. We guard our research even more carefully than our financial assets".

In this age, wealth is the product of knowledge. Knowledge and information – not just scientific knowledge, but news, advice, entertainment, communication, service – have become the knowledge-based economy's primary raw materials and its most important products (Stewart, 1997).

Insert Table 1

Summary of differences between the Industrial Age and Information Age

2.3 Evolution of intellectual capital

2.3.1 The hidden roots of value

Shares in Microsoft, the world's largest computer software firm, changed hands at an average price of $70 during 1995 at a time when their so-called book value or equity was just $7. In other words, for every $1 of recorded value the market saw $9 in additional value for which there is no corresponding record in Microsoft's balance sheet (Sveiby, 1997). What is it about Microsoft that makes it worth ten times the value of its recorded assets? What is the nature of that additional value that is perceived by the market but not recorded by the company?

Alternatively, to generalise, why do some companies have higher market-to-book ratios than others? Stock analysts, the most influential judges of corporate value, will say that the reason for Microsoft's high market-to-book ratio is the firm's extra-ordinary profitability – it achieved a return on equity of almost 30% in 1995 (Sveiby, 1997) – and its phenomenal growth record. However, this does not answer the question, it just rephrases it.

Why is Microsoft so profitable and why has it grown so fast? What is the mysterious, hugely productive asset that Microsoft clearly has and that Ford Motor Company, whose share trades close to its book value, lack? Microsoft's annual reports, the primary and official statement of the company's affairs, offer no explanation. Microsoft obviously has something far more valuable than physical or financial capital: It has intellectual capital (Stewart, 1997). Why is this hidden value not recorded in the annual report of Microsoft? The answer is that the traditional model of accounting, which has described the operations of companies for centuries, is now failing to keep up with the revolution that is taking place in business. Annual reports are proving themselves to be too static and hidebound to keep up with the modern organisation, with its fluid structure, strategic partnering, empowered employees, groupware, multimedia network marketing and vital reservoirs of human intellectual resources (Edvinsson and Malone, 1997).

At this point in time, a company has no idea whether they have sustainable competitive advantage. It has become obvious that the real value of companies cannot be determined by only traditional accounting measures. The value of companies does not lie in bricks and mortar, or even in inventories, but in another intangible kind of asset: intellectual capital.

2.3.2 Toward a definition of intellectual capital

What is intellectual capital? Until now, a definition has been elusive. In recent years, driven by necessity, individuals and companies have begun to tackle the challenge of finding a standardised definition.

Funk and Wagnall (1946 p.695 and p.202) offered a broad perspective on what the intellectual capital of a company might mean:

Intellectual (adj): Of or pertaining to the intellect. Engaging, or requiring the use of the intellect.
Capital (noun): Wealth in any form employed in or available for the production of more wealth.

In order to arrive at a workable definition of intellectual capital for the purposes of this research study, it is essential that various definitions of intellectual capital be considered:

The term "intellectual capital" was first published by John Kenneth Galbraith in 1969 (Cited in Bontis, 1998). He believed that intellectual capital meant more than just intellect but rather incorporated a degree of intellectual action. In that sense, intellectual capital is not only a static intangible asset *per se*, but an ideological process: a means to an end (Bontis, 1998).

Brooking (1996) describes intellectual capital as the enhanced value of a firm attributable to assets, generally of an intangible nature, resulting from the company's organisational function, processes, information technology networks, the competency and efficiency of its employees and its relationship with its customers. Intellectual capital assets are developed from (1) the creation of new knowledge and innovation; (2) application of present knowledge to present issues and concerns that enhance employees and customers; (3) packaging, processing and transmission of knowledge; and (4) the acquisition of present knowledge created through research and learning.

Stewart (1997) states that intellectual capital is not a group of PhDs locked in a lab somewhere, nor does it mean intellectual property (such as patents and copyrights), though that is one part of intellectual capital. He describes intellectual capital as the sum of everything everybody in a company knows that gives it a competitive edge.

Unlike the assets with which business people and accountants are familiar – land, factories, equipment, cash – intellectual capital is intangible.

It is the knowledge of a workforce: the training and intuition of a team of scientists who discover a billion-dollar new patent, or the know-how of workmen who come up with a thousand different ways to improve the efficiency of a factory. It is the electronic network that transports information at light speed through a company so that it can react to the market faster than its rivals.

Intellectual capital is the intellectual material – knowledge, intellectual property, information, experience – that can be used to create wealth.

Edvinsson and Malone (1997) defined intellectual capital as the possession of knowledge, applied experience, organisational technology, customer relationships and professional skills that provide an organisation with a competitive edge in the market.

The Society of Management Accountants of Canada (Cited in IFAC, 1998) defines intellectual assets as knowledge-based items, which the company owns, which will produce a future stream of benefits for the company.

Bontis (1998) suggests that intellectual capital is the pursuit of effective use of knowledge as opposed to information.

As it is applied today, the term "intellectual capital" has many complex connotations and is often used synonymously with intellectual property, intellectual assets, and knowledge assets. Intellectual capital can be thought of as the total stock of capital or knowledge-based equity that a company possesses. As such, intellectual capital can be both the end result of a knowledge transformation process, or the knowledge itself that is transformed into intellectual property or intellectual assets of the company (IFAC, 1998).

2.3.3 Summary

Generally speaking, intellectual capital consists of the non-physical and the non-financial resources of a company. Knowledge, expertise, customer relations, brands, and other intangibles are the basic ingredients of a definition of intellectual capital. These ingredients are the basic factors for identifying and analysing a company's value drivers and key business processes.

2.4 History of intellectual capital management and measurement

2.4.1 The Intellectual Capital Movement

2.4.1.1 Introduction

An historical perspective is essential in fostering an understanding of the context within which intellectual capital came to be viewed as the essential business resource that it is today.

The evolution of intellectual capital management as a discipline followed a pattern that is detectable in hindsight, although to the people involved at the beginning there was no pattern discernible at the time (Sveiby, 2000). There were three distinctly different origins of the "rise of the new economy". The first was in Japan with the groundbreaking work of Hiroyuki Itami who studied the effect of invisible assets on the management of Japanese corporations. This study brought into existence the notion that intangible assets were important to the company. The second was the work of a diversified set of economists seeking a different view of the theory of the firm. David Teece blended these views into a research study. The research was instrumental in demonstrating the need for innovation to create profits.

Finally, the work of Karl-Erik Sveiby in Sweden addressed the human capital dimension of intellectual capital and, in doing so, provided a "rich and tantalising" view of the potential for valuing the firm upon the competencies and knowledge of its employees (Sullivan, 2000).

The concept of intellectual capital appears to have emerged from the depths of the early 1980s' recession as traditional industries struggled with brutal problems of excess capacity and falling profitability, and as governments wrestled with ballooning deficits and declining real incomes (Harris, 2000). The work of Itami, Teece and Sveiby introduced to the business community an enormous potential for improving business strategy and created a construct that would "change the way" business was executed (Sveiby, 1998, p.2).

2.4.1.2 History of the Intellectual Capital Movement (Cited in Sveiby, 1998)

2.4.1.2(a) Time line

The Intellectual Capital Movement is grounded in practice. The time line of major intellectual capital practice and research milestones is presented below. This timeline is a simplification of the richness of the development process and is presented solely to illustrate the development of intellectual capital from a general notion of intangibles to how intellectual capital became a popular topic with researchers and practitioners.

Insert Table 1b

Time line

History of the Intellectual Capital Movement

A brief discussion of the main role players in the development of the Intellectual Capital Movement follows:

2.4.1.2(b) Hiroyuki Itami

Hiroyuki Itami's groundbreaking work on the value of invisible assets to the corporation was originally published in 1980. Itami introduced the notion that intangible assets are essential to a company's success.

2.4.1.2(c) Brian Hall

In collaboration with Benjamin Tonna, Brian Hall developed a hierarchy of human values as well as several instruments for measuring and describing the value sets of individuals and corporations. This research enabled Hall to advise corporations on how to identify their values, and to analyse how those values aid or impede their achievements of their business goals.

2.4.1.2(d) David Teece

Teece's 1986 article "Profiting from Technological Innovation" brought together much of the work done by academic researchers and economists leading towards a resource-based theory of strategy. This article was instrumental in demonstrating the economists' view of technology commercialisation and contained several ideas that were key to a management capability for extracting value from innovation. This article identified sources of value in technological innovation, the mechanisms for converting value to profits, and the steps necessary for commercialising innovation.

2.4.1.2(e) Karl-Erik Sveiby

Sveiby is known as the founding father of the early Swedish movement in knowledge management and intellectual capital. In 1987, he published a book, "The New Organisational Wealth" in which he explored how to manage the rapidly growing field of knowledge companies that have no traditional production function, only the knowledge and creativity of their employees. In 1989, he published the results of his research in the book called The Invisible Balance Sheet, proposing a theory for measuring knowledge capital by dividing it into three categories: customer capital, individual capital, and structural capital. This approach was adopted by a large number of Swedish listed companies.

In 1990, he published the world's first book dealing with knowledge management titled "Knowledge Management". Sveiby was first to recognise the need to measure human capital, and he pioneered accounting practices for these intangible assets, testing them in his own company.

2.4.1.2(f) Thomas Stewart

In his book "Intellectual Capital: The New Wealth of Organisations" (1997), Stewart developed a framework upon which business people can build useful and valuable strategies for competing in the Information Age. His work explores the definition of intellectual capital, how to manage it, its potential pitfalls, and the economics surrounding it. Stewart shows how to capitalise on often ignored value found in the talent of an organisation's people, the loyalty of its customers and the collective knowledge within its culture, systems and processes.

2.4.1.2(g) Hubert St. Onge

The father of the concept of customer capital, St. Onge developed methods to translate learning into both human and structural capital. He explored the relationship between human and structural capital and the firm's financial capital. He determined that in order to be commercially successful in the long term, the first two capitals must focus on customer-related interests. He developed a model that shows that long-term profits are created at the confluence between human, structural and customer capital.

2.4.1.2(h) Leif Edvinsson

Edvinsson was responsible for creating ways to describe what Skandia called "the hidden values" and developed intellectual capital management models for the firm. Edvinsson built upon the concept pioneered by Sveiby of reporting on external capital. In his book "Intellectual Capital" (1997), he explains the workings of intellectual capital measurement and its usefulness to the modern corporation.

2.4.1.2(i) Patrick Sullivan

The focus of Sullivan's work "Profiting from Intellectual Capital" (1998) has been the extraction of value from intellectual capital. Sullivan encouraged companies and individuals to share information and to jointly develop decision processes, methods, and systems that produce practical results.

2.4.1.2(j) Gordon Petrash

Petrash created an intellectual asset management function to identify innovations or ideas that might have been overlooked by the corporation and bring them to commercialisation. Petrash developed an Intellectual Asset Vision and Implementation Model, including approaches to enable the company to maximise the value of its existing portfolio of intellectual assets.

2.4.1.2(k) Baruch Lev

Lev's work focuses on quantifying the value of intangibles and correlating those values with financial measures observable in the capital markets.

2.4.2 History of intellectual capital management and measurement in selected areas

2.4.2.1 Malaysia

Malaysian researchers argue that, in their business world, knowledge is a necessity and can be used a strategic tool against competitors (Bontis, Keow, and Richardson, 2000). The number of knowledge workers and new knowledge-based opportunities is expected to increase dramatically in the next few years. This new demand will force employers to further develop employees' competencies. In Malaysia the production based economy of the 1970s and 1980s led to a focus on computing activities that forced employers to update the skills of the workforce in that context. The current emphasis on knowledge-based economies has prompted the move towards a new skills development initiative that strives to position Malaysia as a world leader in telecommunications.

Intellectual capital research began in Malaysia in 2000. The research completed to date has dealt only with perceptions of intellectual capital. No research has been conducted in respect of the measurement of intellectual capital. The main conclusions from research conducted so far in Malaysia (Bontis, Keow, and Richardson, 2000) was that human capital is important regardless of the type of industry, and that structural capital has a positive relationship with business performance regardless of industry.

The results from the research programme in Malaysia should be beneficial to both academics and practitioners. This first phase of the research programme has shown that in Malaysia, intellectual capital has a significant and substantive relationship with business performance regardless of industry sector.

2.4.2.2 Asia and the Middle East

Managers of firms operating in Asia and the Middle East are interested in knowledge management and intellectual capital measuring and reporting. Managers surveyed in these continents declared that they were not working on these issues currently but they hoped to do so in the near future (Pablos, 2002).

2.4.2.3 Australia

In Australia the transformation from the Industrial Age to the Information Age has been more pronounced than in most other countries (Guthrie and Petty, 2000). Australia's economy has traditionally rested on the commodity and resource sectors; manufacturing was never a huge part of the Australian economy. Tourism and education became dominant sectors in the late 1990s and Australia embraced a vision of becoming a high technology society by pouring large sums of money into the fields of bio-technology, financial services, insurance products, software development and training and development. By the end of 1998, only two of Australia's largest ten companies were resourced based and the remaining eight were characterised by the preponderance of intellectual capital (Guthrie and Petty, 2000). Consequently, the management and measurement of intellectual capital in Australia became a topic of relevance.

Empirical research conducted by Guthrie and Petty (2000) on Australian companies indicated that there appears to be a lot of empty rhetoric surrounding the notion of managing and measuring of intellectual capital. The most significant finding was that, in nearly every instance of reporting involved, the intellectual capital attribute was expressed in discursive rather than numerical terms. Companies in Australia are more concerned with simply understanding intellectual capital than in assigning a monetary value to such an item.

2.4.2.4 Sweden

Skandia AFS, a Swedish insurance and financial service company was the first company in the world to report on intellectual capital as part of its financial statements (Partanen, 1998). Most authors agree that Skandia's considerable effort to quantify a company's intellectual capital has emboldened others to look beyond the traditional assumptions of what creates value for organisations (Bontis, 2001).

2.4.2.5 North America

The major portion of the empirical research in respect of the management and measurement of intellectual capital has taken place in the United States of America (USA) and Canada. These two countries are prime examples of developed nations. Research done in these two countries clearly indicates that intellectual capital is a decisive business resource and is significantly a major predictor of company performance (Huselid, 1995; Bontis, 1998; Reed, 1999; Miller, 1999, Low, 2000; Walker, 2001; Riahi-Belkaoui, 2003).

In 1999, knowledge was the USA's most valuable export [the country took in $37 billion in licensing fees and royalties versus $29 billion in tangible assets (Stewart, 2001)]. According to the USA Commerce department, by 2006 almost half the USA's workforce are employed by industries that are either major producers or intensive users of information technology products and services (Stewart, 2001).

2.4.2.6 Croatia

"A few years ago the average Croatian manager just did not bother to learn about intangibles or how to manage or measure them. It was a real challenge to fight and change this attitude. The Chamber of Economy was the first institution to anticipate the need for the business community to learn about knowledge and intellectual capital management and to take action" (Pulic, 2003, p.3). The Intellectual Capital Association was formed within the Chamber of Economy to provide a platform for intellectual capital related activities.

The Association visited all 20 counties within Croatia during 2002 and measured the intellectual capital performance of companies within each county from 1997 to 2001. The analysis covered 56,987 companies, based on the data published in their annual reports (Pulic, 2003. p.6). The performance of intellectual capital reveals slow growth and low levels of intellectual capital performance.

These low levels of growth and performance are directly related to the company managers and executive staff being unaware of the benefits to managing, measuring, and reporting intellectual capital. "To-day (2003) due to professional and social efforts, many Croatian businesspersons comprehend intellectual capital management and measurement and it is not a "whether" but a "how" question and have started initiatives to manage intellectual capital in their own companies" (Pulic, 2003, p.3).

2.5 Development of intellectual capital management and measurement

2.5.1 Definition of intellectual capital

The term intellectual capital is frequently used in an all-encompassing fashion with the risk that in time the identity of the construct will become unclear (Petty and Guthrie, 2000). It is therefore essential that, for the purposes of this research study, intellectual capital be described in a practical and operative way. Accordingly, intellectual capital can be characterised as the economic value of two categories of intangible assets of a company (Organisation for Economic Co-operation and Development (OECD), 1999) namely:

1. Organisational (Structural) capital; and
2. Human Capital

Structural capital refers to (OECD, 1999; Pulic, 1999; Stewart, 1997; Sveiby, 1999):

- Proprietary software;
- Distribution networks; and
- Supply Chains.

Human capital includes human resources within an organisation (staff resources) and resources external to the organisation, namely customers and suppliers (Luthy, 1998, Kaplan, 1996, Edvinsson, 1997). Often the term intellectual capital is treated as synonymous with intangible assets (Guthrie, 2001). The definition offered by the OECD, however, makes an appropriate distinction by locating intellectual capital as a subset rather than the same as the overall intangible asset base of a business (OECD, 1999).

However, most experts seem to agree that an organisation's intellectual capital is best described in terms of three main components (Bontis, 1999):

- Human capital: the collective knowledge, education, skills and experiences of a company's employees;
- Structural capital: the collective (often proprietary) routines systems, processes and information within an organisation (including its culture) that help / hinder employees in their pursuit of organisational performance excellence; and
- Relationship capital: the value of relationships with those stakeholders external to the organisation, such as customers, suppliers and regulatory agencies.

Human capital can be defined in more detail as the knowledge, skills and competencies, and other attributes embodied in individuals or groups of individuals acquired during their life and used to produce goods, services or ideas in market circumstances (Westphalen, 1999).

For the purposes of this research study, it is critical to distinguish between the terms knowledge management and intellectual capital. According to Petty and Guthrie (2000), knowledge management is about the management of the intellectual capital controlled by a company. Knowledge management as a function describes the act of managing the object intellectual capital (Guthrie, 2001).

2.5.2 Classification of intellectual capital

Various models are used to direct the classification of intellectual capital controlled by the company. Most versions, however, classify intellectual capital according to three categories of intangible assets – human capital, structural capital, and customer capital. Examples of these models include the intangible asset monitor (Sveiby, 1997), the balanced scorecard (Kaplan, 1996), and the Skandia Value Scheme (Edvinsson, 1997).

Sveiby's model (1998b) offers employee competence, internal structure and external structure. Kaplan and Norton's (Kaplan, 1996) model presents innovation and learning perspective, internal business perspective and customer perspective. Edvinsson and Malone's (Edvinsson, 1997) main distinction is between human capital and structural capital (which can be divided into organisational capital and customer capital). Stewart (1997) identifies human capital, structural capital and customer capital. The Danish Agency for Development of Trade and Industry (Aniwattananpong, 2000) publish the studies of intellectual capital accounts developed in co-operation with several companies. These studies describe intellectual capital accounts in four categories: human resources, customers, processes, and technology.

Insert Table 2

Classification of intellectual capital

2.5.3 Measuring intellectual capital

2.5.3.1 Introduction

There is considerable debate within the literature regarding the measurement of intellectual capital performance. Due to various conceptual, epistemological and theoretical differences, there is yet no fully accepted measure of intellectual capital performance

There are two general methods for measuring intellectual capital. The first method is to do a component-by-component evaluation. This involves using units of measure appropriate for each component. For example, market share, the value of patents, and the number of work related competencies each have unique units of measure. In addition, different measures have different relevance and usefulness at different levels in an organisation. For example, quantity measures are usually more relevant at the work unit level, and financial measures are usually more relevant at the organisational level. To be effective, all of these measures, what ever the unit of measure or wherever used in an organisation, they must be aligned so they reflect a common understanding of purpose and direction when looking at the organisation as a whole.

The second method is to measure the value of intellectual assets in financial terms at the organisation level without reference to individual components of intellectual capital. Shareholder value is a key indicator in today's economy of how effectively managers employ intellectual capital. Therefore, measures expressed in financial terms that take into account the synergistic effect of intellectual assets at the organisation level, provide a key measure of progress and value.

2.5.3.2 Component-by-Component Measurement

As stated previously, there are three ways to define and classify the components of intellectual capital (Human, Structural, and Relationship Capital). These classifications form the basis for the component-by-component approach.

In this approach, a number of different and unique measures are established to value each component of intellectual capital. For example, indicators of the value of human capital may be represented by some measures such as: the reputation of a company's employees, employee satisfaction, and value added by employees. Relationship capital may be measured by growth in business volume, customer complaints, and brand loyalty. The value of each component is then summed to give a representation of the total value of intellectual capital. To truly to be effective, all measures applied under the component-by-component approach must be aligned so they reflect a common purpose and direction when looking at the organisational as a whole.

Advantages of the component-by-component approach is that it can create a more comprehensive picture of an organisation's health than financial metrics and it can be applied at any level of an organisation. The component-by-component approach measures closer to events and reporting, and, therefore, is faster and more accurate than purely financial measures.

Difficulties in aligning various component measures, however, led to criticism of the component-by-component approach to measuring intellectual capital. Another limitation of the component-by-component approach is that measures have usually been designed to fit the characteristics of one single company or industry. The generalisability of such measures, therefore, is in question. Finally, the component-by-component approach is considered cumbersome and incomprehensible to the average user due the large number of measures utilised in valuing the respective components of intellectual capital.

There are two types of measures used in the component-by-component approach. First, measures known as the Direct Intellectual Capital methods (DIC) and, second, measures known as the Scorecard methods (SC).

The DIC approach estimates the monetary value of intangible assets by identifying its various components. Once these components are identified, they can be directly measured, either individually or as an aggregated co-efficient. The SC approach identifies the various components of intangible assets or intellectual capital and indicators, and indices are generated and reported on scorecards or graphs. SC methods are similar to DIC methods, with the exception that no estimate is made for the monetary value of the intangible assets.

Insert Table 3

Examples of the Component-by-Component Approach

The above categories are an extension of the classifications suggested by Luthy (1998), Mitchell Williams (2000), and Sveiby (2002).

2.5.3 Organisational Level/Financial Basis Measurement

Such measures establish a perceived value of intellectual capital by benchmarking it against a known value of a company such as its shareholders equity. Measures comprising the first category have usually been criticised for their continued relationship and reference to a company's physical capital.

There are two types of measures used in the above approach. First, measures known as the Market Capitalisation methods (MCM) and second, measures known as the Return on Assets methods (ROA).

MCM methods calculate the difference between a company's market capitalisation and its stockholder's equity as the value of its intellectual capital or intangible assets. ROA methods use average pre-tax earnings of a company for a period of time divided by the average tangible assets of the company. The result is a company ROA that is then compared with its industry average. The difference is then multiplied by the company's average tangible assets to calculate average annual earnings from intangibles. Dividing the above-average earnings by the company's average cost of capital, one can derive an estimate of the value its intangible assets or intellectual capital.

MCM and ROA methods are useful in merger and acquisition situations and for stock market valuations. They can also be used for comparisons between companies within the same industry and they are good for illustrating the financial value of intangible assets.

Insert Table 4

Examples of the Organisational Level/Financial Basis Approach

No one method can fulfil all purposes; a method must be selected depending on purpose, situation and audience (Sveiby, 2001; Bontis, Dragonetti, Jacobson, Roos, 1999).

2.5.4 Additional criticisms of intellectual capital measuring models

The literature predominantly suggests intellectual capital measurement models that group input factors into categories (i.e. DIC, SC, MCM, and ROA). In almost all of these models there are interdependencies between variables, and they are depicted through the use of arrow diagrams in their visual presentation. They are not specified other than by ambiguous verbal description.

The most common suggestions for indicators of intellectual capital are:

- Research and development expenditures
- Human resource development
- Information processing and communication infrastructure
- Customer focus
- Patents and trademarks
- Discounted cash flows
- Stock market values
- Excess of normalised earnings over expected earnings attributable to book assets

Intellectual capital measurement models that use input related indicators are based on "fashion" development by management. These measurement models exist until an inconsistency arises in respect of these input related measurement models. For example: (1) human resource development during the 1970s and 1980s. A large amount of money was spent on training, but human resource managers were usually unable to prove that training contributed to the bottom line. (2) During the 1980s and early 1990s there was a lack of correlation between information technology expenditures and company performance.

Management "fashion" is created by the new packaging of common sense truth, popularised in books, referring to a handful of success stories (in respect of intellectual capital measurement). The ''fashion" is grown out of the narrow recommendations that follow the publication of these success stories.

The literature is full of these examples: culture, quality, re-engineering, speed and innovation have been offered as the core "fashions". The life cycle of these "fashions" has become shorter and shorter. These "fashions" are presented as high levels of abstraction, and can almost never be falsified; it is the failure of implementation that is blamed for disappointing results.

The intellectual capital community is at a crucial stage in the development of intellectual capital as a discipline. The acceptance of intellectual capital as a decisive business resource must be based on facts, not on "fashions". Part of these inconsistencies may be due to the lack of measurement models for intangible assets.

2.5.5 Importance of intellectual capital

The importance of intellectual capital and its management to the organisation is not really a new phenomenon (Smith, 2000). Awareness of its value has grown substantially in recent years. Over the last decade, there has been growing recognition that these types of assets have become the most valuable and fastest growing part of our economy (Brinker, 1998). Whereas in 1982, tangible assets represented 62% of a company's market value, by 1992 this figure had dropped to 38% (Dzinkowski, 2000). Surveys of top US and Canadian companies support this statistic (Smith, 2000). One showed that between 50% and 90% of the value of the company creates comes not from management of traditional assets, but from the management of intellectual capital (Cahill, 2000). Today it is clear that intellectual assets and their effective management, in fact, may be the only form of sustainable competitive advantage (Aniwattananpong, 2000).

2.5.5 Statutory implications of intellectual capital measurement

The measurement and reporting of intellectual capital in published financial statements is at present voluntary.

The financial statements published by companies for use by external users are governed by a set of conventions, rules and guidelines, referred to as generally accepted accounting practice (GAAP). The process of developing statements of GAAP involves the issue of an exposure draft and, later, a statement on the topic.

The aim of this process is to eliminate undesirable practices and to limit the number of allowed alternatives. This is done in order to make the reported information comparable. In an effort to standardise them, annual reports are also governed by statutory requirements, such as Company's Act requirements.

The comparability requirement is found in the South African Accounting Framework AC 000 (SAICA, 1990), which was taken from the International Accounting Standards Board Framework – (IAS 1). It is also a requirement of the USA Accounting Framework – (FASB, 1980). This requirement determines that users should be able to compare the annual reports of an enterprise over time with different enterprises. The aim is to identify trends over time and to evaluate the relative performance of the enterprise. Hence, the measurement and display of the financial effect of like transactions and other events must be carried out in a consistent way throughout the enterprise and over time for that enterprise, and in a consistent way for different enterprises (SAICA, 1990, par. 39).

The consistency in the treatment of like items is normally brought about by statutory requirements. In the absence of such requirements, the reporting entity usually reports the results in the way that is most beneficial to it, without regard to comparability and consistency. In order to achieve comparability, the development of financial statements therefore generally results in statutory requirements or accounting standards that govern presentation.

The lack of statutory requirements for the measurement and reporting of intellectual capital has the potential to lead to inconsistencies in the treatment of similar items. This can result in the loss of comparability that could, in turn, seriously impact on the usefulness of managing, measuring and reporting of intellectual capital.

When considering why no statutory requirements for the measurement and reporting of intellectual capital exist, the following issues emerge from the literature:

It is recognised that intellectual capital of a company plays a significant role in creating competitive advantage and thus managers and other stakeholders in organisations are asking, with increasing frequency, that its value be measured and reported for planning, control, reporting and evaluation purposes.

However at this point there is still a great deal of room for experimentation in quantifying and reporting on the intellectual capital of a company. Given the potential for both complexity and diversity, developing intellectual capital measures and reporting practices that are comparable between firms remains one of the key challenges for the accounting profession. The international accounting bodies represented by the International Federation of Accountants and the International Accounting Standards Board, and the United States Financial Accounting Standards Board have begun to examine the role of the accounting profession in measuring and reporting the intellectual capital of the company. These standard setting bodies support the growing effort to understand the complexities of intellectual capital measurement and reporting, yet recognise there is a long way to go for generally accepted accounting practices to evolve.

The empirical research that forms the central part of this study assists in the understanding of the importance of intellectual capital, and suggests a method for measuring intellectual capital that captures company value in a precise manner. This will provide the necessary catalyst to enable the accounting profession to address some of the major issues surrounding the measurement and reporting of intellectual capital.

2.6 Conceptual framework

2.6.1 Resource-Based Theory of the Firm

This research is largely based on Barney's (1991) model. Barney (1991) argued that sustained competitive advantage is derived from the resources and capabilities a company controls that are valuable, rare, imperfectly imitable, and not substitutable. These resources and capabilities can be viewed as bundles of tangible and intangible assets, including a company's management skills, its organisational processes and routines and the information and knowledge it controls, i.e. it's intellectual capital.

This view is known as the resourced-based theory of the firm. The resource-based theory of the firm is a strategic management theory that seeks to identify the resources that may provide companies with a sustainable competitive advantage. According to Barney's Model (1991), firm resources can be classified into three categories: Physical Capital Resources, Human Capital Resources, and Structural Capital Resources. Physical Capital resources include the physical technology used in a firm, a firm's plant and equipment, its geographic location, and its access to raw materials.

Human Capital Resources include the training, experience, judgment, intelligence, relationships, and insight of individual managers and workers in a firm. Structural Capital Resources include a firm's formal reporting structure, its formal and informal planning, controlling and co-ordinating systems, as well as informal relations among groups within a firm and between a firm and those in its environment.

While the role of physical assets is well established in the literature and in practice, it is the role of intangible assets as strategic resources that needs and deserves investigation (Riahi-Belkaoui, 2003).

2.6.2 Resource-Based Theory of the Firm and intellectual capital

Sveiby (1997) brings two important concepts and observations to the literature that gives the author reasons for exploring Barney's conceptual model (Barney, 1991). The first, as previously discussed, is that 50% of the fastest growing companies in the United States can be described as knowledge-based and second, the business services sector in the USA now equals the manufacturing sector in terms of share of total employment (Sveiby, 1997). Boulton, Libert and Samek (2000), while consulting for Arthur Andersen, reconfirmed Sveiby's 1997 observations and Barney's theoretical framework.

Boulton, Libert and Samek (2000) found that companies that concentrated on using human capital (the major component of intellectual capital) as a source of value creation appeared to be industry leaders and more profitable than their competitors.

The qualification of intellectual capital as a strategic asset rests on the potential link between intellectual capital on the one hand, and company performance on the other. Accordingly, this study tests two important aspects: whether intellectual capital is a decisive strategic business resource, and whether there is a significant and substantive relationship between intellectual capital and company performance for a sample of South African listed companies.

2.7 Summary

An analysis of the nature and history of intellectual capital has indicated that it is perceived as a resource that can be used to create competitive advantage, which can be translated into positive company performance. As the measurement and reporting of intellectual capital performance is voluntary, it is probable that it is used as and when management wants to convey a certain message to the users.

An investigation into the development of intellectual capital indicated that the statutory requirements have not developed, and the resultant inconsistencies found in the measurement of intellectual capital might affect the usefulness of intellectual capital to the users. In Chapter 3, research published around the world on the usefulness of intellectual capital is therefore reviewed as evidence of usefulness.

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CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

It is an interesting time to be active in the field of research into intellectual capital (Petty and Guthrie, 2000). The community of intellectual capital researchers and practitioners is at an important juncture. The battle for acceptance of intellectual capital as a topic worthy of boardroom discussion and serious academic investigation has largely been won (Petty and Guthrie, 2000). The proliferation of conferences on intellectual capital, the myriad of books, working papers, and journal articles that grapple with the topic, and the large number of consulting firms offering products and services centered around intellectual capital, are testament to this (Petty and Guthrie, 2000). However, much of the work to date belongs to the first stage of development of a framework of intellectual capital. First stage efforts have typically focused on consciousness raising activities that strive to communicate the importance of recognising and understanding the potential for intellectual capital in creating and managing sustainable competitive advantage. The aim of stage one was to render the invisible visible by creating a discourse that all could engage in (Petty and Guthrie, 2000).

A great deal of stage one is purely descriptive of what was happening in various organisations. Publications falling under the first stage tended to take the position that intellectual capital is something significant and should be measured and reported, based on subjective beliefs and perceptions.

The research challenge now is to consolidate the second stage of development, one that establishes research into intellectual capital as a legitimate undertaking and gathers robust evidence in support of its further development and usefulness (Petty and Guthrie, 2000).

The second stage of development of intellectual capital as a discipline has seen researchers begin to investigate ideas relating to the influence of intellectual capital on company performance. Second stage research is in its infancy and there are countless opportunities to explore hypotheses already developed (Petty and Guthrie, 2000).

The second stage of development involves understanding what must be measured, and the ability to express this in numbers, to quantify it. A concept (intellectual capital) identified, yet not expressed in numbers, cannot be said to be understood. There may be the beginnings of knowledge, but scarcely advanced to the state of science.

The aim of this chapter is to identify empirical studies – the second stage of development – on intellectual capital management and measurement and its contribution to company performance. The emphasis of this review of the literature is on the significant empirical contributions relating intellectual capital management and measurement and its contribution to company performance.

This review of the existing literature assists in determining the usefulness of intellectual capital management and measurement, in order to ascertain whether the literature contains sufficient evidence of usefulness from the perspective of users of accounting information and to evaluate such evidence. Usefulness is evidenced when results show that:

- Intellectual capital is a decisive resource in obtaining and maintaining competitive advantage; and
- Intellectual capital has a significant and substantive relationship with company performance.

3.2 Selection of The literature

In line with the aim of this review of existing literature, a detailed analysis is provided of the significant empirical research into intellectual capital – focusing on the second stage of development. The empirical research is divided into two components:

- Research determining whether intellectual capital is a decisive business resource. The following empirical studies have been identified in this context:

- Pulic (1998); and
- Firer and Saunders (2003).

- Research linking the performance of a company's intellectual capital to company performance. The following empirical studies have been identified in this context:

- Huselid (1995);
- Youndt and Snell (1996);
- Bontis (1998);
- Miller (1999);
- Van Buren (1999);
- Bontis (2000);
- Low (2000);
- Reed (2000);
- Ballot, Fakhfakh, and Taymaz (2001);
- Walker (2001);
- Hurwitz, Lines, Montgomery, and Schmidt (2002);
- Riahi-Belkaoui (2003); and
- Firer and Williams (2003).

A discussion of these empirical studies follows:

3.3 Discussion of research studies

According to Cooper and Schindler (2000), the term "empirical" points to the requirement for the researcher to test subjective beliefs against objective reality. In the case of intellectual capital management and measurement and its contribution to company performance, the subjective beliefs as determined by the discussion on the historical perspective (Chapter 2) are that intellectual capital is a business resource that can lead to – if managed and measured correctly – sustainable competitive advantage. If a company enjoys sustainable competitive advantage within a market, this in turn will have a positive effect on company performance. The objective reality will be in the determination of whether intellectual capital actually has a positive effect on company performance. The comparison of subjective beliefs and objective reality is carried out using hypothesis testing. The hypotheses being: intellectual capital is the decisive business resource within a country's economy, and intellectual capital is positively associated with company performance.

Methods of measurement and assessment of intellectual capital performance have been slow to develop (Staples, 2000). Consequently, there is an extremely limited amount of literature on the measurement of intellectual capital, notably in the explanatory relationship between intellectual capital performance and overall business performance (Walker, 2001). As a result managers of organisations do not realise the importance of managing, measuring and developing their organisation's intellectual capital (Reed, 2000). The way to resolve this problem is to legitimise the construct of intellectual capital and to persuade managers, shareholders and other users of financial information that intellectual capital is a dominant factor that contributes positively to company performance. For all stakeholders to be convinced as to the validity of intellectual capital as an instrument that management can employ to procure sustainable competitive advantage, researchers need to furnish empirical evidence that intellectual capital is a decisive business resource and that intellectual capital performance contributes to business performance.

3.3.1 Research determining whether intellectual capital is a decisive business resource

The research in this section endeavours to view intellectual capital or its components as the definitive business resource within a company, business sector, or a nation's economy.

3.3.1.1 Pulic (1998)

Pulic analysed the relationship between the ability of a company to produce economic value (value added) and the resources that are necessary to create value (physical capital and human capital) in the Croatian and Austrian economies.

Pulic argues that it is the management and development of intellectual capital that gives developed economies a competitive edge over emerging economies. Pulic, in this study on intellectual capital in the Austrian and Croatian economies, concludes that human capital is the determinant for value creation and not physical capital. The correlation between value added and human capital is high in both these countries, while the correlation between value added and physical capital is low. According to Pulic, this is an indication of a developed economy, which can be said to be knowledge-based.

3.3.1.2 Firer and Saunders (2002)

This study was carried out as a preliminary analysis to this doctoral research study. Firer and Saunders analysed the relationship between the ability of a company to produce economic value (value added) and the resources that are necessary to create value (physical capital and human capital) in the South African economy. A sample of one hundred firms listed on the JSE Securities Exchange was surveyed for the study. The following sectors were chosen: banking, financial services, insurance, information technology, media, transport and electronics. The study used a recently proposed measure, the Value Added Intellectual Co-efficient (VAIC™), developed by the Austrian Center for Intellectual Capital to measure resource performance. The findings of the study suggest human capital of company is significant in the ability of a company to produce wealth.

3.3.1.3 Summary

Both these studies have found that human capital is a decisive business resource within their respective economies. Human capital creates new ideas and relationships, perpetuates past ideas and relationships, and refines and develops existing products, services, and ideas (Walker, 2001).

Human capital is what develops and sustains an organisation's unique competitive advantage, which in turn will result in better company performance. Human capital is perhaps the most important element of intellectual capital because people are primarily responsible for the company's structural and customer capital. It is for these reasons there is a need to investigate empirically whether human capital is positively associated with company performance.

3.3.2 Research linking the performance of a company's intellectual capital to company performance

The research in this section views intellectual capital or its components as the main driver behind competitiveness and firm performance.

The discussion of each study consists of three parts:

- Objectives;
- Method; and
- Discussion and Conclusions.

3.3.2.1 Huselid (1995)

Objectives

This study comprehensively evaluated the links between systems of High Performance Work Practices and firm performance.

Method

Firm data on High Performance Work Practices were collected from a questionnaire mailed to senior human resources professionals in each firm. The data collected represented the measure for the major explanatory independent variable: High Performance Work Practices. The dependent variables were represented by turnover (average annual), productivity (sales per employee), Tobin's q, and gross rate of return on capital.

The control variables consisted of firm size, capital intensity, growth in sales, research and development, firm-specific risk, industry levels of profitability, net sales to total assets, and 34 dummy variables representing 35 industries.

Discussion and conclusions

Results based on a national sample (USA) of 1 000 firms indicate that these practices have an economically and statistically significant impact on both turnover, productivity and financial performance.

3.3.2.2 Youndt and Snell (1996)

Objectives

This study examines the relationship between human resource management, manufacturing strategy and firm performance.

Method

The sample chosen was taken from a pool of 512 manufacturing plants in Pennsylvania (USA). Data was collected by means of a survey instrument in the form of a questionnaire. Plants rather than entire firms were the units of analysis, because manufacturers frequently have several different production facilities.

Discussion and conclusions

Human resource systems were directly related to multiple dimensions of operational performance (productivity, efficiency, and customer alignment).

3.3.2.3 Bontis (1998)

Objectives

This paper details an empirical pilot study that explores the development of several conceptual measures and models regarding intellectual capital and its impact on business performance. Specifically, the objectives of this study were to determine which items capture the constructs of human capital, structural capital, customer capital and business performance.

Method

A survey was designed that taps into the intellectual capital constructs (human capital, structural capital, and customer capital) as well as business performance. A questionnaire was administered to one section of MBA students at the Ivey School of Business in the University of Western Ontario. The questionnaire was designed in an easy to read booklet format with a total of 80 pages. Sixty four students filled out the questionnaire. In designing the questionnaire, a 7 point Likert scale for each item (question) was used. The results were coded in SPSS for Windows.

Discussion and conclusions

The analysis revealed a valid, reliable, significant and substantive causal link between the dimensions of intellectual capital and business performance. The specific results indicate there must exist a constant interplay among human, structural and customer capital in order for an organisation to leverage its knowledge base. This must be done in order for intellectual capital to have a maximum impact on business performance.

3.3.2.4 Miller (1999)

Objectives

A research project was undertaken by four diverse Canadian companies to explore the issues surrounding the measuring and reporting of intellectual capital. The study examined the perceptions of managers as to the usefulness and potential use for intellectual capital indicators, barriers to their development and application, opportunities for reporting internally and externally and comparability of indicators across companies.

Method

A large sample (226 managers) was surveyed by means of a questionnaire.

Discussion and conclusions

Overall, the managers of the four companies placed a heavy emphasis on the usefulness of human capital indicators regardless of their industry type or degree of capital intensity. It would appear from these findings that managers in all four companies have the greatest amount of consensus with respect to using and seeing as useful human and customer capital indicators over structural capital indicators. While arguably people are a company's most important asset, the findings suggest that the interaction between human, structural and customer capital cannot be ignored.

These findings point to the need for companies to adopt a more comprehensive approach to managing dynamically all three types of intellectual capital. All managers surveyed were concerned with managing their human capital and expressed that optimising human capital must be a conscious part of the business strategy of the company.

3.3.2.5 Van Buren (1999)

Objectives

The American Society for Training and Development (ASTD) developed a system for benchmarking a core set of intellectual capital indicators – the Intellectual Capital Management Model. This paper reported on ASTD's research behind the development of the intellectual capital model. ASTD embedded the core set of intellectual capital indicators as questions in a module. This module was known as the Measurement Kit, and served as the data collection instrument for ASTD's "Benchmarking Service".

Method

The core indicators were broken down into ratios that formed a proxy for the measurement of human capital, innovation capital, process capital and customer capital.

There were two methods for the collection of data. First, questionnaires (in the form of the ASTD measurement kit) and second, correlation and simple regression analysis to determine the relationships between variables.

Discussion and conclusions

The implications for establishing a measure for intellectual capital were immense. For the first time ever, comparable data has been reported by hundreds of firms on their intellectual capital investments. The core intellectual capital indicators permitted a level of benchmarking across organisations that was previously unavailable.

The statistical results from this aspect of the research study – although elementary – reflected an immense variation in intellectual capital investments across organisations. The analysis illustrated the ability of the core indicators to represent a concise yet comparable picture of a firm's stock of intellectual capital.

Van Buren's study was the first to link indicators of intellectual capital and company performance. The analysis pointed to some compelling links between investments in intellectual capital and firm performance. The study concluded that there is a possibility that investments in intellectual capital may influence a firm's prosperity, in terms of earnings profits, and stockholder value.

3.3.2.6 Low (2000)

Objectives

The purpose of this study was to identify the importance of non-financial intangibles and to quantify their role in corporate performance.

Method

The Cap Gemini Ernst and Young Center for Business Leadership conducted a series of studies on the role of intangibles in creating value in the modern corporation, and developed a rigorous, comprehensive model – the value creation index – of value creation for progressive companies that enables users to measure the impact of key intangible asset categories on a company's market value. By devising a set of standardised measures, weighted according to their relative impact, managers have the tools to drive and monitor more efficiently their company's future performance.

Discussion and conclusions

The findings suggest that improvements in the critical intangible categories resulted in increased market value. Of the nine factors making the value creation index, innovation as measured by research and development expenditures, number of patents and the importance of patents – items that are included in the definition of intellectual capital – had the greatest impact on market value. Management quality and employee relations followed closely behind, validating the corporate platitude that people are the most important asset.

3.3.2.7 Bontis (2000)

Objectives

The purpose of this empirical study is to investigate the three elements of intellectual capital, i.e. human capital, structural capital, and customer capital, and their inter-relationships within two industry sectors (service and non-service) in Malaysia.

Method

The study was conducted using a psychometrically validated questionnaire, which was originally administered in Canada. Based on the final specified model developed by Bontis (1998), the following hypotheses were tested:

- Human capital is positively associated with customer capital;
- Human capital is positively associated with structural capital;
- Customer capital is positively associated with structural capital; and
- Structural capital is positively associated with business performance.

Data was collected from 107 respondents in Malaysia. The respondents were all part-time MBA students from Kuala Lumpur and Seremban.

Discussion and conclusions

The main conclusions from this particular study are: that human capital has a greater influence on how a business should be structured in non-service industries compared to service industries; that customer capital has a significant influence over structural capital irrespective of industry; and finally, that the development of structural capital has a positive relationship with business performance regardless of industry.

3.3.2.8 Reed (2000)

Objectives

This research study tested the association between intellectual capital and firm performance.

Method

The sample chosen was taken from the overall banking population in the New England area of the United States of America. Data was collected by means of a survey instrument in the form of a questionnaire. The survey instrument was designed to capture each component of intellectual capital and firm performance.

Discussion and conclusions

The results suggest that intellectual capital is a strong predictor of firm performance.

3.3.2.9 Ballot, Fakhfakh, and Taymaz (2001)

Objectives

This paper studies the effect of human and technological capital on productivity in a sample of large French and Swedish firms.

Method

The study uses data from two panels of large French and Swedish firms for the period 1987 to 1993. It constructs measures of a firm's human capital stock based on their past and present training expenditures.

Discussion and conclusions

Three tentative results are derived from this study. First, both types of intangible assets, research and development and training stocks, appear as significant inputs in the production function, but one factor seems to be more influential that the other in each country, and it is not the same one. Second, some interaction effects between research and development and training stocks indicate an interesting complementarity, but the results are not robust. Third, no growth effects were found.

The results indicate that there are high rates of return in terms of productivity, which results in high rates of return in terms of profit. This reflects that human and technological capital are significantly and substantially associated with profitability.

3.3.2.10 Walker (2001)

Objectives

This study empirically investigates the relationship between a firm's human capital and performance.

Method

Firm performance was examined in four dimensions: productivity, profitability, market valuation, and market premium. The major independent variable of the analysis is the value of human capital. Human capital was defined as salaries and wages per employee. The control variables consisted of industry type and physical capital intensity.

Data is collected from 1998 fiscal year annual reports from the Compustat database.

Linear multiple regression analysis was performed based on the following general model:

Dependent Variable (ROA, ATO or MB)i = ai + χiIT + χiiCI + χiiiHC

Where:

ROA: Return on Assets
ATO: Asset Turnover Ratio
MB: Maket to Book Ratio
IT: Industry Type Dummy Variable
CI: Physical Capital Intensity Ratio (Fixed Assets divided by Total assets)
HC: Human Capital Performance (Salaries and Wages divided by Number of Employees)

Discussion and Conclusions

The analysis of the data did not support a positive relationship between the value of human capital and firm performance for the measurements of productivity, profitability, or market evaluation.

3.3.2.11 Hurwitz, Lines, Montgomery, and Schmidt (2002)

Objectives

The objective of this research study was to examine the relationship of firm's management of human and organisational capital to the growth in their intangible performance and to stock price. The goal of the analysis was to determine whether selected variables that correspond to categories of human resource management have a positive correlation to increases in intangible performance.

Method

The dependent variables were represented by 15 objective functions, including intangibles performance divided by sales, intangible assets divided by sales, change in intangibles' performance (calculation based on Baruch Lev's methodology) divided by sales, earnings divided by sales, operating cash flow divided by sales, and stock returns.

The independent variables consisted of 136 variables, including data on compensation practices and levels, benefits offerings and valuations, training intensity and expenditures, training techniques and focus, work practices, and performance management systems. Time series spanning 1996 to 2000 were available for 124 of the independent variables; the remainder had single year data only.

Calculation was made of Pearson correlation coefficients with same year data and, where possible, with one and two year lags.

Regression analysis was used to test the relative (incremental) importance of potential human capital drivers with other intangible value streams. The sample size was 267 companies from publicly available data from 1996 to 1999. The dependent variable was represented by intangibles' performance divided by sales. The independent variables consisted of research and development divided by sales, capital expenditure divided by sales, selling, general and administrative expenditures divided by sales, and compensation.

Discussion and conclusions

The analysis revealed that numerous variables had moderate to high correlation coefficients with intangibles' performance divided by sales. In most instances, intangibles performance divided by sales correlated more strongly than any other of the objective functions. This result suggests that the management policies and programs measured can affect intangibles performance and thus stock returns. The major part of the value of this new measure of intangibles is its ability to determine which management policies are most effective.

A significant finding from the regression analysis revealed that companies emphasising long term compensation over cash bonuses enjoyed greater success in generating intangibles performance.

A major implication of this research is that a value stream based on intangibles performance is the most significant driver of stock returns. This was true regardless of the industry or a firm's strategy.

3.3.2.12 Riahi-Belkaoui (2003)

Objectives

This study examines the relationship between a return on total assets based on net value added (stakeholder view) and the specific intangible asset of intellectual capital to test the resource-based view of the firm. The firm in this study is defined as United States of America multinational firms.

Method

The dependent variable in this study is represented by financial performance. Financial performance is measured by the net value added over total assets (VATA). The major explanatory independent variable is represented by intellectual capital performance. Intellectual capital performance was measured on the basis that trademarks and/or patents have been previously used as surrogate measures of intellectual capital. The approach taken in this study was to compute the difference between a firm's total trademarks and the median number of trademarks for the sample of firms. The result is a relative measure of trademarks that control differences in the number of trademarks across the sample of firms, and indicates whether a firm has more or less trademarks than the median number in the sample. The control variables are those that are frequently used in the literature: financial performance (RVATA) (1987-1991), firm size and debt structure. A new type of control variable was added: multinationality. Data for VATA was collected from annual reports for the 1992-1996 period.

The regression models were divided into two parts. Model 1 tested the relationship between the dependent variable and the control variable. Model 2 tested the collective impact of the major explanatory variable and control variables.

Discussion and conclusions

The results of the regression analysis strongly supported both the resource based-view and stakeholder view. A test of the relationship between intellectual capital and financial performance using 81 multinational firms yielded positive and significant results. These results point to the usefulness of intangibles in general and intellectual capital in particular as a source of sustainable competitive advantage; and the relevance of net value added as a measure of wealth creation.

The study suggests that broader measures of financial performance should be used in future studies such as Return on Assets (ROA).

3.3.2.13 Firer and Mitchell Williams (2003)

Objectives

This study was carried out as a preliminary analysis to this doctoral research study. The primary objective of this study was to examine empirically the association between a developing measure of intellectual capital [namely, the Value Added Intellectual Coefficient™ developed by Ante Pulic (1998)] and traditional measures of corporate performance: (1) profitability, (2) productivity, and (3) market valuation.

Method

To conduct the relevant analysis in the present study three dependent variables – related to the dimensions of profitability, productivity, and market valuation – are formed. These are denoted as (1) ROA, (2) ATO and (3) MB. Profitability (ROA): ratio of the net income (less preference dividends) divided by book value of total; Productivity (ATO): ratio of total revenue to total book value of assets; and Market Valuation (MB): ratio of total market capitalisation (share price times number of outstanding common shares) to book value of net assets.

The Value Added Intellectual Coefficient™ (VAIC™) methodology developed by Ante Pulic (1998) forms the underlying measurement basis for the three major independent variables in the present study. VAIC™ is an analytical procedure designed to enable management, shareholders and other relevant stakeholders effectively to monitor and evaluate the efficiency of value added by a firm's total resources and each major resource component.

For purposes of empirical analysis this study used correlation and linear multiple regression as the underlying statistical tests. In conducting the linear multiple regression analysis four control variables (size of the firm, leverage, financial performance and industry type) are included.

Data was hand-collected from 2001 fiscal year annual reports of publicly traded firms listed on the Johannesburg Securities Exchange (JSE).

Linear multiple regression analysis was performed based on the following general model:

Dependent Variable (ROA, ATO or MB)i = ai + χi1VACAi + χi2VAHCi + χi 3SCVAi + χi 4LCAPi + χi 5Levi + χi 6ROEi + χi 7BANKi + χi 8ELECi + χi 9ITi + χi 10SERi + εI

Where:

ROA: Return on Assets
ATO: Asset Turnover Ratio
MB: Market to Book Ratio
VACA: See Equation 4 – 5.4.1.1
VAHC: See Equation 5 – 5.4.1.1
SCVA: See Equation 6 – 5.4.1.1
LCAP: Market Capitalisation (Firm Size)
LEV: Debt Equity Ratio (Risk)
ROE: Return on Equity (Profitability)
BANK: Dummy Variable for Banking Industry
ELEC: Dummy Variable for Electronics Industry
IT: Dummy Variable for Information Technology Industry
SER: Dummy Variable for Service Industry

Discussion and conclusions

The empirical findings based on correlation and linear multiple regression analysis indicated the association between the efficiency of value added by a firm's major resource components and the three traditional dimensions of corporate performance is limited and mixed.

In general, empirical findings suggest that despite efforts to improve its intellectual capital base, the business environment and market in South Africa still appears to place greater weight to company performance based on physical capital assets.

3.3.2.14 Summary

Two types of research methodologies were generally used: questionnaires and surveys of annual reports. Questionnaires were used in seven of the studies, three studies made use of financial information obtained directly from management financial reports and three studies made use of audited annual reports.

Nine studies suggested that intellectual capital is a company's most important asset and it contributes to company performance. The studies analysed suggest that there is no generally accepted theoretical model for understanding intellectual capital.

3.4 Factors limiting the evidence

3.4.1 Study by study basis

The methodology for measuring intellectual capital in the Van Buren (1999) study is complex for the average user due to the use of a large number of measures to value the respective components of intellectual capital. According to Van Buren (1999), the results did not prove anything definitive and therefore no singular conclusion could be made regarding intellectual capital as a predictor of company performance. A strong criticism against the data obtained for the Bontis (1998) study, was the appropriateness and representativeness of the respondents.

Some of the MBA's mentioned that they had forgotten or were not currently close enough to their organisation to respond accurately to some of the questions. Others thought they were not in high enough positions to respond thoughtfully (Bontis, 1998). This limitation of evidence applies to the study conducted by Bontis in 2000 where he used the same methodology as in 1998.

A major concern of Reed's (2000) study, is the sample industry that was chosen. Using the same industry represents a conservative test of the relationship between intellectual capital and performance. This concern also applies to the study conducted by Firer and Mitchell Williams (2003), where the sample chosen was from firms within business sectors reliant on intellectual capital. The major criticism of the study by Riahi-Belkaoui (2003) concerns the methodology adopted to measure intellectual capital. Intellectual property – such as patents and trademarks – forms only a subset of the entire intellectual assets base of a company, and cannot be used as complete measure of intellectual capital.

Walker's (2001) study fails to find a significant relationship between human capital and firm performance. This finding is contrary to widespread belief and other significant empirical studies conducted in developed economies. While these results may be correct, they could also be explained by the compensation per employee measure for human capital being a poor measure. As other measures of human capital are not examined, this alternative cannot be ruled out.

A limitation of the Huselid (1995), Youndt and Snell (1996), Ballot *et al* (2001), Walker (2001) and Hurwitz et al (2002) studies can be seen in their use of human capital as the major explanatory variable. Human capital forms only a subset of the entire intellectual assets base of a company, and cannot be used as a complete measure of intellectual capital.

3.4.2 Overall limitations

Intellectual capital can affect and be affected by the unique culture of the organisation and distinct processes and relationships within it. This propensity for complexity suggests that a rigorous approach to managing, measuring and reporting intellectual capital within a company would require a number of measures to evaluate the intellectual capital of a company.

This idea is confirmed in the study by Van Buren (1999), Miller (1999) and Low (2000). Van Buren (1999) identified 17 core intellectual capital indicators, Miller (1999) identified 36 core intellectual capital indicators and Low (2000) identified nine critical categories of intellectual capital performance. A major criticism of this approach is that it is considered to be cumbersome and incomprehensible for the average user owing to the use of a large number of measures for evaluating the respective components of intellectual capital.

In the analysis of the results of the studies examined for this review of the literature, three major factors limiting the general application of the results were identified:

1. Most of the studies were conducted in the USA and Canada. As stated previously, a major feature of this study is the focus on South Africa – the reason for not utilising data from developed western countries. Knowledge of the understanding and impact of intellectual capital in developing economies such as South Africa is, in contrast to these developed economies, still much in its infancy. Given the significance of emerging economies to the overall well-being and balance of the global economy, it is important to establish an understanding of the development of intellectual capital in different socio-political and economic settings.

To date, little work has been done to provide an understanding of where South African organisations are positioned in comparable world-wide terms when it comes to the management and measurement of intellectual capital. This literature review is primarily focused on filling this gap.

2. A number of studies used questionnaires as their methodology to collect data. There is a methodological problem that is related to the widespread collection of data via questionnaires. Because survey respondents generally self-select into samples, this selectivity or response bias affects results. The use of questionnaires addresses perceptions in respect of the performance of intellectual capital, while the relationship between financial values is not addressed. While the author agrees that perceptions play a vital role in the value of securities, eventually perceptions and potential will be forgotten if a company does not succeed financially, as dividends will only be paid to shareholders if a company is de facto profitable. This literature review is primarily focused on filling this gap, by using annual reports to collect financial data.

3. The method of calculation of the performance of intellectual capital in a company presents a problem. The various studies all used different measures to calculate intellectual capital. This casts doubt as to the comparability of the studies, in determining whether intellectual capital contributes to company performance.

Until now, research has generally not sought to investigate empirically the relationship between new proposed measures[1] of intellectual capital and established mainstream measures of company performance. Empirical research of such links is nevertheless important for various reasons. For example, the determination of any such associations better assists in the cognitive understanding of intellectual capital, its importance and measurability, and reduces uncertainty amongst stakeholders (such as users of financial information) about dealing conceptually and practically with intellectual capital. The empirical research that forms the central part of this study will, in addition, assist in the development of better accounting, finance and valuation models than those that are currently based on traditional business models and that usually ignore or have vague impressions of the relevant components of intellectual capital, and will better assist in the comparability of intellectual capital performance between companies.

This research study seeks to fill the above-mentioned gap in the literature dealing with the measurement of intellectual capital by providing empirical and practical evidence of the possible usefulness of a new measurement model for intellectual capital, to help predict the appropriate value of a company in an economy where physical capital has traditionally been the dominant resource.

The review of existing literature could not provide conclusive evidence that intellectual capital has a causal association with company performance. Therefore, this study seeks to provide additional evidence as to the usefulness of intellectual capital by examining the explanatory and predictive power of intellectual capital. The purpose of this is to determine whether intellectual capital can explain and predict company performance. The objective of this research study therefore is to provide evidence in support of the further development of intellectual capital, or to determine whether its management and measurement is a waste of company time and resources.

[1] New proposed measures of intellectual capital that are appropriate in Knowledge Economy.

3.5 Summary

From the factors inferred from the above literature review, it is possible to conclude that there is a need to examine the proposition that intellectual capital and knowledge management is an important strategy to companies in South Africa. Most first-world nations have experienced a shift in their source of gross domestic product away from the traditional commodities and manufacturing based sectors toward a broader concept of economic value creation that encompasses service items and intangible based output. The biggest challenge that is reflected in this literature review is the need to provide tangible empirical evidence that intellectual capital contributes to company performance. At present (as analysed in the factors limiting the evidence) this link has not yet been satisfactorily articulated and the lack of empirical evidence to this effect handicaps the further development of a standard acceptable measurement of intellectual capital.

Petty and Guthrie (2000, p.168) state “few studies have at this stage used a multi-method approach to data collection. The potential usefulness of multiple methods has long been recognised in the management accounting literature as a way of corroborating research findings”. The value of intellectual capital as a business resource has been tested primarily with the use of questionnaires. This has resulted in a great deal of evidence which was purely descriptive of what was happening in various organisations and economies. The objective of this study is to provide the necessary corroborating evidence as gained by previous studies (use of questionnaires) by surveying financial reports to determine whether the descriptive evidence that intellectual capital is a primary business resource can be converted into actual profitability.

It is acknowledged that a company has access to a variety of tools for the dissemination of information in respect of its performance in the market place (Mitchell Williams, 2001). There is, however, considerable support within the accounting literature for the analysis of company performance using annual reports. Gray, Kouhy, and Lavers (1995) argued for the importance of a company’s annual report, stating that statutory regulations require these reports to be produced on a regular basis, and they therefore provide a consistent historical picture of a company. Hines (1998) further argues that annual reports are probably the most important documents for constructing a company’s social image.

Tilt (1994) supports this view, suggesting companies can symbolically demonstrate values and views to the relevant public through this document. Campbell (2000) provided two further reasons to support the use of annual reports. First, annual reports are the most widely distributed of all publicly produced documents of a company, and, second, management has complete editorial control of the discretionary disclosure of information in the annual report. Tay and Parker (1990) argue that actual reporting practices may be assessed more accurately from annual reports. Sveiby (1997) supports this view by arguing that annual financial statements will always remain the centerpiece of corporate communication, and that its historical and symbolic value are unrivaled, despite the existence of other methods of conveying company data.

This research study has pointed out that the current accounting model and, as a result, the annual report, are unable to measure value creation in the knowledge economy. The question arises: how do traditional annual reports relate to the larger measurement of intellectual capital? Annual reports offer the best feedback of establishing whether or not intellectual capital is performing. If a certain intellectual capital index or indicator, such as customer satisfaction or employee morale, never makes itself felt in the income statement or balance sheet, then it actually measures nothing of value. As intellectual capital develops and its measures and forms become standardised, it will be the financial test that will play a crucial role in establishing those standards. This research study will add to the ongoing debate on the usefulness of intellectual capital by applying this financial test by measuring intellectual capital using annual reports.

This review of the literature has attempted to conduct an analysis of the second stage of the development of intellectual capital as a discipline. It is evident that there is an inadequate empirical data on whether intellectual capital actually contributes to company performance. To ensure that intellectual capital takes its rightful place as a legal asset (in terms of generally accepted accounting practice), the link between intellectual capital performance and business performance must be validated and replicated[2]. Petty and Guthrie (2000, p. 167) state: " at a market and regulatory level, widespread acceptance (and possible future mandatory reporting requirements) will likely be achieved only with the support of research evidence indicating the advantage and value of measuring, managing and reporting intellectual capital".

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[2] These thoughts were expressed by H. St Onge at the World Congress of Intellectual Capital in Canada, January 2003.

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CHAPTER 4

DEFINITION OF CONSTRUCTS AND RATIONALE FOR HYPOTHESES

4.1 Introduction

This chapter introduces and sets out the theoretical constructs and hypotheses that underlie this research study. A detailed definition and description of the constructs together with an explicit reasoning for the development of the hypotheses is posited.

4.2 Definition of constructs

4.2.1 Resource-based view of the firm

The resource-based view of the firm considers firm resources as the main driver behind competitiveness and firm performance. These resources include both tangible physical assets as well as intangible assets that have been internalised by the firm and used effectively and efficiently to implement specific competitive and profitable strategies.

4.2.2 Intangibles as strategic assets

Firms own resources that are necessary for the conduct of operations, and resources that are vital for competitive advantage and strong financial performance. The first type of assets, generally tangible, such as property, plant and equipment, is common place in the market, easily imitable, and substitutable, and can easily be purchased and sold on the open market. The second type of assets, are generally intangible, valuable, rare, mostly inimitable and non-substitutable, and are strategic assets capable of generating sustainable competitive advantage and superior financial performance (Barney, 1991).

The fundamental characteristics of intangible assets as strategic assets are their rarity, inimitability, and non-substitutability as well as their unobservability (Barney, 1991). While many types of intangible assets may qualify as strategic assets, the strict application of the above criteria reduces the number to few in general and to intellectual capital in particular.

4.2.3 Human, structural and physical capital

Human capital generates innovation, whether of new products and services, or improving business processes. This construct deals with the knowledge, skills, competencies, and other attributes embodied in employees that are used by a company to produce and sell goods or services. Structural capital is the knowledge that belongs to the organisation as a whole in terms of technologies, inventions, data, publications, strategy, culture, structures and systems, organisational routines and procedures. This construct deals with the mechanisms and structures of the organisation that can support employees in their quest for optimum intellectual capital performance. An individual can have a high level of intellect, but if the organisation in which he is employed has poor systems and procedures by which to track employee actions, the performance of that individual – intellectual capital in a company may not reach its fullest potential. The construct of physical capital is expressed in precise terms. For the purposes of this research study a company's net assets or equity measures physical capital[1]. Equity is the funds provided by the shareholders of the company to enable the entity to acquire assets.

Assets comprise:

- Property, plant and equipment (including intangible assets that, in terms of generally accepted accounting practice, are qualified to be recorded, recognised and measured in a company's annual report);
- Cash and cash equivalents;
- Financial assets, such as investments in financial instruments;
- Inventories; and
- Accounts receivable.

Liabilities comprise:

- Interest bearing borrowings;
- Minority interests;
- Preference share capital;
- Accounts payable; and
- Provisions.

The above list is not exhaustive. There are many other classes of assets and liabilities. The above list represents the primary classes of assets and liabilities (Atrill and Mclaney, 2001).

[1] Net Assets/Equity equals: Assets of company less company liabilities.

4.2.4 The stakeholder view

A commonly accepted view is that income is the reward due to shareholders from their investment (Morley, 1978). A significant factor underlying the acceptance of this view is the dominance of "contractual theories of the firm" within the accounting discipline (Peirson, 1998). Alternative theories of the firm emerged with growing dissatisfaction with the traditional model of the firm. The enterprise theory of the firm is one alternative theoretical perspective that provides an alternative notion of income (Van Staden, 1998).

Suojanen (1954) posits the view that the enterprise is conceived as a decision-making centre for the people who are participants with the organisation. Under enterprise theory, income is the rewards of stakeholders for their participation with the firm (Morley, 1978).

The stakeholder view maintains that firms have stakeholders rather than just shareholders to account for (Donaldson and Preston, 1995). The traditional view of a corporation having obligations only to shareholders, holders of the firm's equity, as espoused by the shareholder view, is replaced by the notion that there are other groups to whom the firm is responsible in addition to the shareholders as espoused by the stakeholder group. The groups that have a stake in the firm include shareholders, employees, customers, suppliers, lenders, government and society. A consensus arising from the stakeholder view is that the accounting profit is only a measure of return to the shareholder, and that value added is a more accurate measure created by the stakeholders and then distributed to the same stakeholders (Meek and Gray, 1998).

Basically, value added is the increase in wealth generated by the productive use of the firm's resources prior to its allocation among shareholders, bondholders, workers and the government. Sveiby (1997) argues that value added exemplifies the correct measure for the production ability of a knowledge economy and the shortfall of traditional financial measures.

To evaluate overall organisational performance created and accrued to all stakeholders, a stakeholder view of the firm calls for the use of the value added (gross or net) as a measure of the total wealth created.

For the purpose of this research study value added is used in two different ways: to measure financial performance and as a major component to measure the performance of intellectual capital in a company.

4.2.5 Dimensions of company performance

Conceptually, the broad construct of company performance can be divided into narrower sub-constructs that refer to specific dimensions of performance (Walker, 2001). This research study focuses on three dimensions of company performance.

The first dimension is the company's productivity, or the efficiency with which inputs are converted to outputs. The second dimension is commonly referred to as profitability, or the degree to which a company's revenues exceed its costs (although the accounting definition is more complicated). The third dimension, has no accepted name or label, but refers to the degree to which a company's market value exceeds its book value. This last dimension is related to company performance, because, if a company is not operating well (not performing), then its market value should be limited to the net value of its physical and financial assets after deducting financial liabilities (Walker, 2001). In this sense, the additional value over and above the net book value of a company's assets can be attributed to the operations of the company.

4.3 Rationale for hypotheses

4.3.1 Determining the decisive business resource in the South African economy

Prior research (Pulic, 1998) suggests that a significant indication of whether an economy is knowledge-based is that it is more reliant on intellectual assets than tangible assets.

To answer the first research question of how South African companies compare internationally with regard to the management of intellectual capital, this component of the study will analyse the relationship between the ability of a company to produce economic value (value added) and the resources that are necessary to create value (physical capital and intellectual capital). In order to analyse this relationship and to determine which resource contributes more to business success, the following hypotheses is made, which is based on Pulic's (1998) model:

***H1*: The correlation coefficient for intellectual assets to value added exceeds that of tangible assets to value added.**

To further analyse the respective relationships described in the rationale for the first hypothesis linear multiple regression analysis is performed based on the following general model (Firer and Mitchell Williams, 2003):

***H2*: Human capital is positively associated with company performance; and**
***H3*: Structural capital is positively associated with company performance.**

The above hypotheses: *H2* and *H3* are in line with the resource-based view of the firm by anticipating a positive contribution of intellectual assets to company performance.

4.3.2 The explanatory and predictive power of intellectual capital in determining company performance (within industry analysis)

The resource-based view of the firm suggests that companies obtain competitive advantage by implementing strategies that exploit company resources in such a manner as to improve company performance. Accordingly, intellectual capital will be positively associated with company performance.

Given the importance of intellectual capital in creating and sustaining an organisation's competitive advantage and capabilities, which will in turn influence company performance, the following three hypotheses are made:

Within a given industry, and controlling for the differences in organisational level factors, the greater the value (performance) of a company's intellectual capital:

***H4*: The greater the company's productivity;**
***H5*: The greater the company's profitability; and**
***H6*: The greater the market's valuation of the company, relative to the value of its financial and physical assets.**

4.3.3 The importance of knowledge and intellectual capital in producing an industries goods and services (across industry analysis)

The above hypotheses focus on differences in intellectual capital within a given industry. A related issue is whether similar relationships between values of intellectual capital and company performance exist across different industries. This is more difficult to address because different industries use different combinations of human, physical and structural capital.

To investigate the relationship between the value of intellectual capital and company performance across industries, this research study suggests that industries can be classified according to the degree to which they are knowledge based.

Distinguishing among industries based on their underlying knowledge base is important because the greater the knowledge intensity of an industry, the more important intellectual capital becomes to company's performance.

Although the idea that industries vary in the relative importance of knowledge and intellectual capital is not well defined in the literature, this research study should help clarify how this construct can be used in the future.

Logically, the degree to which an industry relies on intellectual capital (i.e. the degree to which it is a knowledge-based industry) to produce its goods and services moderates the strength of the relationship between the value of intellectual capital and company performance. In other words, the relationship between the value of intellectual capital in a company and company performance is controlled by the importance of knowledge and intellectual capital (i.e. its knowledge base) in the production of goods and services. This reasoning leads to the following hypotheses across different industries:

The greater the role of knowledge in the production of an industry's goods and services, and in the control of organisational level factors:

***H7*: The greater the contribution a company's intellectual capital will make to its productivity;**
***H8*: The greater the contribution a company's intellectual capital will make to its profitability; and**
***H9*: The greater the contribution a company's intellectual capital will make to the market value of the company relative to the book value of its assets.**

Although the focus of this research is on the contribution of intellectual capital to company performance, many other factors contribute to company performance.

4.3.4 Control factors

Company performance is not as a direct result of intellectual capital, and thus should be differentiated in the theoretical model from other factors that contribute to company performance.

Prior research (Mitchell Williams, 2000; Mitchell Williams, 2001; Walker, 2001; Riahi-Belkaoui, 2003) have suggested that organisational level factors will influence company performance. For the purposes of this study, therefore, five organisational level control factors are included in this study based on the strength of previous research into company performance. These five organisational level factors are: (1) organisational size; (2) industry type; (3) knowledge base; (4) physical capital performance and (5) risk.

Therefore, the above organisational level factors will also be incorporated into the research model. This will improve the model's specification, and thus will help to identify the unique contribution of intellectual capital to company performance.

4.4 Summary

Intellectual capital is considered in this study as a strategic, intangible asset. According to the resource-based view, it should be positively associated with company performance. The hypotheses were designed to establish the usefulness of intellectual capital as a source of superior wealth creation in the South African economy.

Once the definition of constructs and rationale for the hypotheses have been postulated, the following questions need to be answered:

- What techniques will be used to gather data?
- What kind of sampling will be used? and
- How will the constructs be measured?

These questions will be answered in Chapter 5 and 6, which outlines the research framework, design and methodology used in this research study.

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CHAPTER 5
RESEARCH FRAMEWORK

5.1 Introduction

This chapter introduces the principals and concepts of the research framework that is employed in this research study. This research study is classified as empirical. Empirical research is concerned with establishing the relationships between variables (Ryan, Scapens and Theobald, 2002). The variables considered in empirical research may be dichotomised as dependent or independent variables. The independent variable in an experiment is the variable that is manipulated by the researcher; it is in effect the variable that is being studied by the experimenter. The dependent variable measures the response to the manipulation of the independent variable. Thus in an experiment the researcher is interested in determining the impact of the changes in the independent variable upon the dependent variable. In the accounting and financial field, the direct manipulation of the independent variable is generally not possible. Empirical accounting and finance research cannot strictly be described as experimental and many of the experimental designs employed are of a quasi-experimental nature (Ryan, Scapens and Theobald, 2002). In the context of the above discussion, the research framework that the author considers the most appropriate for this research study is known as Correlation Design.

5.2 Correlation Design

Many of the theoretical models developed in accounting and finance predict that correlations should exist between variables (Ryan, Scapens and Theobald, 2002). At the simple correlation level there is no implication of causality; all that is implied is that the variables under study covary. The major problem associated with simple correlation is that spurious correlations can arise between variables as a result of both variables being correlated with a third variable. Where the underlying theoretical structure predicts a causal relationship between the variables, designs using regression techniques should be used (Cooper and Schindler, 2001).

Where the causal relationship is between the dependent variable and one independent variable, simple regression techniques are employed, but when the relationship between a dependent variable and more than one independent variable multiple regression techniques should be used (Ryan, Scapens and Theobald, 2002). Multiple regression is an extension of correlation analysis (Coakes, and Steed, 2001). The results of regression analysis is an equation that represents the best prediction of a dependent variable from several independent variables (Coakes, and Steed, 2001). There are three major regression models – namely, standard or simultaneous regression, hierarchical regression, and stepwise regression. In the standard or simultaneous model, all independent variables enter the regression equation at once because one wants to examine the whole set of predictors and the dependent variable. In hierarchical multiple regression, one determines the order of entry of the independent variables based on theoretical knowledge. In stepwise regression, the number of independent variables and the order of entry are determined by statistical criteria generated by the stepwise procedure. The choice of technique depends largely on the researcher's goals (Coakes, and Steed, 2001).

5.3 Choice of research design

This research study is based on the posture that relationships do exist between company performance, on the one hand, and intellectual capital and other drivers of company performance on the other hand. As such, the construction of statistical models in the form of linear regression serve as a vehicle to verify or otherwise refute the presence of relationships between interacting variables.

A significant number of empirical studies in accounting and finance research employ correlation and regression designs. Research into the determination of whether intellectual capital is associated with or can explain company performance, whether questionnaires or annual reports have been used, has in the main employed correlation and regression analysis (examples can be viewed in: Bontis, 1998; Bontis et al, 2000; Firer and Saunders, 2002; Firer and Mitchell Williams, 2003; Ho and Mitchell Williams, 2002; Hurwitz et al, 2002; Huselid, 1995; Mitchell Williams, 2000; Mitchell Williams, 2001; Reed, 2000; Riahi-Belkaoui, 2003; Van Buren, 1999; Walker, 2001, Youndt et al, 1996). It can therefore be generally accepted that correlation and regression analysis is a proven research framework to test and interpret the relationship between intellectual capital and company performance.

The technical approach adopted in this research study consists of three major steps. First, multiple linear regression models areconstructed that represent the anticipated relationships between company performance and intellectual capital and related control variables. The standard or simultaneous model is employed, as the objective is to examine the effect of all the predictors on the dependent variable.

Second, the multiple regression models are then tested for validity and adequacy using statistical tools such as hypothesis testing, ANOVA analysis, and coefficient of determination (R^2).

Finally, based on the derived regression models, conclusions are made as to the primary business resource in the South African economy, whether intellectual capital contributes to company performance and how management can apply these outcomes to improving the performance of intellectual capital in their organisations.

5.4 Regression analysis

Linear regression can be used to examine sample data and draw conclusions about the functional relationships that exist among variables whereby such relationships are expressed in a form of mathematical functions that demonstrate how the variables are interrelated.

In multiple regression analysis, a response (dependent) variable (Y) is related to a set of control (independent) variables (X) using the following linear model:

$$Y = a_0 + a_1 X_1 + a_2 X_2 + a_3 X_3 + \ldots + a_k X_k + \varepsilon$$

Where Y is a linear function of k control variables $X_1 \ldots X_k$ and ε is an error term. The error term is normally distributed about a mean of zero. For the purposes of this research study the ε is assumed to be zero. Where a_0 is a constant, the value of Y and X will always be zero. Where a_1 is the slope of the regression surface or the response surface.

The a represents the regression coefficient associated with each X. The value of the regression coefficient states that Y varies with each unit change of the associated X variable when the effects of all other X variables are being held constant. The regression coefficients are stated either in raw core units (the actual values of X) or as standardised coefficients (X values restated in terms of their standard deviations).

When the regression coefficients are standardised they are called beta weights and their values indicate the relative importance of the associated X values, particularly when the predictors are unrelated. For example, in an equation where a beta (a_1) is 0.60 and another beta (a_2) is 0.20, a conclusion can be reached that X_1 has three times the influence on Y (the dependent variable) as does X_2.

A number of assumptions underpin the use of regression analysis:

- The number of sampling units needed depends on the type of regression model to be used. For standard regression, the minimum requirement is to have at least five times more units than independent variables (Coakes, and Steed, 2001);
- Extreme cases have considerable impact on the regression solution and should be deleted or modified to reduce their influence (Coakes, and Steed, 2001);
- Multicollinearity or collinearity refers to high correlations among the independent variables. Multicollinearity or collinearity will affect how the relationships between the predictors and the dependent variable will be interpreted. Predictor variables that vary significantly with one another must be removed from the model (Coakes, and Steed, 2001); and
- Normality, is a prerequisite for the conducting of correlation and regression analysis. The scores for each variable in the analysis should be normally distributed. Mild deviations from linearity are not serious (Coakes, and Steed, 2001).

The first assumption relates the sample selection procedures while the other assumptions is tested through regression analysis.

5.5 Hypotheses testing

Having detailed the hypotheses in Chapter four, it is important to determine the accuracy of the hypotheses as stated. The more established approach to hypothesis testing is known as the classical or sampling-theory approach (Cooper and Schindler, 2001). It this approach that is adopted for use in this research study. This approach represents an objective view of probability in which the decision making rests totally on an analysis of available sampling data. A hypothesis is established; it is rejected or fails to be rejected (accepted), based on the sample data collected (Cooper and Schindler, 2001).

The following steps are adopted to test the hypotheses in this research study (Cooper and Schindler, 2001):

- Step 1: State the null hypothesis. The null hypothesis states that there are no relationships between variables. That intellectual capital has no relationship with company performance;
- Step two: Choose the statistical test. Where data has been transformed parametric tests will be carried out. Where data has not been transformed non-parametric tests will be carried out;
- Step 3: Select the desired level of significance. The most accepted significance level is 0.05 (Cooper and Schindler, 2001; Coakes and Steed, 2001). Statistical significance for the purposes of this research study will be assessed at the ρ=0.05 level.
- Step 4: Compute the calculated difference value. SPSS will determine the calculated value t;
- Step 5: Obtain the critical test value. Once t has been calculated, SPSS will determine the critical value. The critical value is the criterion that defines the region of rejection from the region of acceptance of the null hypothesis.; and
- Step 6: Interpret the test. The method to be adopted for the purposes of this research study will be by presenting the extent to which the test statistic disagrees with the null hypothesis.

This method is in line with the use of SPSS. SPSS reports the results of statistical tests as a probability value (ρ values). The ρ value is the probability of observing a sample value as extreme as or more extreme than the actual value observed, given that the null hypothesis is true. The ρ value is compared to the level of significance determined above and on this basis the null hypothesis is either rejected or not rejected.

If the $\rho < 0.05$ (significance level), the null hypothesis is rejected. If $\rho > 0.05$ (significance level), the null hypothesis is not rejected. SPSS will compute the ρ value during the execution of the hypothesis test.

The alternative hypothesis holds that there is a relationship between variables. In other words, there is a relationship between intellectual capital and company performance. The objective of this research study is to establish whether there is a relationship between intellectual capital and company performance. As a result of the conceptual framework adopted in this study and in line with the hypotheses that have been developed, this relationship must be positive. Therefore, a one-tailed test or directional test will be used. This directional test will be a right one-tailed test. This means that t statistic calculated must be positive and significant (here t is > zero), if it is negative (here $t < 0$) the null hypothesis will not be rejected.

5.6 Description of the statistical tests and their implications

5.6.1 Data screening and transformation

Before statistical analysis can take place, it is important to ensure that the underlying assumptions of correlation and regression analysis are in place. A critical assumption of correlation and regression analysis is normality (Cohen and Cohen, 1975). The scores for each variable in the analysis should be normally distributed. For each variable in the analysis that is not normally distributed a natural logarithmic transformation must be carried out (Coakes and Steed, 2001).

The following different tests are considered appropriate for the exploration of normality (Coakes and Steed, 2001):

- Histograms. A histogram is a conventional solution for the display of interval-ratio data (Cooper and Schindler, 2001). Histograms are used when it is possible to group variable values into intervals. Histograms are constructed with bars where each value occupies an equal amount of area within an enclosed area. Histograms are useful for displaying all intervals in a distribution and examining the shape and distribution for skewness, kurtosis and the modal pattern (Cooper and Schindler, 2001); and

- Kolmogorov-Smirnov and Shapiro-Wilk statistic. This statistic tests for normality (Coakes and Steed, 2001). If the significance level is greater than 0.05, then normality is assumed (Coakes and Steed, 2001).

5.6.2 Independent groups t-test

This research study differentiates between companies with a high knowledge-base and companies with a low knowledge-base (Lee and Has, 1996; Harris, 2000; Walker, 2001). Therefore, the focus of this study will be on knowledge intensity and intellectual capital performance. To provide evidence that the high and low knowledge-base groups are completely different, an independent groups t-test will be carried out in respect of knowledge intensity and intellectual capital performance. This test is appropriate to justify the distinction between the high and low knowledge-base groups (Cooper and Schindler, 2001; Coakes, and Steed, 2001).

The objective of the test is to ensure that the two groups can be distinguished. This is accomplished by first establishing that the variances of the two groups are different and second that the means of the two groups are different. SPSS uses the Levene test (Coakes, and Steed, 2001) for determining the equality of variances.

The null hypothesis being that variances of the two groups are equal and therefore not different. If this test is significant ($\rho < 0.05$ level), then the null hypothesis is rejected and the alternative hypothesis that the variances are unequal and hence the two groups are different. SPSS uses the t-test for Equality of Means to establish whether the means of the two groups are different. If the two-tail t-test is significant ($\rho < 0.05$ level) then the null hypothesis is rejected and the alternative hypothesis that the means are unequal and hence the two groups are different.

5.6.3 Descriptive statistics

The objective of descriptive statistics is first to explore the data and second to summarise and describe the observations (Coakes, and Steed, 2001). The following descriptive statistics will be used for the purposes of this research study (Firer and Mitchell Williams, 2003):

- Mean; and
- Standard deviation.

The mean is the most often used measure of central tendency (Kranzler and Moursund, 1999). The mean of a set of numerical values is the average of the set of values (Jaisingh, 2000). The standard deviation is the most common measure of variability (Jaisingh, 2000). The standard deviation provides information about how the data vary about the mean (Jaisingh, 2000).

5.6.4 Correlation analysis

Correlation analysis indicates the extent to which a relationship exists between at least two sets of data. Correlation suggests determining the extent of the relationship between a dependent and independent variable. Before proceeding to the mechanics of how to determine the extent of correlation between two sets of data, the terms dependent variable and independent variable need to be explained.

Technically, the category of data which has a bearing on the outcome of the other category, is known as the independent variable (Julyan and Nel, 2003), and the category of data which is "affected by" or "dependent on" the other category of data is known as the dependent variable (Julyan and Nel, 2003). For the purposes of this research study, the company performance will represent the dependent variable and all factors that are expected to have an influence on company performance will represent the independent variables.

Correlation analysis is conducted in order to determine whether there is a significant relationship between any of the variables that will be used in this research study. This analysis will reveal the magnitude and direction of the relationships. The magnitude is the degree to which the variables move in unison or opposition (Cooper and Schindler, 2000). Direction tells whether large values on one variable are associated with large values on the other (and small values with small values). When the values correspond in this way, the two variables have a positive relationship. As one increases, the other also increases in opposition (Cooper and Schindler, 2000). Direction can also show that variables are inversely (negatively) related. Large values are associated with small values (and vica versa). In other words as one variable increases the associated variable decreases in opposition (Cooper and Schindler, 2000).

The coefficient of correlation (*R*) indicates the extent of the relationship between variables (SPSS will be used to calculate *R*). It is calculated using a mathematical formula (which can be viewed in Julyan and Nel, p. 78). For the purposes of this research study two different coefficients of correlation are used. First, the Pearson product moment correlation. This analytical tool are used as an introductory analysis to all the different regression models. This coefficient is used when the assumptions underlying correlation have been adequately met. Second the Spearman's rank-order correlation. This analytical tool will be used as support in determining the primary business resource in the South African economy. This coefficient is used when the assumptions underlying correlation have not been adequately met (for example – normality).

A coefficient of correlation of positive one (positive relationship) or negative one (negative relationship) indicates a perfect correlation between variables, while a value of zero indicates that there is no correlation at all. The closer the coefficient of determination is to positive one (positive relationship) or negative one (negative relationship) the stronger the association between the variables are. A correlation matrix will be used to reflect the different correlations between the variables. A correlation matrix is a table used to display coefficients for more than two variables, which will be the case in this research study. A major criticism of correlation analysis does not imply causation. Causation is the primary objective of this research study. In order that this limitation is overcome, regression analysis will also be undertaken.

5.6.5 Regression analysis

As explained previously multiple regression analysis is used. This model is based on one dependent variable and more than one independent variable. This analysis tool is used to determine the unique correlation that each independent variable will have with the dependent variable.

Regression analysis will be conducted through SPSS. SPSS provides three important regression analysis reports:

1. Model summary;
2. ANOVA; and
3. Coefficients.

The model summary consists of R, R^2, adjusted R^2 and standard error of the estimate. For the purposes of this research, study R^2 is used as the tool to test the internal validity of the research study. Internal validity of an experiment is determined by how much control has been achieved in the study, that is, the greater the control achieved, the higher the internal validity (Ryan, Scapens and Theobald, 2002).

When a study is described as having a high internal validity this is understood to mean that the changes in the dependent variable have been brought about, in the main by the independent variable changes nature (Ryan, Scapens and Theobald, 2002). The correlation of determination (R^2) is considered to be one of the preferred statistical tests for this purpose.

The coefficient of determination is determined by squaring the coefficient of correlation (Julyan and Nel, 2003). If R^2 is for example 80% this should be interpreted to mean that 80% of the change in the dependent variable can be explained by the independent variables and that 20% of the change in the dependent variable is caused by factors other than the independent variables used.

ANOVA stands for analysis of variances (Cooper and Schindler, 2000). The ANOVA report produced by SPSS consists of two main statistics. The first is the level of significance. The second is known as the F statistic (or test). In multiple regression, the F test has an overall role for the model. If the level of significance is less than 0.05, the F statistic will indicate that there is evidence of a linear relationship between variables, and the model can be used for explanatory and predictive purposes.

Although the coefficients report is part of ANOVA, SPSS produces a separate report. There are three important statistics produced by this report. First, the level of significance. Second, standard beta coefficients. When the regression coefficients are standardised, they are called beta weights (for explanation see 5.4).

Third is the t-test. This test measures the statistical significance of each of the regression coefficients, and must be read in conjunction with levels of significance. The t-test also indicates the direction of the relationship between variables a positive t – test indicates a positive relationship while a negative t-test indicates a negative relationship.

5.6.6 Multicollinearity (or collinearity) analysis

The situation where two or more of the independent variables are highly correlated is termed multicollinearity or collinearity. This can have a damaging effect on multiple regression. When this condition exists, the estimated regression coefficients can fluctuate, making it risky to interpret the coefficients as an indicator of the relative importance of predictor variables. SPSS calculates a variable inflation factor (VIF). This is a measure of the effect of the other independent variables on a regression coefficient. VIF values of usually larger than 10.0 or more suggest multicollinearity (or collinearity) (Cooper and Schindler, 2000). Multicollinearity (or collinearity) analysis will be conducted on all regression models.

5.7 Summary

The objective of this research study is to establish whether intellectual capital is associated with or can explain company performance. In statistical terminology: the aim is to explain or predict a dependent variable (company performance) from a set of independent variables (intellectual capital and control factors). Multiple regression analysis has been selected for this purpose. Regression results provide information on the statistical significance of the independent variables, the strength of association between one or more of the predictors, and a predictive equation for future use. The information provided by regression analysis clearly achieves the aims and objectives of this research study. The following chapter implements the research framework that has been discussed in this chapter.

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CHAPTER 6
RESEARCH DESIGN AND METHODOLOGY

6.1 Introduction

This chapter outlines the research design and methodology that will be followed in this study. The research design and methodology constitutes the blueprint for the collection, measurement, and analysis of data. It consists of a plan and a structure for the investigation in order that answers for the research questions may be obtained.

The research design and methodology in respect of this research study is divided into four parts. Part 1 (6.3) describes the method that is used to enable the collection of data and further describes the source from which data is collected. Part 2 (6.4) gives a detailed analysis of the variables that will be used in this study. Each variable is defined and reviewed. Part 3 (6.6) formulates the hypotheses that will be tested. Part 4 (6.6) discusses the various statistical techniques that will be used to test the hypotheses.

6.2 High knowledge-base and low knowledge-base

This research study has been modified to a within knowledge-base analysis and not a within industry analysis because of the difficulty in obtaining sufficient number of companies reporting the key variable of staff costs within a specific industry. This knowledge base is broken down into high and low knowledge (Lee and Has, 1996; Harris, 2000; Walker, 2001).

The literature provides various ways of differentiating high and low knowledge-base companies (Lee and Has, 1996; Harris, 2000; Walker, 2001). For the purposes of this research study, differentiating high and low knowledge-base companies, was based on the primary source of value creation of the company (Walker, 2001). The high knowledge-base group derives its value exclusively from the efforts of people (human capital) and the collective routine systems, processes and information within the organisation (structural capital), for example, banking, electronics and health.

The primary source of value creation of the companies in the low knowledge-base group is expected to be derived from the value of the raw resource (material) extracted, from significant fixed capital investments, and from companies who traditionally rely exclusively on physical labour, for example, mining, hospitality and construction.

6.3 Data source

Due to the difficulty in acquiring information from private companies, it was decided to limit this study to public companies that are listed on the JSE Securities Exchange. For the purposes of this study, the extent of company performance is measured using statutory annual reports. Data was collected from the 2001 fiscal year annual reports of publicly traded companies listed on the JSE Securities Exchange.

A number of techniques were used to collect the necessary annual reports from the selected companies. The primary source of information for this study was the use of the secondary database from McGgregor BFA (McGregor's, 2002). Mcgregor BFA supplies real-time and historical fundamental information on South African listed companies. Other techniques used consisted of contacting the companies and stockbrokers directly and extensive searches of company and related websites.

6.4 Variables

6.4.1 Independent variables

6.4.1.1 Intellectual capital performance (explanatory variable)

Mindful of the respective criticisms of the various measures of intellectual capital that were discussed in 2.5.3, 2.5.4 and 3.4, the following criteria are proposed for the selection of a model to measure intellectual capital performance: (1) the basic underlying feature of the measurement model should be based on key recognised components of intellectual capital, and (2) simplistic enough to enhance cognitive understanding and allow for the collection of data.

Simple measures of intellectual capital are needed for three reasons: 1) cognitive: human beings can hardly process more than seven indicators at a time and will therefore be confused by long checklists or complicated simulation models (Schneider, 1998), 2) behavioural: simple measures provide direction and priorities. Complexity is a limiting factor in the use of any measurement model (Schneider, 1998), and 3) cost: cost-benefit analysis is one the major cornerstones of business theory. If the design, administration, and implementation of intellectual capital costs more than its perceived benefits, management will not use it.

Traditional accounting practice is inadequate to measure wealth creation in the knowledge economy accounting (Pulic, 1998; Stewart, 1997; Sveiby, 1997;Edvinsson and Malone, 1997).

The question therefore arises: if knowledge is the key to future success but not adequately reflected in traditional accounting financial measures, and if financial measures are the main drivers of top management's decision making, what measuring system would fulfil the requirements of the knowledge economy and modern companies' needs?

Pulic (1998) argues that this measuring system has to meet two requirements:

- It has to establish reliable and objective evidence of the value creation processes. This means a precise measuring of knowledge which employees incorporate into products and services; and
- It has to provide reliable and objective information on the employee's ability to create value.

In order to manage value in a company there has to be measurement of where value is created and how much of each resource, tangible and intangible, has participated in the value created. Due to the strategic importance for modern businesses of intellectual capital and its components human and structural capital, it is critical to take these factors into designing a measuring system.

The measurement model that satisfies all the above requirements is the VAIC™ method developed by Pulic (1998). This method uses "Value Creation" as a measure of intellectual capital performance. In the knowledge economy, the modern business is defined as an organisation that adds value and creates wealth (Pulic, 1999; Sveiby, 1997; Stewart, 1997). Consequently, it can be argued that any method measuring company success in the knowledge economy should be focused on value creation, those who create value and the processes where that value is created.

Although the focus of this measurement model is on intellectual capital, it includes the premise that physical capital is also an important factor of production. The VAIC™ uses physical capital as a component of intellectual capital for the following reason: the better the physical assets available for employees, conceivably, the greater the productivity of intellectual assets. In this context, in order to understand the importance of measuring the performance and contribution of intellectual capital to company performance, management needs to measure the entire value creation process.

The VAIC™ measurement model indicates how successfully the resources physical capital and intellectual capital have contributed to value and whether physical capital or intellectual capital is the decisive resource for business success.

Value added grows as efficiency of resources increases, therefore the objective of any business is clear: create as much value added as possible with a given amount of financial and intellectual capital. In order to calculate a company's value creation efficiency, value added must be related to the resources: physical capital (VACA), human capital (VAHC) and structural capital (SCVA). The VACA, VAHC and SCVA indicators can be considered precise and objective as they are derived directly from the financial reports of a company.

These coefficients enable management to visualise the value creation efficiency of resources in the company, which means they can see how much of the new value is created by each invested Rand in each resource and how successfully each of the resources participates in the achieved value added. The VAIC™ model indicates corporate value creation efficiency, or, as Pulic describes it, corporate intellectual capital performance (Pulic, 2003). The higher the VAIC™ coefficient, the better management utilises the company's value creation potential.

According to Skyrme (2002), the value added creation efficiency methodology provides an essential link between intellectual capital and financial performance that should help to bring together the currently distinctive disciplines of finance and performance measurement.

According to Mitchell Williams (2003) the reasons for choosing VAIC™ methodology to measure intellectual capital performance are:

- The value creation efficiency analysis is unique in its flexibility in being applied at various economic levels (macro, meso and micro). This methodology, therefore, can be applied on a broader scope to enable stakeholders to develop an understanding of intellectual capital performance of a single firm, a group of firms, a specific business sector or capital market;
- This methodology provides a standardised and consistent basis of measure, thereby better enabling the effective conduct of an international comparative analysis between firms, within a nation's economic structure and across international boundaries. Alternative intellectual capital measures are limited in that they: (1) utilise information associated with a select group of firms (for example stock data); (2) involve unique financial and non-financial indicators that can be readily combined into a single comprehensive measure; and/or (3) are customised to fit the profile of individual firms;

- All data used in the value creation efficiency analysis is based on audited information. Therefore, calculations can be considered objective and verifiable. Other intellectual capital measures have been criticised due to the subjectivity and complexity associated with their underlying indicators. As many other measures of intellectual capital are highly internalised and firm specific, there is some difficulty in verifying information used in calculating indicators formed by other measures; and
- The value creation efficiency analysis is a straightforward technique that enhances cognitive understanding and enables ease of calculation by various internal and external stakeholders. Ease of calculation is a feature that has enhanced the universal acceptance of many traditional measures of corporate performance (such as the Market Capitalisation and Return on Assets methods).

Formally, VAIC™ is a composite measure comprising the sum of three indicators formally termed (1) VAHC – Value Added Human Capital Coefficient, (2) VACA – Value Added Capital Coefficient, (3) SCVA – Value Added Structural Capital Coefficient. Equation 1 formalises the VAIC™ relationship algebraically:

Equation 1

$$\text{VAIC}^{\text{TM}} = \text{VACA} + \text{VAHC} + \text{SCVA}$$

Pulic (1998) stated that the higher the VAIC™ coefficient, the better a company's value added efficiency from its total resources involved in value creation. Prior research defines value added by Equation 2 (Stainbank, 1992).

Equation 2

$$\text{REV-B+INV} = W + I + DP + D + T + M + R$$

Where:

REV = Revenue, B = Bought Products and Services, INV = Change in Inventories, W = Salaries and Wages, I = Interest Expense, DP = Depreciation, D = Dividends, T = Corporate Taxes, M = Minority Interest Expense, R = Retained Profits for the Year.

The left hand side of Equation 2 shows the amount of value added whilst the right hand side indicates the distribution of value added to the major stakeholders (stakeholders view) (Morley, 1973).

Under the VAIC™ methodology, Pulic (1998) made one significant modification to the calculation of Value Added as defined by Equation 2. Pulic (1998) argued that because of the central active role human resources plays in the value creation process labour costs (staff costs) should not be included in value added computations.

This view is consistent with the opinions of other intellectual capital experts (Strassman, 1996; Flamholtz, 1986; Edvinsonn and Malone, 1997; Sveiby, 1997). Therefore, for the purposes of this study, value added is calculated using Equation 3:

Equation 3

$$VA = I + DP + D + T + M + R$$

Where:

I = Interest Expense, DP = Depreciation, D = Dividends, T = Corporate Taxes, M = Minority Interest Expense, R = Retained Profits for the Year.

Pulic (1998) stated that VACA is the ratio of total value added, divided by the total amount of physical capital (CA) and is defined as the book value of the company's net assets. Equation 4 presents the VACA relationship algebraically:

Equation 4

$$VACA = VA/CA$$

Consistently with propositions and views of other leading intellectual capital experts (Strassman, 1996; Flamholtz, 1986; Edvinsonn and Malone, 1997; Sveiby, 1997), Pulic (1998) argued that total staff costs were an indicator of a company's human capital (HC). VAHC therefore, was calculated as the ratio of total VA, divided by the HC, the total staff costs spent by the company on its employees. Equation 5 shows this relationship algebraically:

Equation 5

$$VAHC = VA/HC$$

In order to calculate SCVA, it is necessary to determine the value of a company's structural capital (SC). Pulic (1998) proposed a company's total value added, less its human capital (HC), was an appropriate proxy of a company's SC. Equation 6 shows this relationship algebraically:

Equation 6

$SC = VA - HC$

Pulic (1998) reasoned that there was a proportionate inverse relationship between HC and SC in the value creation process attributable to the entire intellectual capital base. Consequently, Pulic (1998) proposed the formula for calculating SCVA differed from that of VACA and VAHC respectively. Specifically, Pulic (1998) stated SCVA was the ratio of a company's SC divided by the total VA. This relationship is shown in Equation 7:

Equation 7

$SCVA = SC/VA$

Insert Table 5

Table 5 represents a formal illustration of the calculation of each variable using the VAIC™ methodology (Mitchell Williams, 2000; Mitchell Williams, 2001)

Schneider (1998), stated that VAIC™ was an effective method of measuring intellectual capital because:

1. VAIC™ enabled the collection of evidence of intellectual capital leverage to key success processes;
2. VAIC™ is easy to calculate using information already accounted for by a company and reported in annual reports thus minimising any additional costs to the compiler and stakeholder; and
3. The methodology used in the calculation of VAIC™ is relatively straightforward and affords greater intellectual understanding.

6.4.1.2 Control variables

Statistical predictions can often be improved by using more than one independent variable (Van Staden, 1998). Therefore, by using control variables in addition to the explanatory variable, the predictive values of the regression models are increased.

6.4.1.2(a) Company size

Company size is measured by a company's market capitalisation (Firer and Mitchell Williams, 2003). The top 100 shares on the JSE Securities Exchange are determined in accordance with market capitalisation (McGregor's, 2002). Larger company's size leads to greater empowerment for management and employees. This leads to an increased motivation and a willingness to perform at the highest levels. This variable is anticipated to have a positive effect on intellectual capital activities (Mitchell Williams, 2000; Mitchell Williams, 2001).

6.4.1.2(b) Industry type

To increase the sample size for the within industry analysis, data from several industries is combined. As a result of possible significant differences in production functions, and thus the relative importance of intellectual capital, a dummy variable is used to control for inter-industry differences.

Coding was accomplished using g-1 classification of companies into g different industry groups as described in Cohen and Cohen (1983, p.173). Using g-1 = number of independent control variables to represent the unique industry within each of the knowledge-based groups.

6.4.1.2(b.i) High knowledge-base

The high knowledge-base group consists of Business Service (1), Chemical and Pharmaceutical Products (2), Communications (3), Electronic and Electrical Products (4) Finance, Insurance and Real Estate (5), and Health and Social Services (6). Industry sector dummy variables of X1, X2, X3, X4 and X5 are coded as follows:

Insert Table 6

Dummy variable analysis – High knowledge-base group

6.4.1.2(b.ii) Low knowledge-base

The low knowledge-base group consists of Accommodation, Food and Beverage (1), Construction (2), Mining (3), Retail Trade (4), and Transport Industry (5). Industry sector dummy variables of X1, X2, X3, and X4 are coded as follows:

Insert Table 7

Dummy variable analysis – Low knowledge-base group

6.4.1.2(c) Risk

The risk profile of a company is measured by the debt equity ratio (Firer and Mitchell Williams, 2003; Mitchell Williams, 2000; Mitchell Williams 2001). With increased debt, the attention of management may be directed towards its own requirements (company survival). Focus, in this case, is diverted from the management, measurement and reporting of intellectual capital. This variable is anticipated to have a negative effect of intellectual capital activities.

6.4.1.2(d) Physical capital intensity

Physical capital is measured by a variable called physical capital intensity (Walker, 2001). This variable is created by calculating the ratio of the company's fixed assets (the physical assets owned by the company), to its total assets (comprised of the company's physical assets and financial assets), both in Rands. The physical capital intensity variable directly measures the relative proportion of money invested in physical assets, including equipment and real property, to total money invested in total assets.

6.4.1.2(e) Knowledge base

Knowledge Base is measured by a dichotomous variable coded (1) if a company was highly knowledge-based, and coded (0) if low knowledge-based (Mitchell Williams, 2000; Mitchell Williams, 2001). The extent to which a company participates in intellectual capital activities may influence intellectual capital performance. Companies in industries more reliant on intellectual capital components such as technology and research may provide management and directors of the entities with greater expertise and demands in managing intellectual capital.

A company is therefore considered high knowledge-based if it is research intensive, meaning that it incurs research and development expenditures (Mitchell Williams, 2000; Mitchell Williams, 2001; Sveiby 1997; Stewart, 1997). If expenditures were not reported, then the company is considered not research intensive and a low knowledge-based company.

6.4.1.3 Other variables

6.4.1.3(a) Value added (Model 1 – part A)

For the purposes of this section of the research study, value added is defined in terms of Pulic (1998).

6.4.1.3(b) Human capital (Model 1 – part A)

Human Capital is measured through the accumulated expenditures for labour (staff costs) (Pulic, 1998).

6.4.1.3(c) Physical capital (Model 1 – part A)

The book value of net assets of a company is measured by the physical capital employed by a company (Mitchell Williams, 2000; Mitchell Williams, 2001; Pulic, 1998)

6.4.1.3(d) Structural capital (Model 1 – part A)

For the purposes of this research study Structural Capital is Value Added minus Human Capital. Human Capital and Structural Capital are reverse proportional; the less Human Capital participates in value creation the more Structural Capital is involved (Pulic, 1999).

6.4.1.4 Dependent variables

The literature documents various accounting- and market-based measures that may be utilised as a proxy measure designed to capture the respective properties of the three dependent variables. Presently, there is no specific theoretical perspective or empirical evidence supporting any specific proxy measure over another. It is decided, therefore, that for the purposes of the present study to use proxy measures deemed to have been widely use in the prior literature. Consequently, the proxy measures for each dependent variable are defined as follows:

6.4.1.4(a) Productivity

Simply using total revenues as a measure of productivity is inadequate because productivity refers to whether that revenue was produced efficiently. However, by dividing total revenues by total assets, this creates a simple measure of productivity. (Walker, 2001; Firer and Mitchell Williams, 2003).

This ratio indicates how effectively a company's assets are being used, by comparing them with the volume of sales that they generate (Faul, Pistoroius, Van Vuuren, Vorster, and Swanevelder, 2000). In other words this ratio represents the efficiency with which physical and intellectual assets convert inputs into the goods and services that are subsequently sold (Walker 2001).

6.4.1.4(b) Profitability

Conceptually, the ratio return on assets consists of a numerator derived from the income statement and indicates a level of earnings of the firm, and a denominator derived from the balance sheet which reflects resources devoted to the generation of those earnings.

The primary objective of a business enterprise is to earn a reasonable yield on the assets invested in it. The earning capacity of the assets is called the Return on Assets (Faul, et al, 2000). Therefore, the variable measuring company profitability will be the company's Return on Assets (Walker, 2001; Firer and Mitchell Williams, 2003), not its profit or net income.

Return on Assets will be calculated as the ratio between the company's profit and its total assets, comprised of both financial, physical assets, and intangible assets owned by the company.

6.4.1.4(c) Market valuation

Market Valuation is the ratio of a stock's market price to its book value. The formula used in this research is Market Price Per Share divided by Net Book Value Per Share (Walker, 2001; Firer and Mitchell Williams, 2003).

6.5 Hypotheses

The contribution of intellectual capital to company performance in the South African economy is examined using three different correlation and regression models.

Model 1 – part A is designed to establish the decisive business resource [what business resource contributes the most in creating wealth (value added)] in the South African economy? Model 1 – part B, Model 2 and Model 3 are proposed on the premise of the Resource Based Theory of the Firm, in that company performance is a function of the company's ability to acquire and deploy resources (intellectual capital) in such a way as to develop a sustainable competitive advantage.

Consequently, Model 1 – part B, Model 2, and Model 3 are designed to empirically investigate the relationship between intellectual capital performance and company performance.

6.5.1 Decisive business resource (Model 1)

6.5.1.1 Model 1 – part A

To test *H1*: The correlation coefficient for intellectual assets to value added exceeds that of tangible assets to value added and, based on the strength of prior research (Pulic, 1998; Firer and Saunders, 2002), the following correlations will be used in determining the decisive business resource in the South African economy:

- physical capital and value added;
- human capital and value added; and
- structural capital and value added.

6.5.1.2 Model 1 – part B

The Value Added Intellectual Coefficient™ (VAIC™) methodology developed by Pulic (1998) forms the underlying measurement basis for the three major independent variables in the part B of Model 1.

To further analyse the respective relationships as set out in *H2* and *H3*; linear multiple regression analysis will be performed based on the following general model (Firer and Mitchell Williams, 2003):

H2: Human capital is positively associated with company performance; and
H3: Structural capital is positively associated with company performance.

These hypothesised relationships will be estimated as follows:

Equation 8

$$ATO = a_0 + a_1(VACA) + a_2(VAHC) + a_3(SCVA) + a_4(OS) + a_5(DER) + a_6(IT) + \varepsilon$$

Equation 9

$$ROA = a_0 + a_1(VACA) + a_2(VAHC) + a_3(SCVA) + a_4(OS) + a_5(DER) + a_6(IT) + \varepsilon$$

Equation 10

$$MB = a_0 + a_1(VACA) + a_2(VAHC) + a_3(SCVA) + a_4(OS) + a_5(DER) + a_6(IT) + \varepsilon$$

The null hypothesis H_0 is that $a_{2-3} \leq 0$

The alternative hypothesis H_1 is that $a_{2-3} > 0$ (i.e. a right-tailed test that there is a significant positive relationship between a_{2-3} and company performance)

Where:

VACA	Value Added Capital Coefficient
VAHC	Value Added Human Capital Coefficient
SCVA	Value Added Structural Capital Coefficient
OS	Organisational Size (Market Capitalisation)
DER	Risk (Debt Equity Ratio)
IT	Industry Type (Dummy Variable)

6.5.1.3 The explanatory and predictive power of intellectual capital in determining company performance (within industry analysis)

Within a given industry, and controlling for the differences in organisational level factors, the greater the value (performance) of a company's intellectual capital:

H4: The greater the company's productivity;
H5: The greater the company's profitability; and
H6: The greater the market's valuation of the company, relative to the value of its financial and physical assets.

These hypothesised relationships will be estimated as follows:

Equation 11

$$ATO = a_0 + a_1(VAIC^{TM}) + a_2(PC) + a_3(OS) + a_4(DER) + a_5(ROA) + a_6(IT) + \varepsilon$$

Equation 12

$$ROA = a_0 + a_1(VAIC^{TM}) + a_2(PC) + a_3(OS) + a_4(DER) + a_5(ATO) + a_6(IT) + \varepsilon$$

Equation 13

$$MB = a_0 + a_1(VAIC^{TM}) + a_2(PC) + a_3(OS) + a_4(DER) + a_5(ATO) + a_6(IT) + a_7(ROA) + \varepsilon$$

For each hypothesis: $a_1(VAIC^{TM}) > 0$

The null hypothesis H_0 is that $a_1(VAIC^{TM}) \leq 0$

The alternative hypothesis H_1 is that $a_1(VAIC^{TM}) > 0$ (i.e. a right-tailed test that there is a positive relationship between $a_1(VAIC^{TM})$ and company performance)

Where:

VAIC	Value Added Intellectual Capital Coefficient
PC	Physical Capital Intensity (Fixed Assets/Total Assets)
ATO	Productivity (Asset Turnover Ratio)
OS	Organisational Size (Market Capitalisation)
DER	Risk (Debt Equity Ratio)
IT	Industry Type (Dummy Variable)
ROA	Profitability (Return on Assets)
MB	Market Valuation (Market to Book Ratio)

6.5.1.4 The importance of knowledge and intellectual capital in producing an industries goods and services (across industry analysis)

The more important that knowledge is to producing an industry's goods and services, and controlling for organisational level factors:

H7: The greater the contribution a company's intellectual capital will make to its productivity;
H8: The greater the contribution a company's intellectual capital will make to its profitability: and
H9: The greater the contribution a company's intellectual capital will make to the market value of the company relative to the book value of its assets.

These hypothesised relationships will be estimated as follows:

Equation 14

$$ATO = a_0 + a_1(KBxVAIC^{TM}) + a_2(IT) + a_3(PC) + a_4(OS) + a_5(DER) + a_6(ROA) + a_7(KB) + a_8(VAIC^{TM}) + \varepsilon$$

Equation 15

$$ROA = a + a_1(KBxVAIC^{TM}) + a_2(IT) + a_3(PC) + a_4(OS) + a_5(DER) + a_6(ATO) + a_7(KB) + a_8(VAIC^{TM}) + \varepsilon$$

Equation 16

$$MB = a_0 + a_1(KBxVAIC^{TM}) + a_2(IT) + a_3(PC) + a_4(OS) + a_5(DER) + a_6(ATO) + a_7(KB) + a_8(VAIC^{TM}) + a_9(ROA) + \varepsilon$$

For each hypothesis:

For each hypothesis: $a_1\left(KBxVAIC^{TM}\right) > 0$

The null hypothesis H_0 is that $a_1\left(KBxVAIC^{TM}\right) \leq 0$

The alternative hypothesis H_1 is that $a_1\left(KBxVAIC^{TM}\right) > 0$ (i.e. a right-tailed test that there is a positive relationship between $a_1\left(KBxVAIC^{TM}\right)$ and company performance)

Where:

VAIC	Value Added Intellectual Capital Coefficient
PC	Physical Capital Intensity (Fixed Assets/Total Assets)
ATO	Productivity (Asset Turnover Ratio)
OS	Organisational Size (Market Capitalisation)
DER	Risk (Debt Equity Ratio)
ROA	Profitability (Return on Assets)
MB	Market Valuation (Market to Book Ratio)
KB	Knowledge-Base (Dummy Variable)
KBxVAIC	Interaction of knowledge-base and intellectual capital

6.6 Summary

The contribution of intellectual capital to company performance in the South African economy was examined using three different models. Model 1 – part A is designed to establish the decisive business resource in creating value added in the South African economy. Model 1 – part B, Model 2, and Model 3 are designed to empirically investigate the relationship between a company's intellectual capital and performance. Company performance is examined in three dimensions: productivity, profitability, and market valuation. The primary explanatory independent variable of the analysis is intellectual capital performance.

Chapter 6 set out the research design and methodology that underlies this research study. The next step in the process is to prepare the data for analysis, conduct the hypothesis testing, and determine whether the hypotheses are to be accepted or rejected. These steps are discussed in detail in Chapter 7.

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CHAPTER 7

ANALYSIS, INTERPRETATIONS AND IMPLICATIONS OF THE RESEARCH RESULTS

7.1 Introduction

The objective of this chapter is to explore, display and examine the data collected. The first step in this process is an analysis of the sample selected. The second step outlines the data screening and transformation procedures that were carried out on the raw data. The third step consists of a detailed examination of the contrasts between the high knowledge-based group and the low knowledge-based group. The fourth step sets out and discusses the descriptive statistics for the primary variables, and describes the statistical results – in respect of each model – of the correlation and multiple regression analysis and determines whether the hypotheses are accepted or rejected. The fifth step entails a detailed discussion of the implications and applications of the acceptance or rejection of the hypotheses.

7.2 The sample

Of the total 427 companies (listed in Appendix A) found on the McGregor BFA database (McGregor's, 2002) a total of 224 companies (listed in Appendix B) displayed the key variable staff costs. Staff costs consist of the overall expenditures for employee's salaries and wages (Pulic, 1998, p.7). Altogether 94 companies were deleted because of data screening and transformation procedures (refer 7.3). A total of 130 (224 less 94) companies were included in the final data set (sample). A complete list of companies included in the final data set is listed in Appendix C and D. The low knowledge-base group contained 65 companies (listed in Appendix E) and the high knowledge-base group contained 65 companies (listed in Appendix F).

The final data set contained a total of 11 industries comprised of five industries for the low knowledge-base group (listed in Table nine) and 6sixfor the high knowledge-base group (listed in Table 10). The final data set of 130 companies represents 58% of the 224 companies from the McGregor BFA database within 11 industries.

A frequency distribution is an organisation of data in tabular form, using classes and frequencies (Jaisingh, 2000). The frequency count for the data is the number of times the class occurs in the data set (Jaisingh, 2000). In respect of Table eight the class is represented by value added (Pulic, 1998), and staff costs, which are the key variables used in this research study. In respect of Table nine and ten, the class is represented by the industry.

Insert Table 8

Rand values of value added and staff Costs

Insert Table 9

Low knowledge-base industries and frequency (listed in Appendix E)

Insert Table 10

High knowledge-base industries and frequency (listed in Appendix F)

7.3 Data screening and transformation

Data screening and transformation constitutes the first step in the analytic process of this research study. This step entails the exploration of the characteristics of the data. Data may have been incorrectly entered or distributions may deviate from normal. Errors in data entry are corrected, and variables that display non-normal distributions have been transformed. There are two major implications on this research study that arise as a result of the implementation of this step:

7.3.1 Implication one

In order to ensure that the data are suitable for estimation purposes (ready for use in the analysis), the following restrictions were placed on the sample:

- Companies with omitted key variables or misreported data values (such as undisclosed or zero staff costs) were excluded from the data set; and
- The requirement that all variables must be positive. The removal of variables that were negative is justified by the natural logarithmic transformation of the data (Loof and Heshmati, 2002).

7.3.2 Implication two

Transformation results in the reexpression of data on a new scale using a single mathematical function for each data input (Cooper and Schindler, 2001). The results of transforming the data using natural logarithmic transformation, improves interpretation and compatibility of the data, enhances the symmetry, stabilises the spread and improves the linear relationships between and among variables. This transformation makes it possible for correlation and regression analysis to be used.

7.3.3 Assessing normality

The Kolmogorov-Smirnov statistic will represent the primary test conducted in order to assess normality. Histograms are also provided, and an assessment of the skewness is made if normality still presents a problem after transformation. Skewness refers to the shape of the distribution.

7.3.3.1 Low knowledge-base group

Histograms were reviewed for the normal distribution of data and the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were performed on all the variables. Each variable was tested for normality (Appendix G: figures 1 – 10). The first analysis depicted scores for each variable that were not normally distributed (Table 11).

Insert Table 11

Tests of normality for low knowledge-base group (untransformed)

It is apparent from the tests of normality (Table 11) that the natural logarithmic transformation is appropriate because the distribution of the data for the variables is not normally distributed (other than SCVA). If the significance level using the Kolmogorov-Smirnov statistic is greater than 0.05 then normality is assumed.

For each variable that was not normally distributed a natural logarithmic transformation was carried out (Appendix G: figures 11 – 20). As a result of the data transformation, the findings were that normality could not be rejected for each variable (Table 12).

Insert Table 12

Tests of normality (transformed)

It is evident from the preceding statistics that there is still a slight problem with the normal distribution of LVAIC, LMB, and LVAHC. However, on further inspection of other diagnostic data such as the skewness normality is considered satisfactory. The skewness for these variables reflected statistics close to zero (LVAIC – 1.396, LMB – 1.404, and LVAHC – 0.751), which indicates only a mild deviation from normality, which is acceptable.

7.3.3.2 High knowledge-base group

Histograms were reviewed for normal distribution of data and the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were performed on all the variables. Each variable was tested for normality (Appendix G: figures 21 – 30). The first analysis depicted scores for each variable (other than ROA) that were not normally distributed (Table 13).

Insert Table 13

Tests of normality for high knowledge-base group (untransformed)

It is apparent from the tests of normality (Table 13) that the natural logarithmic transformation is appropriate because the distribution of the data for the variables is not normally distributed (other than ROA). If the significance level using the Kolmogorov-Smirnov statistic is greater than 0.05 then normality is assumed.

For each variable that was not normally distributed a natural logarithmic transformation was carried out (Appendix G: figures 31 – 39). As a result of the data transformation, the findings were that normality could not be rejected for each variable (Table 14).

Insert Table 14

Tests of normality (transformed)

It is evident from the preceding statistics that there is still a slight problem with the normal distribution of LATO, LMB, LVAHC, and LSCVA. However, on further inspection of other diagnostic data such as the skewness normality is considered satisfactory. The skewness for these variables reflected statistics close to zero (LATO – 1.277, LMB – 1.132, LVAHC – 1.201, and LSCVA – 2.83), which indicates only a mild deviation from normality, which is acceptable.

7.4 Analysis of knowledge-based groups

To assist in the comparison and contrast of the two groups the following descriptive statistics and independent groups t-test were analysed on the variables for knowledge intensity and intellectual capital performance for each group. This analysis assists in determining that the groups are different.

7.4.1 Low knowledge-base group

Insert Table 15

Descriptive statistics for low knowledge-base group (untransformed data)

The first part of the VAIC™ methodology uses a measure of labour value added that could be used to gauge knowledge intensity (Stewart, 2002). This variable is known as the Value Added Human Capital Coefficient (Value Added/Human Capital [Staff Costs]). It measures how much value added has been created by one Rand invested in employees. The mean for the low knowledge-base group is 1.2060.

The low knowledge-base group has a large fixed asset base, with a physical capital intensity of 26.37%. The low knowledge-base group has a small intangible asset base with a mean of R183,891.

7.4.2 High knowledge-base group

Insert Table 16

Descriptive statistics for the high knowledge-base group (untransformed data)

In contrast to the low knowledge-base group, the high knowledge base group contains a much larger mean for Value Added Human Capital Coefficient of 3.3875, indicating a higher knowledge intensity.

The high knowledge-base group has a smaller fixed asset base, with a physical capital intensity of 21.12%. The high knowledge-base group has a larger intangible asset base with a mean of R735,600. These two variables indicate that the high knowledge-base group is reliant on less physical assets and more intangible assets.

According to Sveiby (1997) companies that reflect a high degree of knowledge intensity, rely more on intangible assets than physical assets and is an indication of high knowledge-base companies.

7.4.3 Independent groups t-tests

The focus of this study is on knowledge intensity and intellectual capital performance. To provide evidence that the high and low knowledge-base groups are completely different, an Independent Groups t-test was carried out in respect of knowledge intensity and intellectual capital performance. This test is appropriate to justify the distinction between the high and low knowledge-base groups. A Levene test was used to see if the assumption of equal variances has been violated (Walker, 2001).

7.4.3.1 Knowledge intensity

Insert Table 17

Group statistics and independent samples test (untransformed data)

The F statistic = 19.974 with an associated probability significance of $\rho < 0.05$, indicates that the hypothesis of equal variances is rejected. This is confirmed by the use of the equality of means test. The t-test for the equality of means finding is that knowledge intensity variables differ significantly between the high and low knowledge-base groups. (t = 2.744 with 128 degrees of freedom and significance of $\rho < 0.05$).

Given that the Levene's test has a probability of less than 0.05, it can be assumed that the variances are unequal. The t-test, degrees of freedom and two-tail significance for the equal variance estimates determine whether knowledge-base type differences exist. The two-tail significance for knowledge intensity indicates a probability of less than 0.05 and is thus significant. It can therefore be accepted that the two groups based on knowledge intensity are different.

7.4.3.2 Intellectual capital performance

Insert Table 18

Group statistics and independent samples test (untransformed data)

The F statistic = 19.051 with an associated probability significance of $\rho < 0.05$, indicates that the hypothesis of equal variances is rejected. This is confirmed by the use of the equality of means test.

The t-test for the equality of means finding is that knowledge intensity variables differ significantly between the high and low knowledge-base groups ($t = 3.067$ with 128 degrees of freedom and significance of $\rho < 0.05$).

Given that the Levene's test has a probability of less than 0.05, it can be assumed that the variances are unequal. The t-test, degrees of freedom and two-tail significance for the equal variance estimates determine whether knowledge-base type differences exist. The two-tail significance for intellectual capital performance indicates a probability of less than 0.05 and is thus significant. It can therefore be accepted that the two groups based on intellectual capital performance are different.

The above tests confirm that there is a significant difference between the two groups in respect of knowledge intensity and intellectual capital performance. It also confirms and supports the breakdown of companies into high and low knowledge-base groups, as well as to combine like industries upon the theoretical construct of knowledge base – a company's source of value creation.

7.5 Model 1 – part A: decisive business resource

7.5.1 Introduction

To test *H1*: The correlation coefficient for intellectual assets to value added exceeds that of tangible assets to value added: the following correlations will be used in determining the decisive business resource in the South African economy:

- physical capital and value added;
- human capital and value added; and
- structural capital and value added.

7.5.2 Research results

For Model 1 – part A, there will be a single sample comprised of 130 companies (listed in Appendix C and D). The Spearman's rank order correlation is used as the data being analysed is untransformed and does not have a normal distribution (Coakes and Steed, 2001).

Insert Table 19

Correlation between value added and structural capital

Insert Table 20

Correlation between value added and human capital

Insert Table 21

Correlation between value added and physical capital

7.5.3 Analysis and interpretations

The closer the coefficient of correlation is to positive one, the more powerful the relationship between the variables are, and the more reliable forecasts can be made in terms of regression analysis (Julyan and Nel, 2003). Tables 19, 20 and 21 are discussed in terms of this understanding of the coefficient of correlation.

Table 19 shows the relationship between structural capital and value added. The correlation coefficient is 0.24 ($\rho < 0.01$), showing that there is a weak positive relationship between structural capital and value added. The implication of this result suggest that structural capital plays a very ineffective part in determining value creation in an emerging economy such as South Africa.

Table 20 shows the relationship between human capital and value added. The correlation coefficient is 0.88 ($\rho < 0.01$), showing that there is a strong positive relationship between human capital and value added. The implication of this result suggest that human capital is an important factor in the determination of value creation in an emerging economy such as South Africa.

Table 21 shows the relationship between physical capital and value added. The correlation coefficient is 0.90 ($\rho < 0.01$), showing that there is a strong positive relationship between physical capital and value added. The implication of this result suggest that physical capital is an important factor in determining value creation in an emerging economy such as South Africa.

7.5.4 Summary

The correlation coefficients for that of intellectual assets (structural capital and human capital) to value added do not exceed that of tangible assets (physical capital) to value added. *H1* is therefore rejected.

7.6 Model 1 – part B: decisive business resource

7.6.1 Introduction

To further analyse the respective relationships defined in the Model 1 – part A, linear multiple regression analysis is performed based on the general model used in Firer and Mitchell Williams (2003): (This model will be applied to high knowledge-base and low knowledge-base companies).

Equation 17

$$\ln ATO = a_0 + a_1 \ln(VACA) + a_2 \ln(VAHC) + a_3 \ln(SCVA) + a_4 \ln(OS) + a_5 \ln(DER) + a_6 (IT) + \varepsilon$$

Equation 18

$$\ln ROA = a_0 + a_1 \ln(VACA) + a_2 \ln(VAHC) + a_3 \ln(SCVA) + a_4 \ln(OS) + a_5 \ln(DER) + a_6 (IT) + \varepsilon$$

Equation 19

$$\ln MB = a_0 + a_1 \ln(VACA) + a_2 \ln(VAHC) + a_3 \ln(SCVA) + a_4 \ln(OS) + a_5 \ln(DER) + a_6 (IT) + \varepsilon$$

The null hypothesis H_0 is that $a_{2-3} \leq 0$

The alternative hypothesis H_1 is that $a_{2-3} > 0$ (i.e. a right-tailed test that there is a significant positive relationship between a_{2-3} and company performance)

7.6.2 Low knowledge-base group

7.6.2.1 Descriptive statistics

Insert Table 22

Descriptive statistics for low knowledge-base group (untransformed data)

Comparison of VACA, VAHC and SCVA mean values suggest that during 2001 the sample companies were generally more effective in generating value from their human resource assets than physical and structural assets. South African listed companies appear to have a higher return on value added from human capital than return on value added from physical capital or structural capital. The above interpretation has its limitations, in that the mean contains extreme values, large or small, and therefore the above interpretation can be misleading. However, it is important to note at this stage of the analysis, those South African companies in the low knowledge-base group that place emphasis in their human capital will achieve high returns.

7.6.2.2 Correlation analysis

Insert Table 23

Correlation analysis for low knowledge-base group

7.6.2.2(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate LVACA is significant and positively associated (ρ<0.01) with LROA, LATO, LMB, and LDER. LVAHC is significant and positively associated (ρ<0.01) with LROA, LMB, and LMCAP. LVAHC is significant and negatively associated (ρ<0.01) with LATO. LSCVA is significant and positively associated (ρ<0.01) with LROA, LMB, and LMCAP. LSCVA is significant and negatively associated (ρ<0.01) with LATO. Overall, the correlation results imply that the sample companies with a higher-level efficiency of value added from their physical capital were associated with higher-levels of profitability, productivity, market valuation, and risk.

Sample companies with a higher-level efficiency of value added from their human capital were associated with higher-levels of profitability, market valuation, and company size and lower levels of productivity. Sample companies with a higher-level efficiency of value added from their structural capital were associated with higher-levels of profitability, market valuation, and company size and lower levels of productivity.

7.6.2.3 Multicollinearity analysis

Insert Table 24

Multicollinearity analysis for low knowledge-base group

The above table indicates that all the VIF statistics are less than 10 except for LSCVA. As a result LSCVA is removed from the model.

Insert Table 25

Multicollinearity analysis for low knowledge-base group (removing LSCVA)

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.6.2.4 Regression analysis

7.6.2.4(a) Dependent variable – productivity

Insert Table 26

Research results – Equation 17 (removing LSCVA)

7.6.2.4(a.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 26, gave a computed value for the F-value of 16.244 at the 0.05 level of significance. This shows that the multiple regression was significant and valid.

The R^2 value reached 0.699, thus indicating that the regression was "strong" as about 70% of the variation in productivity could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of physical capital (LVACA) and human capital (LVAHC) were statistically significant.

The t-test for physical capital (LVACA) indicated a t-test greater than zero (5.912), which shows a positive relationship with productivity, while the t-test for human capital (LVAHC) indicated a t-test less than zero (-4.625), which shows a negative relationship with productivity.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 17. The "Beta" analysis for Equation 17 indicates that physical capital (LVACA) contributes to the explanatory power of Equation 17 more than any of the other independent variables.

H2 stated that human capital must be positively associated with company performance. This hypothesis was based on the premise that human capital contributes more to productivity than does physical capital. From the above analysis it is clear that in respect of Equation 17 for the low knowledge-base group of companies, physical capital contributes more to productivity than human capital.

The t-test also shows that human capital has a negative association with productivity. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that human capital is positively associated with productivity.

7.6.2.4(b) Dependent variable – profitability

Insert Table 27

Research results – Equation 18 (removing LSCVA)

7.6.2.4(b.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 27, gave a computed value for the F-statistic of 20.438 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.745, thus indicating that the regression was "strong" as about 75% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficient of physical capital (LVACA) is statistically significant.

The t-test for physical capital (LVACA) indicated a t-test greater than zero (7.786), which shows a positive relationship with profitability, while the t-test for human capital (LVAHC) indicated a t-test greater than zero (1.967), which shows a positive relationship with profitability. However, the association between human capital (LVAHC) and profitability is not significant at the 0.05 level. This indicates that human capital (LVAHC) does not contribute to profitability.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 18. The "Beta" analysis for Equation 18 indicates that physical capital (LVACA) contributes to the explanatory power of Equation 18 more than any of the other independent variables.

H2 stated that human capital must be positively associated with company performance. This hypothesis was based on the premise that human capital contributes more to profitability than does physical capital. From the above analysis it is clear that in respect of Equation 18 for the low knowledge-base group of companies, physical capital contributes more to profitability than human capital. Although a positive relationship exists with profitability, it is not significant. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that human capital is positively associated with profitability.

7.6.2.4(c) Dependent variable – market valuation

Insert Table 28

Research results – Equation 19 (removing LSCVA)

7.6.2.4(c.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 28, gave a computed value for the F-statistic of 9.346 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 statistic reached 0.572, thus indicating that the regression was "strong" as about 57% of the variation in market valuation could be explained by the independent variables. The results of the t-test indicate that neither the regression coefficient of physical capital (LVACA) or human capital (LVAHC) is statistically significant.

The t-test for physical capital (LVACA) indicated a t-test greater than zero (0.464), which shows a positive relationship with market valuation, while the t-test for human capital (LVAHC) indicated a t-test greater than zero (1.378), which shows a positive relationship with market valuation. However, the association between human capital (LVAHC) and market valuation is not significant at the 0.05 level. This indicates that human capital (LVAHC) does not contribute to market valuation.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 19. The "Beta" analysis for Equation 19 indicates that neither physical capital (LVACA) nor human capital contributes significantly to the explanatory power of Equation 19.

H2 stated that human capital must be positively associated with company performance. Although a positive relationship exists with market valuation, it is not significant. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that human capital is positively associated with market valuation.

7.6.3 High knowledge-base group

7.6.3.1 Descriptive statistics

Insert Table 29

Descriptive statistics (untransformed data)

Comparison of VACA, VAHC and SCVA mean values suggest that during 2001 the sample companies were generally more effective in generating value from their human resource assets than physical and structural assets. South African listed companies appear to have a higher return on value added from human capital than return on value added from physical capital or structural capital. The above interpretation has its limitations, in that the mean contains extreme values, large or small, and therefore the above interpretation can be misleading. However, it is important to note at this stage of the analysis, those South African companies in the high knowledge-base group that place emphasis in their human capital will achieve high returns.

7.6.3.2 Correlation analysis

Insert Table 30

Correlation analysis for high knowledge-base group

7.6.3.2(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate LVACA is significant and positively associated (ρ<0.01) with LROA, LMB, and LDER. LVAHC is significant and negatively associated (ρ<0.01) with LATO. LSCVA is significant and negatively associated (ρ<0.05) with LATO. Overall, the correlation results imply that the sample companies with a higher-level efficiency of value added from it physical capital were associated with higher-levels of profitability, company size, and risk. Sample companies with a higher-level efficiency of value added from it human capital were associated with lower levels of productivity. Sample companies with a higher-level efficiency of value added from it structural capital were associated lower levels of productivity.

7.6.3.3 Multicollinearity analysis

Insert Table 31

Multicollinearity analysis for high knowledge-base group

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.6.3.4 Regression analysis

7.6.3.4(a) Dependent variable – productivity

Insert Table 32

Research results – Equation 17

7.6.3.4(a.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 32, gave a computed value for the F-statistic of 6.415 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.666, thus indicating that the regression was "strong" as about 67% of the variation in productivity could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of physical capital (LVACA) and human capital (LVAHC) were statistically significant.

The t-test for physical capital (LVACA) indicated a t-test greater than zero (2.443), which shows a positive relationship with productivity, while the t-test for human capital (LVAHC) indicated a t-test less than zero (-3.262), which shows a negative relationship with productivity.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 17. The "Beta" analysis for Equation 17 indicates that human capital (LVAHC) contributes to the explanatory power of Equation 17 more than any of the other independent variables, however the contribution is negative.

H2 stated that human capital must be positively associated with company performance. This hypothesis was based on the premise that human capital contributes more to productivity than does physical capital. From the above analysis it is clear that in respect of Equation 17 for the high knowledge-base group of companies, human capital contributes more to productivity than physical capital. However, the contribution of physical capital is positive, while the contribution of human capital is negative. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that structural capital is positively associated with productivity.

H3 stated that structural capital must be positively associated with company performance. The t-test for structural capital (LSCVA) indicated a t-test less than zero (-0.919), which shows a negative relationship with productivity, however the association was not significant at the 0.05 level. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that human capital is positively associated with productivity.

7.6.3.4(b) Dependent variable – profitability

Insert Table 33

Research results – Equation 18

7.6.3.4(b.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 33, gave a computed value for the F-statistic of 3.727 at the 0.05 level of significance. This shows that the multiple regression was significant and valid.

The R^2 value reached 0.536, thus indicating that the regression was "strong" as about 54% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficient of physical capital (LVACA) is statistically significant.

The t-test for physical capital (LVACA) indicated a t-test greater than zero (3.320), which shows a positive relationship with profitability, while the t-test for human capital (LVAHC) indicated a t-test less than zero (-0.348), which shows a negative relationship with profitability. However, the association between human capital (LVAHC) and profitability is not significant at the 0.05 level. Indicating that human capital (LVAHC) does not contribute to profitability.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 18. The "Beta" analysis for Equation 18 indicates that physical capital (LVACA) contributes to the explanatory power of Equation 18 more than any of the other independent variables.

H2 stated that human capital must be positively associated with company performance. This hypothesis was based on the premise that human capital contributes more to profitability than does physical capital. From the above analysis it is clear that in respect of Equation 18 for the high knowledge-base group of companies, physical capital contributes more to profitability than human capital. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that human capital is positively associated with profitability.

H3 stated that structural capital must be positively associated with company performance. The t-test for structural capital (LSCVA) indicated a t-test greater than zero (0.441), which shows a positive relationship with profitability, however the association was not significant at the 0.05 level. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that structural capital is positively associated with profitability.

7.6.3.4(c) Dependent variable – market valuation

Insert Table 34

Research results

7.6.3.4(c.i) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 34, gave a computed value for the F-statistic of 1.649 at a level of significance of 0.148, which is greater than the accepted level of significance of 0.05. This shows that the multiple regression was not significant. The R^2 value reached 0.339, thus indicating that the regression was "strong" as about 34% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that no regression coefficient is statistically significant.

The null hypothesis is therefore not rejected as the data does not support the hypothesis that human capital or structural capital is positively associated with market valuation.

7.6.4 Summary of results

7.6.4.1 Low knowledge-base group

Insert Table 35

Summary of results

7.6.4.2 High knowledge-base group

Insert Table 36

Summary of results

7.7 Model 2 – within industry analysis

7.7.1 Introduction

Within a given industry, and controlling for the differences in organisational level factors, the greater the value (performance) of a company's intellectual capital:

H4: The greater the company's productivity;
H5: The greater the company's profitability; and
H6: The greater the market's valuation of the company relative to the value of its financial and physical assets.

These hypothesised relationships will be estimated as follows:

Equation 20

$$H4\!: \ln ATO = a_0 + a_1(\ln VAIC^{TM}) + a_2(\ln PC) + a_3(\ln OS) + a_4(\ln DER) + a_5(\ln ROA) + a_6(IT) + \varepsilon$$

Equation 21

$$H5\!: \ln ROA = a_0 + a_1(\ln VAIC^{TM}) + a_2(\ln PC) + a_3(\ln OS) + a_4(\ln DER) + a_5(\ln ATO) + a_6(IT) + \varepsilon$$

Equation 22

$$H6\, \ln MB = a_0 + a_1(\ln VAIC^{TM}) + a_2(\ln PC) + a_3(\ln OS) + a_4(\ln DER) + a_5(\ln ATO) + a_6(IT) + a_7(\ln ROA) + \varepsilon$$

For each hypothesis: $a_1(VAIC^{TM}) > 0$

The null hypothesis H_0 is that $a_1(VAIC^{TM}) \leq 0$

The alternative hypothesis H_1 is that $a_1(VAIC^{TM}) > 0$ (i.e. a right-tailed test that there is a positive relationship between $a_1(VAIC^{TM})$ company performance)

Insert Table 37

Summary of the within knowledge-base group analysis

7.7.2 Low knowledge-base descriptive statistics

Insert Table 38

Descriptive statistics of the low knowledge-base group

The above table presents the minimum, maximum, mean and standard deviation of the untransformed dependent variables, independent (explanatory) variables for the low knowledge-base final data set. Profitability (ROA) and productivity (ATO) have means of 16.5906% and 1. 4331 respectively.

Overall the financial performance of the sample companies is quite sound as indicated by the reasonably high ROA. Productivity is at low levels as indicated by the fact that for R1 spent on assets only R1.40 is generated in turnover. The mean for market valuation (MB) of 1.7230 indicates that investors in general valued the sample companies in excess of the value of the book value of net assets as reported in the financial statements. The mean for intellectual capital performance of 1.5625 suggests that during 2001 the sample companies were generally not effective in generating value from their intellectual capital base.

7.7.3 High knowledge-base descriptive statistics

Insert Table 39

Descriptive statistics of the high knowledge-base group

The above table presents the minimum, maximum, mean and standard deviation of the untransformed dependent variables, independent (explanatory) variables for the high knowledge-base final data set. Profitability (ROA) and productivity (ATO) have means of 16.6052% and 1.2240 respectively. Overall the financial performance of the sample companies is quite sound as indicated by the reasonably high ROA. Productivity is at low levels as indicated by the fact that for R1 spent on assets only R1.22 is generated in turnover. The mean for market valuation (MB) of 2.0385 indicates that investors in general valued the sample companies in excess of the value of the book value of net assets as reported in the financial statements. The mean for intellectual capital performance of 4.2657 suggests that during 2001 the sample companies were generally effective in generating value from their intellectual capital base.

7.7.4 Model A

7.7.4.1 Correlation analysis

Insert Table 40

Correlation analysis for Model A

7.7.4.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that LATO is found to be significant and positively correlated (ρ<0.01) with risk and profitability. LATO is found to be significant and negatively correlated (ρ<0.01) with company size.

Overall, the correlation results imply that sample companies with a higher-level of productivity were associated with higher-levels of risk and profitability and smaller company size.

7.7.4.2 Regression analysis

Insert Table 41

Research results – Equation 20

7.7.4.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 41, gave a computed value for the F-statistic of 10.7 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.649, thus indicating that the regression was "strong" as about 65% of the variation in productivity could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of company size (LMCAP) risk (LDER), profitability (LROA), and intellectual capital performance (LVAIC) are statistically significant.

The t-test for, risk (LDER – 4.684) and profitability (LROA – 4.467) indicated a t-test greater than zero which shows a positive relationship with productivity, while the t-test for company size (LMCAP) and intellectual capital performance (LVAIC – -2.891) indicated a t-test less than zero which shows a negative relationship with productivity.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 20. The "Beta" analysis for Equation 20 indicates that risk (LDER) and profitability (LROA) contributes to the explanatory power of Equation 20 more than any of the other independent variables.

H4 stated that intellectual capital must be must be positively associated with productivity. From the above analysis it is clear that in respect of Equation 20 for the low knowledge-base group of companies, intellectual capital is negatively associated with productivity. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that intellectual capital performance is positively associated with productivity.

7.7.3 Multicollinearity analysis

Insert Table 42

Multicollinearity analysis for Model A

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.4 Model B

7.7.4.1 Correlation analysis

Insert Table 43

Correlation analysis for Model B

7.7.4.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that LATO is found to be significant and positively correlated (ρ<0.05) with LROA. LATO is found to be significant and negatively correlated (ρ<0.01) with LVAIC. Overall, the correlation results imply that the sample companies with a higher-level of productivity were associated with higher-levels of profitability and lower levels of intellectual capital performance.

7.7.4.2 Regression analysis

Insert Table 44

Research results – Equation 20

7.7.4.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 44, gave a computed value for the F-statistic of 4.111 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.437, thus indicating that the regression was "robust" as about 44% of the variation in productivity could be explained by the independent variables.

The results of the t-test indicate that the regression coefficients of profitability (LROA) and intellectual capital performance (LVAIC) are statistically significant.

The t-test for, profitability (LROA – 2.070) indicated a t-test greater than zero which shows a positive relationship with productivity, while the t-test for intellectual capital performance (LVAIC – -4.227) indicated a t-test less than zero which shows a negative relationship with productivity.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 20. The "Beta" analysis for Equation 20 indicates that intellectual capital performance (LVAIC) contributes to the explanatory power of Equation 20 more than any of the other independent variables.

H4 stated that intellectual capital must be must be positively associated with productivity. From the above analysis it is clear that in respect of Equation 20 for the high knowledge-base group of companies, intellectual capital is negatively associated with productivity. The null hypothesis is therefore not rejected, as the data does not support the hypothesis that intellectual capital performance is positively associated with productivity.

7.7.4.3 Multicollinearity analysis

Insert Table 45

Multicollinearity analysis for Model B

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.5 Model C

7.7.5.1 Correlation analysis

Insert Table 46

Correlation analysis for Model C

7.7.5.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that LROA found to be significantly and positively correlated (ρ<0.01) with LVAIC and LATO. LROA has a significant and negative relationship (ρ<0.01) with LFATA. Overall, the correlation results imply the sample companies with higher-levels of profitability are associated with higher-levels of intellectual capital performance and higher-levels of productivity.

Companies with higher-levels of profitability are associated with lower levels of physical capital intensity, indicating that company profitability is not derived from the use of physical assets, but from intangible assets.

7.7.5.2 Regression analysis

Insert Table 47

Research results – Equation 21

7.7.5.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 47, gave a computed value for the F-statistic of 9.950 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.633, thus indicating that the regression was "strong" as about 63% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of company size (LMCAP), productivity (LATO), physical capital intensity (LFATA), and intellectual capital performance (LVAIC) are statistically significant.

The t-test for, company size (LMCAP – 2.263), productivity (LATO – 4.467) and intellectual capital performance (LVAIC – 6.065) indicated a t-test greater than zero which shows a positive relationship with profitability, while the t-test for physical capital intensity (LFATA) indicated a t-test less than zero (-3.460), which shows a negative relationship with profitability.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 21. The "Beta" analysis for Equation 21 indicates that and intellectual capital performance (LVAIC) contributes to the explanatory power of Equation 21 more than any of the other independent variables.

H5 stated that intellectual capital must be must be positively associated with profitability. From the above analysis it is clear that in respect of Equation 21 for the low knowledge-base group of companies, that intellectual capital is positively associated with profitability. The null hypothesis is therefore rejected as the data does support the hypothesis that intellectual capital performance is positively associated with profitability.

7.7.5.3 Multicollinearity analysis

Insert Table 48

Multicollinearity analysis for Model C

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.6 Model D

7.7.6.1 Correlation analysis

Insert Table 49

Correlation analysis for Model D

7.7.6.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that ROA is has a significant and positive relationship (ρ<0.05) with the LATO. Overall, the correlation results imply that the sample companies with higher-levels of profitability are associated with higher-levels of productivity.

7.7.6.2 Regression analysis

Insert Table 50

Research results – Equation 21

7.7.6.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 50, gave a computed value for the F-statistic of 2.562 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.326, thus indicating that the regression was "robust" as about 33% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of intellectual capital performance (LVAIC) and productivity (LATO) are statistically significant.

The t-test for, intellectual capital performance (LVAIC – 2.899) and productivity (2.070) indicated a t-test greater than zero which shows a positive relationship with profitability.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 21. The "Beta" analysis for Equation 21 indicates that and intellectual capital performance (LVAIC) contributes to the explanatory power of Equation 21 more than any of the other independent variables.

H5 stated that intellectual capital must be must be positively associated with productivity. From the above analysis it is clear that in respect of Equation 21 for the high knowledge-base group of companies, that intellectual capital is positively associated with profitability. The null hypothesis is therefore rejected as the data does support the hypothesis that intellectual capital performance is positively associated with profitability.

7.7.6.3 Multicollinearity analysis

Insert Table 51

Multicollinearity analysis for Model D

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.7 Model E

7.7.7.1 Correlation analysis

Insert Table 52

Correlation analysis for Model E

7.7.7.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that LMB is found to be significant and positively correlated with LVAIC (ρ <0.05), LROA, and LMCAP (ρ <0.01). LMB has a significant and negative relationship with LFATA (ρ <0.01).

Overall, the correlation results imply the sample companies with higher-levels of market valuation are associated with higher-levels of profitability, intellectual capital performance and company size and lower levels of physical capital intensity.

7.7.7.2 Regression analysis

Insert Table 53

Research results – Equation 22

7.7.7.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 53, gave a computed value for the F-statistic of 8.754 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.632, thus indicating that the regression was "strong" as about 63% of the variation in market valuation could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of company size (LMCAP) and physical capital intensity (LFATA) are statistically significant.

The t-test for, company size (LMCAP – 7.575) indicated a t-test greater than zero which shows a positive relationship with market valuation, while the t-test for physical capital intensity (LFATA) indicated a t-test less than zero (-2.334), which shows a negative relationship with market valuation.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 22. The "Beta" analysis for Equation 22 indicates company size (LMCAP) contributes to the explanatory power of Equation 22 more than any of the other independent variables.

H6 stated that intellectual capital must be must be positively associated with market valuation. From the above analysis it is clear that in respect of Equation 22 for the low knowledge-base group of companies, intellectual capital is not statistically significant at the 0.05 level. The null hypothesis is therefore not rejected as the data does not support the hypothesis that intellectual capital performance is positively associated with market valuation.

7.7.7.3 Multicollinearity analysis

Insert Table 54

Multicollinearity analysis for Model E

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.8 Model F

7.7.8.1 Correlation analysis

Insert Table 55

Correlation analysis for Model F

7.7.8.1(a) Analysis and interpretations

Findings from Pearson pairwise correlations indicate that LMB has a positive significant and relationship (ρ<0.01) with LMCAP and LDER. Overall, the correlation results imply that the sample companies with higher-levels of market valuation are associated with higher-levels of company size and risk.

7.7.8.2 Regression analysis

Insert Table 56

Research results – Equation 22

7.7.8.2(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 56, gave a computed value for the F-statistic of 2.617 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.356, thus indicating that the regression was "robust" as about 36% of the variation in market valuation could be explained by the independent variables. The results of the t-test indicate that the regression coefficients of company size (LMCAP) and risk (LDER) are statistically significant.

The t-test for, company size (LMCAP – 3.906) and risk (LDER – 2.566) indicated a t-test greater than zero which shows a positive relationship with market valuation.

The column headed "Beta" gives the regression coefficients expressed in standardised form. The beta coefficients show the relative contribution of the independent variables to the explanatory power of Equation 22. The "Beta" analysis for Equation 22 indicates company size (LMCAP) contributes to the explanatory power of Equation 22 more than any of the other independent variables.

H6 stated that intellectual capital must be must be positively associated with market valuation. From the above analysis it is clear that in respect of Equation 22 for the high knowledge-base group of companies, intellectual capital is not statistically significant at the 0.05 level. The null hypothesis is therefore not rejected as the data does not support the hypothesis that intellectual capital performance is positively associated with market valuation.

7.7.8.3 Multicollinearity analysis

Insert Table 57

Multicollinearity analysis for Model F

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.7.9 Summary of results

7.7.9.1 Low knowledge-base

Insert Table 58

Summary of results

7.7.9.2 High knowledge-base

Table 59

Summary of results

7.8 Model 3 – across industry analysis

7.8.1 Introduction

For the across industries regression model, there will be a single sample comprised of 130 companies (listed in Appendix C and D). Knowledge-base will be measured by a dichotomous variable coded (1) if a company was highly knowledge-based and coded (0) if low knowledge-based. The extent to which a company participates in intellectual capital activities may influence intellectual capital performance.

Companies in industries more reliant on intellectual capital components such as technology and research may provide management and directors of the entities with greater expertise and demands in managing intellectual capital. A company is therefore considered high knowledge-based if it was research intensive, meaning that it incurred research and development expenditures. If expenditures were not reported then the company was considered not research intensive and a low knowledge-based company (Mitchell Williams, 2001).

Whereas the explanatory independent variable for the within knowledge-base group was intellectual capital performance, the across industries explanatory independent variable is the interaction of the source of value creation (KB) and intellectual capital performance. Organisational level factors will also be incorporated into the research model. This will improve the models specification, and thus will help to identify the unique contribution of the interaction of knowledge and intellectual capital performance to company performance.

According Cohen and Cohen (1975, p.291), interactions are carried by products of variables. The interaction of knowledge-base and intellectual capital performance will be a product of the KB dummy variable and the quantitative variable of VAIC™. The following table will describe the interaction (Cohen and Cohen, 1975, p.301):

Insert Table 60

Example of the interaction of knowledge-base and intellectual capital performance

7.8.2 Assessing normality

Histograms were reviewed for normal distribution of data and the Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were performed on all the variables. Each variable was tested for normality (Appendix G: figures 40 – 46). The first analysis depicted scores for each variable that were not normally distributed.

Insert Table 61

Tests of normality for across industry analysis

It is apparent from the tests of normality above that the natural logarithmic transformation is appropriate because the distribution of the data for the variables is not normally distributed If the significance level using the Kolmogorov-Smirnov statistic is greater than 0.05 then normality is assumed.

For each variable that was not normally distributed a natural logarithmic transformation was carried out (Appendix G: figures 47 – 53). As a result of the data transformation, the findings were that normality could not be rejected for each variable.

Insert Table 62

Tests of normality for across industry analysis

It is apparent from the preceding statistics that there is still a slight problem with the normal distribution of the above dependent variables (LROA, LATO, LVAIC, LFATA, LMB), however on further inspection of other diagnostic data such as skewness, normality is considered satisfactory.

7.8.3 Knowledge-base (across industries) hypotheses

7.8.3.1 Introduction

The more important that knowledge is to producing an industry's goods and services, and controlling for organisational level factors:

H7: The greater the contribution a company's intellectual capital will make to its productivity;
H8: The greater the contribution a company's intellectual capital will make to its profitability: and
H9: The greater the contribution a company's intellectual capital will make to the market value of the company relative to the book value of its assets.

These hypothesised relationships are estimated as follows:

Equation 23

$$H7: lnATO = a_0 + a_1\left(KBxVAIC^{TM}\right) + a_2(IT) + a_3(lnPC) + a_4(lnOS) + a_5(lnDER) + a_6(lnROA) + a_7(KB) + a_8\left(lnVAIC^{TM}\right) + \varepsilon$$

Equation 24

$$H8: lnROA = a_0 + a_1\left(KBxVAIC^{TM}\right) + a_2(IT) + a_3(lnPC) + a_4(lnOS) + a_5(lnDER) + a_6(lnATO) + a_7(KB) + a_8\left(lnVAIC^{TM}\right) + \varepsilon$$

Equation 25

$$H9: lnMB = a_0 + a_1\left(KBxVAIC^{TM}\right) + a_2(IT) + a_3(lnPC) + a_4(lnOS) + a_5(lnDER) + a_6(lnATO) + a_7(KB) + a_8\left(lnVAIC^{TM}\right) + a_9(\ln ROA) + \varepsilon$$

For each hypothesis:

For each hypothesis: $a_1\left(KBxVAIC^{TM}\right) > 0$

The null hypothesis H_0 is that $a_1\left(KBxVAIC^{TM}\right) \leq 0$

The alternative hypothesis H_1 is that $a_1\left(KBXVAIC^{TM}\right) > 0$ (i.e. a right-tailed test that there is a positive relationship between $a_1\left(KBxVAIC^{TM}\right)$ company performance)

7.8.4 Descriptive statistics

Insert Table 63

Descriptive statistics for across industry analysis

7.8.4.1 Analysis and interpretations

The above table presents the minimum, maximum, mean and standard deviation of the transformed dependent variables, and independent variables for the final data set. Profitability and Productivity have means of 16.6% and 1.33 respectively.

Overall financial performance of the sample companies is quite sound as indicated by the reasonably high ROA. Productivity is at low levels as indicated by the fact that for R1 spent on assets only R1.33 is generated in revenue.

The mean for Market Valuation of 1.88, which indicates that investors in general valued the sample, companies in excess of the value of the book value of net assets as reported in the financial statements. The mean for intellectual capital performance of 2.9141 suggests that during 2001 the sample companies were generally not effective in generating value from their intellectual capital base.

7.8.5 Correlation analysis

Insert Table 64

Correlation data for across industry analysis

7.8.5.1 Analysis and interpretations

Findings from Pearson pairwise correlations indicate that none of the dependent variables are significantly associated with the interaction of knowledge-base and intellectual capital performance.

7.8.6 Model G

7..8.6.1 Regression analysis

Insert Table 65

Research results – Equation 23

7.8.6.1(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 65, gave a computed value for the F-value of 8.677 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.340, thus indicating that the regression was "robust" as about 34% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficient the interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant.

H6 stated that interaction of knowledge and intellectual capital must be must be positively associated with productivity. From the above analysis it is clear that in respect of Equation 23 interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant. The null hypothesis is therefore not rejected as the data does not support the hypothesis that interaction of knowledge and intellectual capital (KBVAIC) is positively associated with productivity.

7.8.8.2 Multicollinearity analysis

Insert Table 66

Multicollinearity analysis for Model G

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.8.7 Model H

7.8.7.1 Regression analysis

Insert Table 67

Research results – Equation 24

7.8.7.1(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 67, gave a computed value for the F-statistic of 6.191 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.269, thus indicating that the regression was "robust" as about 27% of the variation in profitability could be explained by the independent variables. The results of the t-test indicate that the regression coefficient the interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant.

H6 stated that interaction of knowledge and intellectual capital must be must be positively associated with profitability. From the above analysis it is clear that in respect of Equation 24 interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant. The null hypothesis is therefore not rejected as the data does not support the hypothesis that interaction of knowledge and intellectual capital (KBVAIC) is positively associated with profitability.

7.8.7.2 Multicollinearity analysis

Insert Table 68

Multicollinearity analysis for Model H

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.8.8 Model I

7.8.8.1 Regression analysis

Insert Table 69

Research results – Equation 25

7.8.8.1(a) Analysis and interpretations

The ANOVA analysis in the regression report, shown in Table 67, gave a computed value for the F-statistic of 10.48 at the 0.05 level of significance. This shows that the multiple regression was significant and valid. The R^2 value reached 0.417, thus indicating that the regression was "robust" as about 42% of the variation in market valuation could be explained by the independent variables. The results of the t-test indicate that the regression coefficient the interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant.

H6 stated that interaction of knowledge and intellectual capital must be must be positively associated with market valuation. From the above analysis it is clear that in respect of Equation 24 interaction of knowledge and intellectual capital (KBVAIC) is not statistically significant. The null hypothesis is therefore not rejected as the data does not support the hypothesis that interaction of knowledge and intellectual capital (KBVAIC) is positively associated with market valuation.

7.8.8.2 Multicollinearity analysis

Insert Table 70

Multicollinearity analysis for Model I

The above table indicates that all the VIF statistics are less than 10 and therefore multicollinearity is not a concern.

7.8.9 Summary of results across industries

Table 71

Summary of results

7.9 Summary

Insert Table 72

Anova summary

One of the primary objectives of this research study is to empirically examine a developing measure of intellectual capital. The study compares the association between the Value Added Intellectual Coefficient and measures of company performance, such as productivity, profitability, and market valuation. The Value Added Intellectual Coefficient is found to explain company performance in eight out of twelve models (Table 72 above). These findings suggest that the VAIC™ methodology can be viewed as a step toward the creation of an accepted measuring system for the knowledge-economy.

The findings of this study also suggest that 11 out of 12 models have significant explanatory and predictive power as evidence by the F statistics in each model. These findings also provide evidence that the basic theoretical construct of the regression models was correct.

As a whole, the research results provide sufficient evidence that intellectual capital has explanatory and predictive powers in respect of company performance.

7.10 The implications of the research results

7.10.1 Model 1 – part A: determining the decisive business resource

Insert Table 73

Summary of results for Model 1 – part A

7.10.1.1 Implications

The correlation statistics in Table 73 reflect relationships that are all significant and positive. The strongest correlation appears to be the correlation between physical capital and value added.

Pulic (1998) argues that it is the management and development of human capital that gives developed economies a competitive edge over emerging economies such as South Africa. In his study on human capital in the Austrian and Croatian economies, he concludes that human capital, and not physical capital, is the determinant for the creation of value.

The correlation between human capital and value added is high in both these countries and the correlation between physical capital and value added is low (Pulic, 1998).

According to Pulic (1998), this is the "telltale" sign of a developed economy that can be said to be knowledge based. In contrast, the South African economy reflects correlations between human capital and value added and physical capital and value added that are almost equal. This shows that human and physical capital both make an equal contribution to the creation of wealth in the South African economy, evidence that South Africa has not yet manifested this “tell tale” sign of a country that has entered the knowledge economy.

7.10.2 Model 1 – part B: determining the decisive business resource

Table 74

Summary of results for Model 1 – part B

7.10.2.1 Low knowledge-base

7.16.2.1(a) Implications

The results that relate to Model 1 show that there is a strong positive relationship between physical capital and productivity. The beta coefficients reflect that physical capital contributes more than human capital to the explanatory power of this Equation. This finding implies that publicly traded companies and the business environment in South Africa view physical capital as the key driver of company productivity. This means that companies in South Africa are seeking to increase productivity through the employment of physical capital assets rather than by pouring their efforts into utilising their human resource base.

The results that relate to Model 2 show that there is a positive relationship between physical capital and profitability. The beta coefficients reflect that physical capital contributes more than human capital to the explanatory power of this Equation.

This finding implies that publicly traded companies and the business environment in South Africa view physical capital as the key driver of company profitability. In other words, companies in South Africa are seeking to increase profitability through the employment of physical capital assets rather than by pouring their efforts into utilising their human resource base.

The results that relate to Model 3 show that there is no significant relationship between physical capital and market valuation and human capital and market valuation. This finding implies that the market in South Africa places no significant emphasis on returns from human capital or physical capital.

It is evident from the findings from the low knowledge-base group that there is sufficient acceptable empirical evidence that physical capital contributes more to company performance than human capital. These results imply that companies in the low knowledge-base group have the ability to transform employees' knowledge into non-human knowledge. In other words, much of the human capital in low knowledge-base companies is absorbed in large capital outlays (i.e. machinery and equipment) found in construction and other manufacturing-intensive industries.

7.10.2.2 High knowledge-base

7.10.2.2(a) Implications

The results that relate to Model 4 show that there is a strong positive relationship between physical capital and productivity. The beta coefficients reflect that physical capital contributes more than human capital and structural capital to the explanatory power of this Equation. This finding implies that publicly traded companies and the business environment in South Africa view physical capital as the key driver of company productivity.

This means that companies in South Africa are seeking to increase productivity through the employment of physical capital assets rather than by pouring their efforts into utilising their human resource base.

The results that relate to Model 5 show that there is a positive relationship between physical capital and profitability. The beta coefficients reflect that physical capital contributes more than human capital and structural capital to the explanatory power of this Equation.

This finding implies that publicly traded companies and the business environment in South Africa view physical capital as the key driver of company profitability. In other words, companies in South Africa are seeking to increase profitability through the employment of physical capital assets rather than by pouring their efforts into utilising their human resource base.

The results that relate to Model 6 show that there is no significant relationship between physical capital and market valuation, human capital and market valuation and structural capital and market valuation. This finding implies that the market in South Africa places no significant emphasis on returns from human capital, structural capital, or physical capital.

7.10.2.2(b) Discussion

The principal purpose of this component of the research study was to analyse further the respective relationships defined in the Model 1 – part A, by providing additional evidence as to the primary business resource in the South economy. Overall, in both knowledge-base groups, the findings indicate that physical capital is the dominant company resource when measuring productivity and profitability.

7.10.2.2(b.i) Physical capital

Empirical findings suggest physical capital is the only company resource that has a significant and positive association with productivity and profitability. This finding suggests that companies in South Africa view physical capital resources, and not human capital or structural capital resources, as critical for competitive advantage and strong financial performance.

As previously stated, historically South Africa was recognised for its underlying wealth of natural resources and therefore traditional business practices over many years were developed on the basis of the use of these physical capital resources. Investments in physical capital resources became the accepted methodology for the reduction of risk and uncertainty. Government saw investments in physical capital assets as the source of competitive advantage. Companies were given tax incentives and interests rates were kept artificially low in order that companies invested in physical capital resources.

Government and management viewed investments in human capital resources to be inherently more risky than physical capital resource investments. The reasoning was that companies owned physical capital resources, but not human capital resources. Accepted accounting practice viewed physical resources as assets and human capital resources as expenses. Investments in people have, historically, never been considered assets. Physical capital resources were viewed as the only resources that could produce future economic benefits. This is reflected in the World Competitiveness Scoreboard, published annually by the International Institute for Management Development in Switzerland. For the last 5 years (1996 to 2000) South Africa has been rated between 42 and 44 out of a total of 47 countries (Meyer and Botha, 2000).

Meyer and Botha (2000 p.5 and 167) state that the reasons for this are: (1) the fragile relationship between labour and management; (2) the productivity output of companies in South Africa falls in the lowest 10% when compared to other developing nations; and (3) the poor state of South Africa's skills development. These problems are as a direct result of the lack of investments in human resource assets and the utilisation of physical capital resources as a company's strategic asset.

The findings of this component of the research study are therefore not surprising. In 2001, physical capital resources are still viewed by companies as the primary strategic asset.
For nearly half a century the South African economy has relied upon the use of physical capital resources, and it was only in 1998 that government recognised the weaknesses in these business practices and has developed a strategy that will address them.

It is not feasible in the space of three years to completely change these traditional business practices and perceptions on wealth creation.

7.10.2.2(b.ii) Human capital

In accordance with the resource-based view of the firm, human capital resources should have a positive effect on company performance. However, the empirical findings suggest that human capital has a significant and negative association with productivity for both knowledge-base groups and no significant association with profitability and market valuation.

As a result of the traditional business practices and perceptions of wealth creation that have existed for many years, there are: (1) a large populace of unskilled workers in the South African economy which lacks the basic skill-base for meaningful employment; (2) low levels of productivity as a result of poor and inadequate training; (3) large disparities between skills of whites and previously disadvantaged groups; (4) low levels of expenditure on training, (training was perceived as too costly and the benefits of training could not be quantified in order to change this view). Hofmeyr (2000) provides the following statistics: on average South African companies spend about 2.7% of their payroll on training their employees, compared to between 4 and 6% in OECD countries and 10% in Japan.

The findings of this component of the research study are therefore not surprising (as in the findings for physical capital resources). The key conclusions from these findings are that South African companies do not place a high enough value on their human resource assets and that little is done about training and development.

7.10.2.2(b.iii) Structural capital

Empirical findings fail to indicate any strong association between structural capital and any of the dimensions of company performance. This suggests that companies in South Africa have poor systems and procedures by which to monitor their behaviour and therefore the overall intellectual capital will not reach its fullest potential. This finding will have an impact on the human capital of the company.

If a company does not have an effective supportive culture (structural capital), human capital will not be innovative. Therefore, human capital will not perform and will not contribute in a manner promoting improved company performance (as indicated by the findings on human capital).

Findings related to the association between market valuation and each of a company's major resource components indicate that the South African market appears to give very little attention to the performance of company resources. This suggests that investors in South Africa place more emphasis on non-financial performance indicators (such as company image, sentiment and company size) when implementing their investment strategies.

The empirical findings, based on correlation and linear multiple regression analysis, indicate that the South African economy places greater faith and value in physical capital assets than in human and structural assets.

7.10.3 Model 2: The explanatory and predictive power of intellectual capital in determining company performance (within industry analysis)

Table 75

Summary of results for Model 2

7.10.3.1 Implications and discussion

7.10.3.1(a) Profitability

The results that relate to Model C and D (Table 75) indicate that there is a significant positive relationship between the performance of intellectual capital and profitability. The beta coefficients and the R^2 for this relationship shown in Table 75 (Models C and D) indicate that these models are robust.

This is a profound result, within the context of the South African economy, as it implies that if company management is able to realise the full potential of its organisation's intellectual capital, it will result in company success and ultimately shareholder value and competitive advantage.

The movement of money through a company is ultimately the most tangible measure of its value. It is also the source of its rewards in terms of profits, salaries, and earnings.

The history of business, beneath all the changes in technology, organisation, and management theory, is just an allegory of how to attach monetary value to activity and assets. Consequently, if intellectual capital is to have value, it must be converted into cash, profits, and earnings. As stated previously in this research study, if intellectual capital cannot be converted into profits and improved business performance, it is not worth pursuing as a construct. It is therefore not a resource that results in sustainable competitive advantage. In simple terms, at some point in time all intellectual capital must convert to currency. For example, a new technology may take months to develop and years to convert to a real product, but at some point, it must turn into revenues for the company.

By the same token, indices of customer satisfaction, employee morale and any of the other indices discussed in Chapter 3, must also manifest themselves as higher revenues, lower overhead and greater profits.

The findings of this also imply that as profitability increases, shareholders will become more content with management decisions. With less pressure to meet the expectations of the shareholders, management will have greater flexibility to address the needs of other stakeholder groups such as employees and customers, thus fostering greater intellectual capital performance in a company.

At this point of the research study, the following pertinent statement needs to be addressed: if all stakeholders are to be convinced of the validity of intellectual capital as an instrument that management can employ to procure sustainable competitive advantage, researchers need to furnish empirical evidence that intellectual capital performance can be converted into profits. The significant positive relationship between intellectual capital performance and that of financial performance as measured by profitability provides this much needed evidence that intellectual capital is an asset that can be utilised as a vehicle for improving company profitability.

Although the findings in Model 1 suggest that physical capital is the dominant business resource in the South African economy, the findings in the Model 2, parts C and D, suggest that should management administer its intellectual assets in the same manner as their physical assets, improved financial performance, and ultimately increased stakeholder value, would be the result.

7.10.3.1(b) Productivity

It is important to note the following:

- In the low and high knowledge-base groups (Table 75, Models A and B), there is enough statistical evidence at the ($p < 0.05$ level) to infer that a significant negative relationship between intellectual capital performance and productivity exists.

The primary reason for this finding can also be explained by the same reasoning as discussed in respect of the inverse relationship human capital has with productivity. There is no need to discuss it again in respect of this component of the research study.

This negative relationship also suggests that as a company's employees become more productive, management focuses on the requirements of the shareholders, rather than on those of employees. By focusing on the needs of the company's shareholders, management may not take sufficient time to effectively manage its intellectual capital.

This negative relationship can also be explained by the following intuitive reasoning: when companies invest in physical capital assets, intellectual capital assets are left unattended and therefore under perform, yet productivity remains high.

This is attributable to the good performance of physical capital assets and not the poor performance of intellectual capital assets. On the other hand, when a company invests in intellectual capital assets, which results in the good performance of these assets, productivity is reduced.

The question arises: how is this possible? When a company invests in intellectual capital assets, as previously discussed, the investments made are not substantial, but the nevertheless indicates that human capital is performing.

There are two possible explanations for poor productivity. (1) Poor performance of physical capital assets: the positive relationship between physical capital assets and productivity indicates that when the performance of physical capital is low, productivity is low as well. (2) The learning curve: during the transitional phase when company learning is converted into productivity, company outputs are converted at a slower rate than intellectual capital asset performance.

7.10.3.1(c) Market valuation

It is important to note the following:

- In the low and high knowledge-base groups (Table 75, E and F) there is inadequate statistical evidence at the ($p < 0.05$ level) to infer that there is a significant relationship between intellectual capital performance and market valuation.

In terms of this finding, there is no significant relationship between intellectual capital performance and market valuation. The implication is that the market in South Africa places no serious emphasis on returns from investments in intellectual capital assets. A probable reason is that standard accounting models were designed for informing users of annual reports on stocks and flows of value – value that could be attributable to places, periods of time, products, customers and activities. Most of these are quantifiable and subject to generally accepted accounting principles (GAAP). In contrast, intellectual capital is a relatively new and enigmatic concept, relating primarily to the intangible assets of a company. As such, the current accounting model does not adequately capture its value nor represent it in a concise, meaningful format. Therefore, the users of annual reports are unable to incorporate the relevant information with respect to investments in intellectual capital assets in their valuation models, as the information is not adequately disclosed.

If there is to be a change in the empirical findings (relating to this component of the research study), accounting for intellectual capital will ultimately require the invention of new financial and management accounting concepts and practices to enable the relevant information about investments in intellectual capital assets to be efficiently communicated to the users of annual reports.

The findings also suggest that the South African market appears to give very little attention to the performance of intellectual capital assets.

This suggests that investors in South Africa place more emphasis on non-financial performance indicators (such as company image, sentiment and company size) when implementing their investment strategies than on the performance of intellectual capital assets.

7.10.3.1(d) Control variables

The significant conclusions regarding the association between the control variables and dependent variables can be summarised as follows:

7.10.3.1(d.i) Productivity

Organisational size as measured by a company's market capitalisation is found to have a significant negative relationship with productivity. This was true for both knowledge-base groups. This finding suggests that smaller company size leads to greater empowerment for employees, which leads to increased motivation and a willingness to perform. Employees in South Africa appear to be more comfortable working for smaller companies than larger ones. This finding is contrary to views widely held in the literature that larger company size leads to greater productivity of management and employees.

Profitability as measured by a company's return on assets is found to have a significant positive relationship with productivity. This was true for both knowledge-base groups. This finding suggests that as profitability increases, management will become more content with the financial performance of the company. With less pressure to meet the expectations of the shareholders and the market, management will have greater flexibility to address the needs of human and structural capital, thus fostering greater productivity in a company.

7.10.3.1(d.ii) Profitability

Organisational size as measured by a company's market capitalisation is found to have a significant positive relationship with profitability. This is true for both knowledge-base groups. Larger company size enables management to procure and develop the necessary resources to enhance the income producing assets of the company. This leads to increased productivity and ultimately profitability.

Productivity as measured by a company's asset turnover ratio is found to have a significant positive relationship with productivity.

This is true for both knowledge-base groups. This finding suggests that as productivity of a company increases, profitability will increase. An increase in productivity is an indication that assets are being used more productively in the generation of revenue and ultimately profit.

7.10.3.1(d.iii) Market valuation

Organisational size as measured by a company's market capitalisation is found to have a significant positive relationship with market valuation. This was true for both knowledge-base groups. This finding suggests that investors tend to direct their funding to acquisition of investments in the larger companies.

7.11 Summary

The principal purpose of this component of the research study was to investigate the explanatory and predictive power of the performance of intellectual capital in a company in determining three traditional dimensions of corporate performance. The three traditional dimensions of corporate performance are: (1) profitability, (2) productivity, and (3) market valuation.

The findings suggest that the performance of intellectual capital can explain and predict productivity and profitability, but not market valuation.

The implication of these findings in this study are that management will have to adjust or intensify initiatives to encourage greater acceptance and understanding of the concept of intellectual capital and the development of related assets.

7.12 Model 3

Insert Table 76

Summary of results for Model 3

7.12.1 Implications and discussion

The results that relate to Table 76 indicate that there is no significant relationship between the interaction of knowledge and intellectual capital performance and any of the measures of company performance.

The beta coefficients for these relationships shown in Table 76 (Models G, H, and I) indicate that these models are not robust. This finding implies that, in the business environment in South Africa, the importance of knowledge and intellectual capital does not moderate the relationship between knowledge and intellectual capital performance in a company, on the one hand, and the company's productivity, profitability and market valuation, on the other.

The conceivable reason for the insignificant empirical results obtained in this component of the research study can be found in the problem with traditional management accounting. The empirical results suggest that managers in the business environment in South Africa appear to rely on traditional management accounting systems.

Traditional management accounting adopts a closed system approach that is concerned with the maintenance of existing systems rather than with learning and the growth of knowledge. Knowledge is a primary competitive factor in business today, and its accumulation, transformation and valuation lie at the core of intellectual capital management.

If management is unable or reluctant to implement management accounting systems that incorporate learning and the growth of knowledge, knowledge will never become a major component of intellectual capital management. Therefore, intellectual capital will become non-existent within organisations and will never be a resource that will have a positive effect on company performance and that results in a sustainable competitive advantage.

7.13 Non-response sample bias

When the data reported differs from the actual data, response error occurs. In this research study, the population was defined as all companies displaying the key variable of salaries and wages. The entire population was used as the sample, which consisted of 224 companies. The final data set consisted of 130 companies. Altogether 94 companies were deleted from the sample (population) because of data screening and transformation procedures. Therefore, there is no response error in this research study.

7.14 Summary

The challenge for South African organisations is to remain competitive in the international arena in terms of quality of products and services provided at competitive prices. This will only be achieved if South African organisations develop the ability to make a paradigm shift to embrace the characteristics of the knowledge economy.

As a result of the findings of this research study, it may be posited that the current performance of South African organisations is not adapting fast enough to the adjustments necessary to make this paradigm shift. This finding is confirmed by an empirical study carried by Ramosedi (2000). In this study on the management of tacit customer intellectual capital in the South African economy, Ramosedi states (Ramosedi, 2000, p. 77):

Senior managers (in South Africa) acknowledge that a change in the world of work had taken had taken place in terms of employees having power and being more knowledgeable than before. Because it was difficult to quantify, senior management tended not to place much emphasis on intellectual capital. The organisation still relies on measurable quantifiable benefits and not on intangible aspects.

There is still a lack of connection between knowledge intensity and how to measure it. However, evidence does exist (found in this research study) that companies that are making the paradigm shift are reaping the rewards in terms of improved profitability.

The findings of this research study are corroborated by the World Competitiveness Reports (Meyer and Botha, 2000) indicates that in 1996 South Africa was placed 43 out of 49 in terms the Competitive Index, in 1997: 44 out of 53, 1998: 42 out of 52, 1999: 47 out of 59, 2000: 32 out of 54, 2001: 34 out of 63, and 2002: 32 out of 64. The Competitiveness reports indicate that development and transformation practices are not effectively utilised within South African organisations. Human capital and ultimately intellectual capital should be positively linked with productivity. The importance of productivity lies in its relationship with competitiveness. Competitiveness is linked to intellectual ability and power. With South Africa's competitiveness at the bottom end of the competitiveness index, it is to be expected that there is no positive association between intellectual assets and productivity and market valuation.

Intellectual capital is considered in this study as a strategic, intangible asset. According to the resource-based view, it should be positively associated with company performance. The results of this study strongly support the resource-based view only in terms of Model 2 C and D.

This finding represents a major step forward for the Intellectual Capital Movement. A test of the relationship between intellectual capital and financial performance as measured by profitability yielded positive and significant results. This result alone points to both the usefulness of intangibles in general, and intellectual capital in particular, as a sustainable source of superior wealth creation and the relevance of return on assets as a measure of profitability. The results call for more voluntary specific disclosures in the short term and standardisation of the accounting for intellectual capital assets in the long term that would allow investors to measure intellectual capital. This would permit investors to incorporate intellectual capital measurement into their valuation models.

Following on from the above analysis and interpretations Chapter 8 will analyse the impact, implications and business applications of the management and measurement of intellectual capital on the business environment in South Africa

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CHAPTER 8

THE BUSINESS APPLICATIONS OF THE RESEARCH RESULTS

8.1 Introduction

The international and national business environments are continually exposed to change. Not only technological changes, but also economic, political, and other changes have an influence on organisations world-wide. Business entities in South Africa are not excluded from the consequences of change. This country has experienced drastic economic and political transformation since 1994, including change of government, affirmative action, and a changing education system. In order to remain competitive, South African businesses have to continually adapt to change. South African managers must see change as a challenge, as an opportunity to take advantage of the changing conditions and become more competitive. As the growing demand for knowledge-based products and services revolutionises the structure of the global economy, the role of intellectual capital in achieving competitive advantage assumes greater importance. Consequently, the knowledge explosion also affects the South African business environment.

Two questions arise: first, how does South African management go about enacting the change from its current situation, where physical capital is the primary business resource, to a situation where intellectual capital is the primary business resource? Second, how does South African management take advantage of the empirical evidence as found in this research study, that the management and measurement of intellectual capital has a positive affect on profitability?

Possible answers and strategies arising in response to these questions can be useful only if and when the South African business community understands and appreciates that intellectual capital management requires a fundamental shift in the way in which work is valued in South Africa.

The importance of intellectual capital, the incorporeal value of companies, such as relationships with business partners, brand awareness, and the ability to innovate, has greatly increased in the last two decades. Unfortunately, financial accounting and traditional management instruments are not yet capable of capturing these new values and reporting on them.

The education of company management regarding the importance of intellectual capital management and reporting, combined with an enhanced concept for company reporting and new management tools that can enable companies to manage these new value drivers in a systematic way, is necessary to equip South African businesses for the changes occurring in the global economy.

Companies like *Skandia* in Sweden (Edvinsson and Malone, 1997) adopted this concept very early in the form of a supplementary intellectual capital statement to the annual financial reports. This concept has since January 2002, been part of the disclosure and accounting rules in Denmark: (Danish Trade and Industry Development Council, 1997).

Since then, companies in Denmark are obliged to report on their intellectual capital if they own significant knowledge assets and their auditors have to certify this report. In the opinion of the author this enhances the investors' understanding of the value and potential of the hidden intellectual capital resources of a company, and enables them to make informed judgements about its capabilities to perform in the future.

There is compelling evidence arising out of this research study that investments in intellectual capital do matter. It is therefore vital that the implications of this, results in a re-assessment of the South African business environment. This chapter explores the implications that intellectual capital management and measurement have for the business environment in South Africa. Suggestions are made as to how companies in South Africa should adapt to the knowledge economy, what strategies they should adopt and how management must change its perceptions and methods of company reporting.

8.2 Using intellectual capital as a success strategy

The empirical findings of this research study indicate that intellectual capital may well be the success strategy for the future. Managers in South Africa will be required to understand both the tangible and intangible components of intellectual capital, and to develop management practices that support the "harvesting of knowledge". These managers will be challenged to develop behaviours needed to value intellectual capital and then to manage that capital as an asset.

To begin managing intellectual capital effectively, management in the South African economy needs to recognise that tangible assets are not necessarily more valuable and profitable than intangible assets. This may mean abandoning "sacred cows" or, at a minimum, renting them out. The bottom line is that intellectual capital management is a viable management tool.

Businesses in South Africa will need to develop intellectual capital management strategies to generate revenue from administrative functions. Such business areas as legal, finance, human resource, and management information have struggled to redefine themselves as "value-added" service providers. The challenge will be to find a way to take advantage of their core competencies.

An effective intellectual asset management strategy draws heavily on the skills inherent in these functions. Under such a strategy, the administrative functions perform crucial capabilities:

- Internal audit must have the necessary skills required to audit intellectual capital;
- Finance must have the resources to value intellectual capital and track performance;
- Human resources must have the ability to develop intangible asset monitoring programs and the systems to drive the required behaviour changes; and
- Management information systems must be able to capitalise on large-scale system solutions, since intellectual capital is an enterprise-wide resource.

8.2.1 Putting the strategy into place

To achieve a significant return on a company's intellectual capital portfolio it may require only a limited investment. The findings of this research study suggest that the resources for creating an intellectual capital portfolio already exist within in many companies in South Africa. It also clear from the findings of this research study that an intellectual capital management strategy reaps benefits in terms of profitability.

Some of the other benefits that will accrue to businesses in South Africa that adopt an intellectual capital management strategy could be:

- Increased creativity;
- Improved customer and supplier relationships;
- New products and services;
- Improved productivity and increased revenue; and
- Improved staff attitudes and external image.

Business in South Africa must adopt the following suggested five-step approach in establishing an intellectual capital strategy:

8.2.1.1 Step one

Create awareness. What is the value of intellectual capital? All staff members will need to know. This step sets out the expectations for the changes that need to be made and the anticipated financial returns.

The intellectual capital management strategy will affect the organisation's strategy. To effectively communicate and enhance the learning process, hands-on business simulation must take place. An effective simulation clarifies the business objectives and helps staff members internalise the key concepts and issues. Only then will staff members truly support a change management program. An effective simulation will help staff members identify the strategic and behavioural changes needed throughout the organisation, and also help staff members to understand the action steps they to take as individuals.

Involving staff members in the process is an effective way of gaining their support. Staff members need to know why they should care about and involve themselves in a new system. Without understanding of the importance and meaning of intellectual capital management and measurement, staff members may not take ownership of, nor involve themselves in, a new strategy, thereby making implementation of it that much more difficult. Box one summarises how management should clarify the idea and concept of an intellectual capital strategy.

Box 1: Clarifying the concept of an intellectual capital strategy

- What is the strategy's overall purpose and link to company strategy?
- What changes are required?
- What is the priority and importance of each aspect of the strategy?
- How knowledge intensive is the business?
- Who is paid for what knowledge? Who pays? How Much? and
- Is this a good knowledge business? That is, does whoever owns the knowledge also create the most value.

8.2.1.2 Step two

An intellectual capital audit must be carried out. The audit objectives are to determine the potential value of intellectual capital and align the intellectual capital strategy with ongoing initiatives defined by the organisation: the company's revenues must be matched with the assets producing them. Questions that need to be answered during the audit are:

- What is the expertise?
- What are the capabilities? and
- What are the brands, the intellectual properties, the processes, and other forms of intellectual capital?

Generating revenue for the company?

The feedback that is uncovered in step one should also determine the content of the intellectual audit, which is a scorecard measure of performance. The following aspects must be considered when conducting the audit:

- Internal structure. The internal structure includes patents, concepts, models, computer, and administrative systems. These are created by employees and generally owned by the business entity. Decisions to develop or invest in such assets can be made with some degree of confidence because work is done in house or brought in from the outside;

- External structure. The external structure includes relationships with customers and suppliers. It also encompasses brand names, trademarks and the company's reputation and image. Some of these can be considered legal property, but investments in external structure cannot be made with the same degree of confidence as investments in internal structure. The value of these assets is primarily determined by how well the company solves its customer's problems, so there is always an element of uncertainty; reputations and relationships change overtime; and
- The competence of staff. Employee competence involves the capacity to act in a variety of situations to create both tangible and intangible assets. It could be argued that employee competence is not an intangible asset. It is true that individual competence cannot be owned by anyone or anything except the person who possesses it; however, employee competence is included because it is impossible to conceive of a business entity without people. People are the only true agents of the business. All assets and structures, whether tangible or intangible, are the result of human actions. All depend ultimately on people for their continued existence.

The company's reason for working with intellectual capital will determine the direction of the audit. Defining the purpose of the audit is a matter of linking it to a coherent strategy i.e. long-term goals and core challenges of the company. An intellectual capital audit should be taken step-by-step and management must be prepared to learn by trial and error. It has to be understood by management that this is an educational aspect of understanding intellectual capital.

8.2.1.3 Step three

Develop the intangible asset portfolio. This process must begin with the creation of a simple grid of the organisation's business to determine if the material compiled in the audit is actively being used. The initial outcome is a matrix to help management analyse asset allocation. Management will be able to see the direct application of intellectual capital, the unused intellectual capital with potential application, and the intellectual capital that is unlikely to be used. Once management is able to plot the intellectual capital and initial relative value, an intellectual capital management strategy can then be developed.

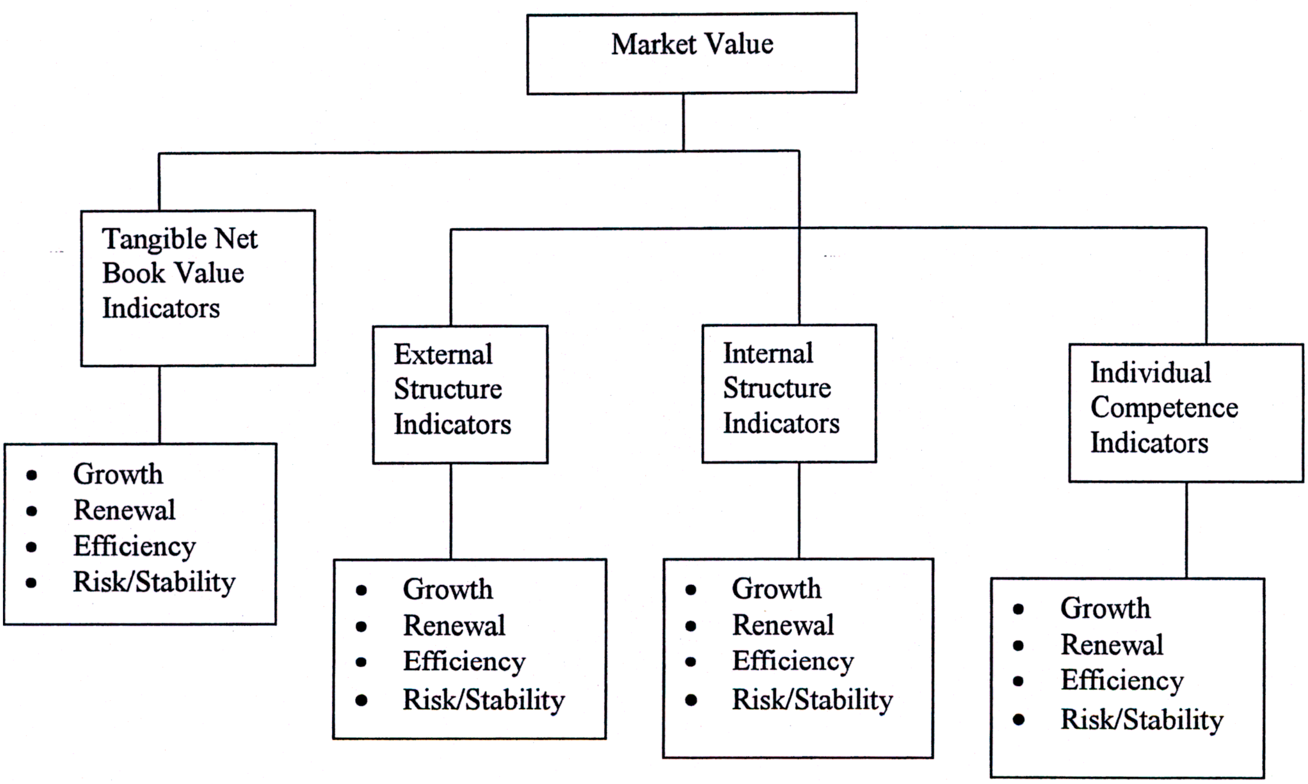
8.2.1.4 Step four

Develop an intangible asset monitor. An intangible asset monitor tracks asset performance as well as the intangible investments made. The specifics of the monitor will vary by organisation, but like the audit, will have the same general focus:

- Internal structure;
- External structure; and
- Individual competence.

The following is a suggested Intangible Assets Monitor Framework (adapted from Sveiby, 1997)

Intangible Assets Monitor



8.2.1.4(a) Measuring internal structure

The main activity of those employees who work in general management, administration, accounting, personnel, and clerical departments is to maintain the internal structure. These people make up the support staff.

8.2.1.4(a.i) Growth/Renewal

Investments in new subsidiaries or new methods and systems are cash outlays that are often accounted for as costs. Such investments indicate a build-up of the internal structure and should be monitored and reviewed on a yearly basis. These investments can be represented as a proportion of sales or percentage of value added.

Investments in information technology influence the internal structure. This investment can be regarded as a measure of progress toward accomplishing the company mission. A company with advanced or sophisticated computer systems might well enjoy competitive advantage. Companies with systems of information retrieval and distributions have a powerful internal structure that supports the company. Information technology investments can be expressed as a percentage of sales or value added or in absolute figures. These indicators can provide valuable clues as to how the internal structure is developing.

8.2.1.4(a.ii) Efficiency

The proportion of support staff to total number of employed is an indication of the efficiency of the internal structure. A change in the proportion indicates if the efficiency is improving.

Sales per support person can indicate how large a sales volume the company's internal structure can handle. A change in the proportion indicates if the efficiency is improving.

Even though value judgements are usually a component of competence, one type of value judgement may be classified under internal structure: the attitude of employees toward the workplace, customers and superiors. This kind of attitude is often referred to as corporate culture. The employee's attitude to their places of work can be measured just as the market's opinion of the company can be measured.

If those attitudes are favourable, they contribute to enhancing the company's image among its customers. If unfavourable, those attitudes could nullify the arguments of any marketing or advertising campaign. It is suggested in this context that companies run regular polls to detect changes in employee attitudes. The results of these polls indicate how the internal structure is developing. The results from attitude polls should be summarised in a few indices, which are then followed up yearly.

8.2.1.4(a.iii) Risk/Stability

An old company is generally more stable than a young one. A company's age should be compared to that of its competitors.

The support staff and the managers are the backbone of the internal structure. It is vital for the survival and efficiency that they function well, and a low turnover rate indicates this.

8.2.1.4(b) Measuring external structure

8.2.1.5(b.i) Growth/Renewal

When companies determine the profitability of their customer base, they often find that most of their customer sales are not profitable. Customer profitability should be monitored routinely. To calculate profitability per customer, profitability per product or market segment will indicate how well the company is growing.

Organic growth, that is, an increase in billings with income from acquisitions deducted, is a measure of how well the business concept is received by the market. If a company grows by buying companies in other lines of business, it may well be a sign that the original business concept is no longer generating enough growth.

8.2.1.4(b.ii) Efficiency

The best early indication of whether results are improving or are deteriorating is customer satisfaction.

Companies must acquire information about their customers' perceptions of quality and other attitudes about the company. The results of these polls are used primarily in marketing but rarely in financial forecasting. It is perfectly feasible to append an index of customer quality perceptions and attitudes to the financial statements.

8.2.1.4(b.iii) Risk/Stability

If a company's dependence on a few large customers is great, its position is weak and so is its external structure. Two indicators can measure this: percentage of billings attributable to the five biggest customers, or the number of customers accounting for 50 percent of billings. A high proportion of sales through customers that have been clients of the company for longer than five years is a measure indicating how devoted the customers are, and therefore is a sign of stability.

Another measure of customer satisfaction is the frequency of repeat orders. A high frequency indicates that customers are satisfied. Since old customers, as a rule, are more profitable than new ones, this key indicator tells something about profitability potential.

8.2.1.4(c) Measuring competence

8.2.1.4(c.i) Growth/Renewal

A simple measure of competence is the total number of years that employees have worked with the company and worked within their profession. The total number of years a staff member has worked in his/her profession or position is a measure of skill and experience. The change in the indicator between two years shows how much the average competence is changing, which is a measure of growth or renewal rate.

The education levels of staff members employed affects the assessment of their competence and thus the company's ability to achieve future success. Formal education is a valid indicator because students at academic levels learn to process vast amounts of information. Average years of education can also be calculated. The change in the average indicates whether the company is improving its education level.

Training costs as a percentage of turnover or the number of training days devoted to education per employee indicates the levels of investment in the competence of employees.

8.2.1.4(c.ii) Efficiency

A key indicator of efficiency is the proportion of professionals in the company, that is the number of professionals divided by the total number of employees. This is a measure of how important professionals are to the firm.

Value added per employee expresses how much value a company's employees produce'. This indicator can be regarded as a measure of the ability to produce economic value. This indicator can be calculated for each category of employee.

8.2.1.4(c.iii) Risk/Stability

Older employees are more stable than younger ones. A company with an older group of employees is likely to be more stable than a younger company in the same industry. Thus, average age is a good indicator of stability. It is also an indicator of wisdom.

Staff turnover is generally regarded as an indicator of stability and is easy to calculate and compare with other companies. A very low turnover rate suggests a stable company. A high turnover rate suggests that people are dissatisfied. The turnover rate is usually calculated as follows: the number of leavers during a year divided by the number of people employed at the beginning of the year.

8.2.1.5 Step five

Put the intellectual strategy to work. Incorporate the strategy into the overall strategic business planning process. Consider intellectual capital as an asset and report it as such.

8.2.2 Summary

The intellectual capital management strategy that capitalises on intellectual capital assists companies to realise the value of developing their intellectual capital. What is important is the value of intellectual capital within a company, and how management decides to reward and recognise the individuals who create and enhance that value.

Developing an intellectual capital management strategy is beneficial to both the company and its employees. The strategy draws on the core competencies of several functional areas, giving both the team as a whole and the individual staff members opportunities to make meaningful contributions.

Found or newly developed resources benefit the organisation most directly with revenues. Individuals benefit by increasing their knowledge, developing their skills and achieving greater career satisfaction.

An intellectual capital management strategy should benefit shareholders, financiers, and management alike. South African business entities can establish competitive advantage from an intellectual capital management strategy. The greatest challenge may be making business executives aware of the untapped value that exists within their companies, and its potential high return.

An intellectual capital focused strategy will have the following benefits for South African companies:

- An intellectual capital focused strategy can be very competitive as it utilises the unlimited resources of intellectual capital; and
- An intellectual capital focused strategy can give new business opportunities because once unidentifiable intangible assets may now prove to be a valuable source of tangible revenues.

8.3 Intellectual capital measurement

It is said that what is measured in companies is also what is managed. In the case of intellectual capital, however, its importance is difficult to measure, and it is, therefore, neither measured nor managed effectively. The crux of the matter is that companies in South Africa need to spend time on identifying items that will provide tangible proof that intangible growth (or decline) is taking place.

The best way of measuring this is by ensuring that goals and strategy are known. Without a strategy, there is a tendency either to measure for measurement sake, or to measure only those items for which measuring tools can be found.

The dilemma for accountants and management remains that, although the benefits of intellectual capital can outweigh physical capital immensely, it is very difficult to find measures that accurately reflect their value within an instrument such as the balance sheet. Physical and intellectual capital have different properties and should therefore have different valuation methods.

Before measuring intellectual capital, two pieces of advice should be taken seriously. First, Stewart (1997, pp. 243-244) is of the opinion that no single measurement will ever describe a company's full quota of stocks and flows in intellectual capital. Therefore, when devising measurements, instead of developing one ultimate tool, one should:

- Keep it simple;
- Measure what is only strategically important; and
- Measure activities that produce intellectual wealth.

A second piece of advice comes from Bontis (1998, p. 73). He states that people are required to rethink their attitudes on intangible assets and to start recognising that measuring and strategically managing knowledge may make the difference between mediocrity and excellence. This change in attitude must be seen not only to reflect the change necessary in the eyes of clients, but also with top management itself.

8.3.1 Intellectual capital reporting

The author is convinced that is essential to encourage accountants and management to allow intellectual capital to provide its own reporting practices rather than to remain imprisoned within the reporting practices that constitute the traditional accounting model.

It is recommended that intellectual capital statements be prepared. The financial statements that accountants prepare are designed to provide an accurate and reliable estimate of a business entity. As previously discussed, in recent times a second estimate of the value of the business has assumed growing significance that is determined not by accountants but by the market, i.e. the market value of a business.

In an ideal world, the difference between the market value of a business and that arrived at by accountants would be minimal. However, in practice there are always businesses where a difference exists between their market and book values.

This difference has been associated with the limitations of the prevailing accounting framework that prohibits the measurement and reporting of internally generated intangible assets, such as goodwill and intellectual capital. While the market recognises the extent of these intangibles, and values them accordingly, the business itself is unable to do so.

If the prevailing accounting model is not the answer to the problem, the question to ask is the following:

- What is a more appropriate model?

The model that the author suggests is appropriate is a mixed model. The measuring of and reporting on intellectual capital should be seen as a separate report, yet complementary to traditional reporting practices. It is not a feasible option at this early stage of the understanding of intellectual capital to include intellectual capital on the balance sheet of a company within the current accounting framework. It is important however, that additional measures exist side by side with the traditional.

8.3.1.1 The intellectual capital statement

What is an intellectual capital statement? The objective of an intellectual capital statement is to give a picture of the company's effort to build-up, develop and streamline its resources and competencies in relation to its employees, technology, and processes.

The intellectual capital statement underpins the development of the future value of the company, and, consequently, its competitiveness in the knowledge economy. The intellectual capital statement forms an integral part of working intellectual capital management within a company. It reports on the company's efforts to obtain, develop, share, and anchor the intellectual capital resources required to ensure future results.

8.3.1.2 Intellectual capital report versus traditional annual financial report

In order for users of accounting information in South Africa to be introduced to intellectual capital, two types of reports should be prepared by management: the intellectual capital statement and the financial report. Both reports should be seen as complementary and offer a more holistic view of the company.

The intellectual capital statement is aimed at providing a holistic picture of the company based on chosen strategies, actions taken and current challenges. This report is focused on "softer" resources such as intellectual capital rather than on financial resources. In essence, it is a supplement to the financial reports as well as a valuable strategic management tool. The intellectual capital statement serves to make the company's intangible resources visible and to measure them. The report could be prepared for the purpose of giving external partners relevant information supplementary to other parts of the annual report and for use as a management tool for the development of the company.

The concept of intellectual capital accounts (adapted from: Danish Trade and Industry Development Council, 1997)

The Contents

What there is	What is done	What happens

The Measurement

Disclosure of <u>resources</u> (human resources, technology, and processes)	Disclosure of <u>qualifications</u> (educational level, technological expertise and development of customer relations	Disclosure of <u>consequences</u> (satisfaction, loyalty, experience, and increase in value)

The Scenario

The vision of how the description of the company's intellectual capital is related to a management system and a competition form focusing on human resources, technology and the entire knowledge-based society

The above diagram shows the structure of the intellectual capital accounts' measurements and illustrates the necessity of making them meaningful through internal and external communication. Companies can accomplish this by linking the intellectual accounts with a scenario illustrating how the company must be managed and how the competition must be handled. Here, the intellectual capital accounts measurements are linked with a vision of the company competing by upgrading its human resources and developing further decentralisation, by taking the new technological opportunities seriously, by getting closer to the customer and by showing how the knowledge and information society must be respected.

Intellectual capital accounts cannot stand-alone. They become important only when seen in a context. This context is a vision of the management system and the competition form. In this way, the intellectual capital accounts put the "new reality" on the agenda. The "new reality" will operate through knowledge and intellectual capital rather than through the traditional intangible assets. The inclusion of this scenario is important because the figures of the intellectual capital accounts cannot alone explain such a huge strategic perspective.

8.3.1.3 Disclosure of intellectual capital related information

During a symposium organised by the Securities Exchange Commission of USA, the then commissioner, Steven Wallman predicted that the disclosure of intellectual capital related information would one day become the most central emphasis of a company's annual report (Cited in Edvinsson and Malone, 1997, p.5). Research (outside South Africa) shows that financial markets (such as those in the USA and the UK) attached significant importance to intellectual capital matters such as company's strategy implementation and quality, management's trustworthiness, the company's innovative ability and the quality of human resource (Mitchell Williams, 2001; Bontis, 2000).

South African companies must recognise the benefits of voluntary disclosing on intellectual capital information in their annual reports. The author believes that disclosure on intellectual capital will intensify and it is this context that this research study will suggest various disclosure requirements that could be included in the intellectual capital statement or part of the annual report. These disclosure requirements will provide users of accounting information with a guideline with which to communicate their intellectual capital information.

The following disclosure requirements are suggested in line with a company's use of an intangible asset monitor (Adapted from Firer and Mitchell Williams, 2003a):

8.3.1.3(a) Section one: Intellectual Capital in Human Resources

- Employee seniority;
- Employee education investment;
- Employee education costs;
- Gender distribution of employees;
- Racial distribution of employees;
- Age distribution of employees;
- Share of employees participating in development plans;
- Number of development days per employee;
- Education costs per employee;
- Development costs per gender of employees;
- Development costs per racial group of employees;
- Employee satisfaction;
- Employee turnover;
- Increase in value per employee; and
- Growth (decline)/recruitment of employees

8.3.1.3(b) Section Two: Intellectual Capital in Customers

- Distribution of revenue by markets/products;
- Marketing expenditure;
- Number of customers per employee;
- Marketing expenditure per cost;
- Administrative cost per unit of marketing expenditure;
- Customer satisfaction;
- Repeat purchase/contracts;
- Customer with long term relations;
- Customer orientation strategy; and
- Customer loyalty.

8.3.1.3(c) Section Three: Intellectual Capital in Information Technology (IT)

- Total IT investments;
- Amount of internal IT customers;
- Amount of external IT customers;
- Investment in IT, Rand and infrastructure;
- PCs per employee;
- Portable PCs per employee;
- IT expenditure per employee;
- IT expenditure to turnover; and
- Extent of IT literacy in the company.

8.3.1.3(d) Section Four: Intellectual Capital in Processes

- Cost per process;
- Human resource distribution by process;
- Lead time;
- Product development time;
- Running in expenses for new organisational units;
- Error rate in processing;
- Waiting time for processes;
- Quality of processing activities; and
- Reputation of the company.

8.3.1.3(e) Section Five: Intellectual Capital in Property (IP)

- IP investments/purchased during year;
- Distribution of IP held;
- Cost of IP developed during the year;
- Number of IP items held/developed;
- Number of development days on IP;
- Number of employees involved in development of IP;

- Administration costs per unit of IP development expenditure;
- Increase in value per IP item;
- Reputation of IP developed; and
- IP renewed.

8.3.1.4 Summary

The biggest challenge by far is establishing a consensus about the need to report, what to report, and how to report it. Without a consensus as to the need to report, there is little hope that the reporting of intellectual capital will become standardised without intervention by regulators. If, and when, consensus is reached, the next major step is either to refine the reporting models in use or to develop new models.

Those who maintain that objectivity is everything, and who have a penchant for steadfastly refusing to accept that anything other than "hard" quantifiable data should appear in the accounting reports, will once again raise the question of how one can know the value imputed to intellectual capital is correct, and how one can have faith in the output of such a subjective reporting system.

The author's response is to question whether the figures reported for the "hard" assets (for example: fair value of financial instruments) are correct. At least, through the reporting of intellectual capital, the existence of intellectual capital as an asset is acknowledged. This broadens the scope of decision-making for those relying on the financial statements for their information, and it creates a platform to provide some leverage in improving reporting methods already in use.

The failure to account for intellectual capital leads to a misallocation of capital, inadequate investment in intellectual capital and misstatement of true operating results and financial position.

A question arises from the above debate: Why is accounting for intellectual capital a problem now, when it was not before? The obvious answer is that intellectual capital is just as fundamental to the knowledge economy as financial capital and physical assets were to traditional manufacturing-based economies.

How then should the current financial accounting framework be improved? The implications of the "intangibles approach", that accounting should start to record intellectual capital as an asset, are immense. The current accounting framework is transaction based. However, most ways of intellectual capital measures are based on indicators.

There are serious conceptual and practical problems in introducing indicators based on measures of intellectual capital into the transactional accounting framework. This research study posits the view that intellectual capital is a driver of value creation. Where the current accounting framework is based on the realisation of value. A new system needs to be developed of an accounting framework based on value creation operating in parallel with the existing system of realisation accounting.

In the knowledge-based economy, managing and measuring intellectual capital is one of the key avenues to creating value. Intellectual capital will have to form the basis of a value creation measurement and reporting framework.

8.4 Conclusion

The objective of this chapter has been to help South African managers understand and make the best of what the author believes are the most important of the profound and confusing changes that are taking place in the modern business environment.

The method adopted has been to influence the South African managers to look consciously at these changes and their business entities from what the author calls the knowledge perspective.

Why a "knowledge perspective"? First, the empirical evidence obtained from this research clearly indicates that investments in intellectual capital assets increases and improves a companies profitability. This indicates that investments in intellectual capital do make a difference. Second, knowledge is the ultimate wellspring of unlimited resources; it is crucial for the business environment in South Africa to understand what knowledge is, and how it can be used to achieve sustained competitive advantage.

Intellectual capital focused strategies are relatively intricate in that they are multifaceted and require both an intimate knowledge of, and a willingness to empower, people.

Those South African managers who focus their attention on realising the infinite capacity of humans to create knowledge will find many ways to exploit that knowledge.

The implications and business applications of the management and measurement of intellectual capital on the business environment in South Africa are immense. The management and measurement of intellectual capital brings accounting and investing back into alignment with the radical changes that are taking place in the business environment. It also addresses the dissolution of boundaries between companies and other institutions that is occurring everywhere in society.

Rather than replacing the current financial measurement system, the product of generations, intellectual capital in fact complements and augments it.

Intellectual capital is not only relevant in advanced economies; this notion is incorrect. The business environment in South Africa, which is rich in natural resources, places a heavy emphasis on the notion that its physical capital is the key to prosperity (as found in this research study), rather than its intellectual capital. Little does management in South Africa understand that people with a wealth of knowledge will exploit a wealth of natural resources, and that the value of natural resources is extracted from a place, not created there. Intellectual capital management and measurement is the way the South African business environment must prepare for the future.

In Chapter nine, the findings of the research are summarised, and final conclusions are drawn and clarified.

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CHAPTER 9

SUMMARY AND CONCLUSIONS

9.1 Introduction

This research study investigates the intellectual capital contribution to company performance in South Africa. Contribution is evidenced by determining whether intellectual capital is the principal business resource within the South African economy, investigating the explanatory and predictive power of intellectual capital, and assessing the importance of knowledge in the South African economy. Company performance is examined in three dimensions: productivity, profitability, and market valuation. In this chapter, the findings of the research are summarised, and conclusions are drawn and explained.

Three research questions were formulated for the study. The first question dealt with determining the decisive business resource in the South African economy; the second question dealt with the explanatory and predictive power of intellectual capital; and the third question dealt with assessing the importance of knowledge in the South African economy. It was found, in respect of the first research question that physical capital, and not intellectual capital was the decisive business resource in the South African economy. In respect of the second research question, results show that intellectual capital has explanatory and predictive power in respect of productivity and profitability, but not for market valuation.

The explanatory and predictive power in respect of productivity was negative, while explanatory and predictive power in respect of profitability was positive. In respect of the third research question, results indicate that industry knowledge did not have a positive effect on the relationship between intellectual capital and company performance.

9.2 Summary of research results

In respect of Model 1 – part A, Spearman's rho (R^2) showed the relationship between structural capital and value added at a correlation coefficient of 0.24 ($\rho < 0.01$); 0.88 ($\rho < 0.01$) between human capital and value added; and 0.90 ($\rho < 0.01$) between physical capital and value added. These results indicate that there is a significant, albeit weak, positive relationship between structural capital and value added, a significant and strong positive relationship between human capital and value added, and a significant and strong positive relationship between physical capital and value added.

These findings suggest that human capital and physical capital play an equal part in value creation in the South African economy. However, correlation analysis does not imply causation. It only gives an indication that there is a relationship between two variables; it was therefore necessary to conduct further tests to establish what is the decisive business resource in the South African economy.

To further analyse the respective relationships as set out in Model 1 – part A, Model 1 – part B hypothesised that human capital and structural capital are positively associated with company performance. This hypothesis was rejected for the low knowledge-base and high knowledge-base groups. Physical capital was positively associated with productivity and profitability for both knowledge-base groups.

To decide whether intellectual capital could explain and predict company performance, Model 2 hypothesised that there was a positive relationship between intellectual capital and company performance. The findings indicated a significant positive relationship between intellectual capital and profitability, a significant negative relationship between intellectual capital and productivity and no significant relationship between intellectual capital and market valuation.

This is true for both knowledge-base groups. These results suggest that the greater the performance of intellectual capital in a company the greater the profitability and the greater the performance of intellectual capital in a company the less the productivity. Intellectual capital can explain and predict profitability and productivity, but not market valuation.

Model 3, hypothesised that there would be a positive relationship between the knowledge-base of an industry and the interaction of the performance of intellectual capital and company performance. This hypothesis was based on the conceptual construct that certain industries rely more heavily on the use of knowledge and intellectual capital in producing a company's goods and services. The findings did not support the hypothesis of a positive effect on the relationship between the interaction of knowledge and the performance of intellectual capital and company performance. This was true no matter whether productivity, profitability, or market valuation was used to measure company performance.

As a whole, the findings indicated that the contribution of intellectual capital to company performance were informative, but mixed. The empirical findings suggest intellectual capital is not the primary business resource in the South African economy, however the better a company manages its intellectual capital, the more likely it is that its profitability will increase. The existence of the inverse relationship between the performance of intellectual capital and productivity reflects that companies in South Africa prefer to invest in physical capital rather than intellectual capital. This conclusion is drawn as result of the findings in Model 1 – part A, where physical capital is the dominant business resource.

The finding that there was no significant relationship between intellectual capital and market valuation suggests that investors did not incorporate intellectual capital into their stock market investment strategies. This could be as a result of the limitations of current financial reporting practices or that investors did not view intellectual capital as a key business resource.

The overall findings suggest that, despite efforts to improve its intellectual capital base, the business environment and market in South Africa appear place larger significance on tangible capital assets than on intellectual capital assets.

9.3 Usefulness of intellectual capital

The literature review in Chapter 3 revealed that there is minimal robust empirical evidence in support of the actual usage of intellectual capital assets. The utility of intellectual capital as a business resource has been tested in the main by way of questionnaires.

This has resulted in a great deal of evidence being purely descriptive of what was happening in various organisations and economies. This has created mass awareness of the relevance of intellectual capital, but little evidence of the causal link between intellectual capital and company performance. The literature review could not provide conclusive evidence that intellectual capital has a causal association with company performance. Therefore, this study sought to provide additional evidence as to the efficacy of intellectual capital by examining the explanatory and predictive power of intellectual capital in order to determine whether intellectual capital could explain and predict company performance. The finding of this component of this research study provided evidence in support of the further development of intellectual capital and, thus, further enhances the concept of intellectual capital being a legitimate undertaking.

The measurement and reporting of intellectual capital is not governed by any set of statutory requirements. This has resulted in diverse and complex measurement models and a limited amount of disclosure in financial reports. An obstacle arising as a result of these diverse and complex measurement models is that traditional accounting practice does not provide for the identification and measurement of intellectual capital assets in companies. Intellectual capital assets such as staff competencies, customer relationships, computer, and administrative systems receive no recognition in the traditional financial and management-reporting model. Consequently, this has led to the limited utility of intellectual capital in South Africa.

Dialogue and debate on new methods to measure and report on company intellectual capital have been motivated by the limitations of the current financial reporting system for capital markets and other stakeholders. It is the intention of this research study to add to the ongoing dialogue on how to measure a company's intellectual capital.

9.4 International implications

As South Africa continues its efforts to join the international community and increase its level of economic development beyond that of an emerging economy, a continued aversion and apathetic view toward intellectual capital amongst South African companies and the business community may have negative consequences. Knowledge management and intellectual capital are necessary tools for any company aiming at national and global competition. Today, no top management can afford to be ignorant of its company's knowledge base (the knowledge, skills, and abilities at their disposal) nor of how this knowledge base can best be utilised in order to achieve the company objectives and improve the business result. Only those companies that use their intellectual capital resources most successfully will become global players.

9.5 Recommendations

Findings from this research study indicate that South African companies continue to rely on traditional business practices and perceptions (a reliance on natural resources for wealth creation), and are not shifting toward a greater reliance on intellectual capital factors of production. However, the findings suggest that if South African companies manage their intellectual capital in the appropriate manner, financial performance will be enhanced.

There is a growing awareness that intellectual capital is a key asset for success in today's economic environment. Intellectual capital is indispensable in organisations, whether they are low or high knowledge-based.

Therefore, it is critically essential that intellectual assets be well understood and properly managed if organisations are to compete successfully in today's world economy. Effective management of intellectual capital begins with understanding. For this reason, this research study has provided various definitions of intellectual capital to help managers understand the breadth of management requirements. Several models for classifying the components of intellectual capital were presented so management might understand the depth of management requirements. In addition, different measurement schemes were presented, showing how intellectual capital can be viewed at both the organisation and component-by-component levels.

The following recommendations, which should result in a movement toward a greater acknowledgement and incorporation of intellectual capital factors of production in the South African economy, are therefore made. These recommendations are made in addition to the suggestions made in Chapter 8.

9.5.1 Priorities

The number one priority business executives, should be the recognition, identification, measurement, benchmarking, development, and harvesting of the nation's and its companies' intellectual capital. Human capital is the pre-eminent antecedent for the intellectual wealth of a nation.

It should be the ultimate aim of business executives in South Africa to make better resource allocation decisions. Questions that need to be answered include: Are enough resources going into employee training and development relative to the purchase of new equipment and software? Are investors willing to put new capital into worthy new business ventures that are intangibles intensive, at a reasonable cost of capital? Should the government provide stronger tax incentives to encourage more investments in intangible assets? Should the government invest in attracting foreign human capital?

9.5.2 Economic policy

In order to develop an economy that will create value successfully, one of South Africa's primary objectives should be to raise the intellectual capital performance of companies. With this objective in mind, it is imperative to identify the intellectual capital performance of each economic sector at local, municipal, provincial and national level. A priority of economic policy should be to raise intellectual capital performance in regions where performance is low.

Economic decision-makers must also provide a better understanding of the importance of intellectual capital. Raising intellectual capital performance is essential if the South African government wants to ensure the prosperity of companies, regions and the whole country. The better this is understood in South Africa, the faster will be the path to developing a healthy and globally focused economy.

9.5.3 Accounting profession

The accounting profession in the emergence of intellectual capital as a primary resource, has the opportunity to concentrate its best talent and experience on an issue that will fundamentally affect business from this point on.

New performance measures are needed, and new valuation methods will have to be devised. Who better to refine the valuation process than accountants?

However, ensuring that businesses recognise the value of intellectual capital is not only a job for practising accountants. Instead, accountants in business and industry, along with accounting educators, consultants, and regulators will have to collaborate on establishing criteria for recognising and measuring of intellectual capital, implementing appropriate controls and developing information systems.

Four important new roles for accountants can be envisaged:

1. Design: to apply accounting skills and experience to designing systems for companies, setting up appropriate programs for managing and monitoring intellectual capital and related databases;
2. Standards: to develop generally accepted reporting standards for intellectual capital, including measurements, indexes, benchmarks and policies;
3. Certification: to formalise and certify audits of intellectual capital; and
4. Navigation: to assist clients to identify patterns and systems for value creation and management.

Intellectual capital holds far-reaching implications for the accounting profession, which should seize the opportunity to help measure and audit what makes companies valuable. Rather than the historical and supposedly objective approach that has characterised financial reporting to date, valuation of intellectual capital requires immediate and precise measures. Can the accounting profession adapt?

Intellectual capital cries out for standardisation, including a new auditing process and certified measurement. Assisting companies in the measure of intellectual capital thus represents an important opportunity for accountants to shape their future. If accountants fail to take the initiative, the full importance, and impact on the economy of intellectual capital may never be realised.

9.5.4 Intellectual capital strategy

Companies must adopt an intellectual capital strategy. This can be divided into four steps. First, identify and evaluate the role of knowledge in the company. Management must decide on how knowledge-intensive the business is.

Second, management should match the company's revenues with the knowledge assets that produce the revenue. Management must identify the expertise, capabilities, brands, intellectual properties, processes, and other intellectual capital that can create value. Management must also determine the mixture of human capital, structural capital, and customer capital assets. This must be done to increase management's ability to leverage the company's intellectual assets.

Third, management must develop a strategy for investing in and exploiting the company's intellectual capital assets. Strategies must be developed to increase the knowledge intensity of the business.

Fourth, management must improve the efficiency and productivity of its workforce.

9.5.5 Knowledge leadership

The performance of any country or organisation, small or large, is directly related to the quality of its leadership. Good leaders will direct their organisations to greater heights of achievement, productivity, and profitability. Leadership involves bringing about change, envisioning a new future for the organisation, and motivating people to commit and dedicate themselves to new directions. South Africa needs good knowledge leadership. Intellectual capital management is largely dependent on the ability and willingness of the chief executive officer of an organisation to drive the process (Ramosedi, 2000, p.1). Politicians and business executives must be able to channel their organisation's intellectual capital as a source of competitive advantage. They must be held responsible for justifying the value of knowledge that is being developed in their organisations. An organisation's leadership must be committed to the development of an intellectual capital strategy and its implementation. For management to delegate responsibility for knowledge management to the lower ranks and then walk away from the issue is a recipe for failure. Until such time as the ideal self-motivating learning organisation has emerged, management will have to take the lead until the banner for knowledge management is flying high.

The literature suggests that to ensure sustained managerial support and participation for knowledge management, consideration should be given to the appointment of a chief knowledge officer (Meyer and Botha 2000; Bontis, 1998; Van Deventer, 2002; Ramosedi, 2000), whose responsibility it would be to create a company culture in which knowledge is accepted and appreciated as an essential factor of production.

9.5.6 Education and training

To take advantage of globalisation, South Africa must be able to produce goods and services of high quality and at competitive prices. It must be ensured that conditions are created through policy, law, and a collective ethos that facilitate development. Education and training together form the vital weapon in a nation's arsenal to achieve these aims. Investment in the people of South Africa must not be seen as a luxury: education must become a basic human right, necessary for human dignity and good citizenship.

Education is also vital for the achievement of economic and social development. Continuous training and development is the watchword for the modern company in South Africa.

Companies in South Africa need to establish what aspect of their employee training programs actually enhances productivity, and which are misdirected and worthless. Through understanding its intellectual capital assets, South African companies can redesign their training programs to best enhance those assets.

9.5.7 Progress

The findings of this research indicate that intellectual capital is important in the South African economy. Intellectual capital has been found to explain and predict profitability. There is a link between the performance of a company's intellectual capital and its financial prosperity in South Africa.

South Africa has made important progress in the renewal and improvement of education. Education improvement and expansion has become the central theme to the government's strategy for social development and economic growth. This strategy is in its infancy; it will be possible to acknowledge the success of this strategy only once intellectual assets are recognised as the primary business resource in South Africa.

9.6 Limitations of research study and suggestions for future research

Findings of the present study are subject to some limitations that provide initiatives for future research.

One possible reason for the mixed results can be found in the methodology for measuring the value of intellectual capital performance. The focus of this study was on one specific intellectual capital performance measure.

The VAIC™ methodology cannot prescribe precisely what actions management or regulators should take in a company, business sector, or economy to strengthen value creation. Similarly, this methodology does not provide stakeholders, such as investors, with a precise tool with which to handle their specific interests in a company or business sector.

The value creation efficiency methodology is only a power pointer, an effective starting point from which to direct one's further in-depth search of a company, business sector or economy, using the support of other intellectual capital measurement and management tools. A future study could explore a different standardised measure for intellectual capital performance.

The author believes that the basic theoretical construct of the regression models is correct. What is missing from the current study is a way to account for the lag between the cost of implementing and investing in knowledge, human and intellectual capital, and subsequent observable results.

Future studies could use the same basic hypotheses and regression construction, but might implement the study as a longitudinal study rather than a cross-sectional design. The longitudinal study would need to correct changes in data relative to time element, such as price inflation.

Despite the possible limitations of using single-period data, a relatively focused sample, a single standardised measure of intellectual capital, and a single domestic location, it is believed that the results from the present study provide valuable insights into the association between intellectual capital and traditional perceptions of company performance. Furthermore, this study helps to expand the current research agenda within the intellectual capital discipline toward alternative areas of interest.

There is still plenty of scope for research that provides an overview of the topic of intellectual capital and that ties together the diversified threads of the literature. Such research will assist in the determination of whether the management, measurement, and reporting of intellectual capital has advanced to the stage of a science.

There is no definitive unified study that helps to explain fully intellectual capital as a topic of significance. Empirical evidence of best practice models of intellectual capital would also provide the setters of accounting standards with guidance on the setting of accounting standards for intellectual capital measurement and reporting.

9.7 Final conclusions

This research study points to some compelling links between investments in intellectual capital and company performance. This connection is found in the empirical evidence that a positive relationship between the core explanatory independent variable (intellectual capital performance) and company profitability (an accepted measure of company performance) exists. These results are particularly promising, as they have revealed the possibility that investments in intellectual capital at a given point in time may influence a company's prosperity in terms of earnings and profits, which will hopefully influence shareholder value at a later date. As previously stated, only by collecting data over a period can this possibility be tested accurately.

The results of this inaugural, exploratory study in South Africa are clearly thought provoking. However, they represent only another step in the process of creating and setting standards for the knowledge era. These results do not demonstrate anything conclusive by themselves. There is nevertheless compelling evidence that investments in intellectual capital do matter. If this assertion is acted upon, it will result in profound changes in the way organisations work and are valued in the South African economy.

The management and measurement of intellectual capital lies at the core of value in the knowledge economy. Methods of measuring and evaluating intellectual capital have been slow to develop. Searching for a new measuring system was a primary objective of this research study. The objective of this research was to further the ongoing debate about the measurement of intellectual capital by providing empirical and practical evidence of the possible usefulness of a proposed technique to predict the appropriate value of a company in an economy where physical capital has been the dominant resource.

The VAIC™ methodology was determined to be this technique. Deceptively simple in its formula, it required detailed analysis and comparison of company figures. It considered the different components of intellectual capital, human capital, physical capital, and structural capital. It also introduced an efficiency coefficient that shows how well a company converts intellectual capital into value added.

The whole field of intellectual capital measurement and its management is still relatively new. Accountants and business managers still have to grapple with its concepts and detailed application. The VAIC™ methodology provides a useful guide to intellectual capital performance. It is a good place to start before delving into the more detailed in-company assessment. Above all, it provides an essential link between intellectual capital and financial performance that should help to bring together the currently distinctive disciplines of finance and performance measurement. Intellectual capital measurement suffers from many inconsistencies, but the users of accounting information clearly perceive that it is a business resource that needs to be managed, measured, and reported. The management, measurement, and reporting of intellectual capital in South Africa is in an embryonic stage of development. Organisational resources need to be redirected to ensure that this key intangible asset is developed and nurtured, to ensure that it truly evolves into an asset that is recognised in terms of generally accepted accounting practice.

The rise of intellectual capital is inevitable, given the historical and technological forces that are sweeping the modern world. Intellectual capital will come to dominate the way institutions are valued because it alone captures the dynamics of organisational sustainability and value creation. Intellectual capital alone recognises that a modern company changes so rapidly all is dependent on its talents and the dedication of its people (human capital), and the quality of the tools they use (structural capital). Traditional valuation models that do not include intellectual capital as a major component will be destined to fail, because without it (intellectual capital) the true value of a company will never be uncovered. It is partly the purpose of this research study to initiate radical rethinking of the perspective of businesses within the South African economy. The South African government and business community must stand up, be counted as part of this Intellectual Capital Movement, and be better prepared and more experienced than the competition. Procrastination will result in the wave of progress washing over the South African economy, as it is tossed forward, struggling to keep itself from being dashed and drowned.

9. 8 List of sources

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APPENDIX A
LIST OF COMPANIES ON THE MCGREGOR BFA DATA BASE FOR 2001

COMPANY NAME

1 ABC CASH PLUS LTD
2 ABSA GROUP LTD
3 ACUCAP PROPERTIES LTD
4 ACUITY GROUP HOLDINGS LTD
5 ADCORP HOLDINGS LTD
6 ADMIRAL LEISURE WORLD LTD
7 ADONIS KNITWEAR HOLDINGS LTD
8 ADVANCED TECHNICAL SYSTEMS LTD
9 ADVTECH LTD
10 AECI LTD
11 AFGRI LTD
12 AFRICAN & OVERSEAS ENTERPRISES LTD
13 AFRICAN BANK INVESTMENTS LTD
14 AFRICAN GEM RESOURCES LTD
15 AFRICAN LIFE ASSURANCE COMPANY LTD
16 AFRICAN MEDIA ENTERTAINMENT LTD
17 AFRICAN OXYGEN LTD
18 AFRICAN RAINBOW MINERALS GOLD LTD
19 AFRIKANDER LEASE LTD (THE)
20 AFROX HEALTHCARE LTD
21 AG INDUSTRIES LTD
22 ALACRITY FINANCIAL SERVICES LTD
23 ALEX WHITE HOLDINGS LTD
24 ALEXANDER FORBES LTD
25 ALL JOY FOODS LTD
26 ALLAN GRAY PROPERTY TRUST
27 ALLIANCE PHARMACEUTICALS LTD
28 ALLIED ELECTRONICS CORPORATION LTD
29 ALLIED TECHNOLOGIES LTD
30 ALUDIE LTD
31 AMALGAMATED APPLIANCE HOLDINGS LTD
32 AMALGAMATED BEVERAGE INDUSTRIES LTD
33 AMB HOLDINGS LTD
34 AMLAC LTD
35 ANBEECO INVESTMENTS HOLDINGS LTD
36 ANGLO AMERICAN PLATINUM CORPORATION LTD
37 ANGLO AMERICAN PLC
38 ANGLOGOLD LTD
39 ANGLOVAAL INDUSTRIES LTD
40 ANGLOVAAL MINING LTD
41 APEXHI PROPERTIES A LTD
42 APS TECHNOLOGIES LTD
43 AQUA ONLINE HOLDINGS LTD
44 AQUILA GROWTH LTD
45 ARGENT INDUSTRIAL LTD
46 ARNOLD PROPERTY FUND
47 ASPEN PHARMACARE HOLDINGS LTD
48 ASSMANG LTD

49 ASSORE LTD
50 AST GROUP LTD
51 ASTRAL FOODS LTD
52 ASTRAPAK LTD
53 ATLAS PROPERTIES LTD
54 AVASA HOLDINGS LIMITED
55 AVENG LTD
56 AVGOLD LTD
57 AVIS SOUTHERN AFRICA LTD
58 AWETHU BREWERIES LTD
59 BARLOWORLD LTD
60 BARNARD JACOBS MELLET HOLDINGS LTD
61 BARNATO EXPLORATION LTD
62 BARPLATS INVESTMENTS LTD
63 BASIL READ HOLDINGS LTD
64 BEARING MAN LTD
65 BEGET HOLDINGS LIMITED
66 BEIGE HOLDINGS LTD
67 BELL EQUIPMENT LTD
68 BHP BILLITON PLC
69 BICC CAFCA LTD
70 BIDVEST GROUP LTD (THE)
71 BONATLA PROPERTY HOLDINGS LTD
72 BOWLER METCALF LTD
73 BRAIT SA
74 BRANDCORP HOLDINGS LTD
75 BRIDGESTONE FIRESTONE MAXIPREST LTD
76 BRIMSTONE INVESTMENT CORPORATION LTD
77 BRYANT TECHNOLOGY LTD
78 BUILDMAX LTD
79 BURLINGTON INDUSTRIES LTD
80 BYTES TECHNOLOGY GROUP LTD
81 CADIZ HOLDINGS LTD
82 CANADIAN OVERSEAS PACKAGING INDUSTRIES LTD
83 CAPE EMPOWERMENT TRUST LTD
84 CAPITAL ALLIANCE HOLDINGS LTD
85 CAPITAL PROPERTY FUND
86 CAPITEC BANK HOLDINGS LTD
87 CARGO CARRIERS LTD
88 CASEY INVESTMENT HOLDINGS LTD
89 CASHBUILD LTD
90 CAXTON CTP PUBLISHERS AND PRINTERS
91 CCI HOLDINGS LTD
92 CCN HOLDINGS LIMITED
93 CEMENTATION COMPANY (AFRICA) LTD
94 CENMAG HOLDINGS LTD
95 CENTRECITY PROPERTY FUND
96 CERAMIC INDUSTRIES LTD
97 CHARIOT LAND LTD
98 CHEMICAL SERVICES LTD

99 CHOICE HOLDINGS LTD
100 CITY LODGE HOTELS LTD
101 CLIENTELE LIFE ASSURANCE COMPANY LTD
102 COMAIR LTD
103 COMBINED MOTOR HOLDINGS LTD
104 COMMAND HOLDINGS LTD
105 COMMERCIAL FINANCE COMPANY LTD
106 COMPAREX HOLDINGS LTD
107 COMPU-CLEARING OUTSOURCING LTD
108 CONAFEX HOLDINGS SOCIETE ANONYME
109 CONCOR LTD
110 CONGELLA FEDERATION LTD
111 CONNECTION GROUP HOLDINGS LTD
112 CONSOLIDATED PROPERTY & FINANCE LTD
113 CONTROL INSTRUMENTS GROUP LTD
114 CORONATION FUND MANAGERS LIMITED
115 CORONATION HOLDINGS LTD
116 CORPCAPITAL LTD
117 CORWIL INVESTMENTS LTD
118 CROOKES BROTHERS LTD
119 CS COMPUTER SERVICES HOLDINGS LTD
120 CULLINAN HOLDINGS LTD
121 CUPAR PROPERTIES LIMITED
122 CYBERHOST LTD
123 CYCAD FINANCIAL HOLDINGS LTD
124 DATACENTRIX HOLDINGS LTD
125 DATATEC LTD
126 DECILLION LTD
127 DELTA ELECTRICAL INDUSTRIES LTD
128 DIAMOND CORE RESOURCES LIMITED
129 DIGICORE HOLDINGS LTD
130 DIMENSION DATA HOLDINGS PLC
131 DISCOVERY HOLDINGS LTD
132 DISTELL GROUP LTD
133 DISTRIBUTION & WAREHOUSING NETWORK LTD
134 DNA SUPPLY CHAIN INVESTMENTS LTD
135 DON GROUP LTD
136 DORBYL LTD
137 DURBAN ROODEPOORT DEEP LTD
138 DYNAMIC CABLES RSA LTD
139 DYNAMO RETAIL LTD
140 EC-HOLDINGS LTD
141 EDGARS CONSOLIDATED STORES LTD
142 EERSTELING GOLD MINING COMPANY LTD
143 ELB GROUP LTD
144 ELECTRONIC MEDIA NETWORK & SUPERSPORT INTL HLD LTD
145 ELEXIR TECHNOLOGY HOLDINGS LTD
146 ELLERINE HOLDINGS LTD
147 ENERGY AFRICA LTD
148 ENTERPRISE OUTSOURCING HOLDINGS LTD

149 ENTERPRISE RISK MANAGEMENT LTD
150 ENVIROSERV HOLDINGS LTD
151 ERP.COM HOLDINGS LTD
152 EUREKA INDUSTRIAL LTD
153 EXCELLERATE HOLDINGS LTD
154 EXPLORER CORPORATION HOLDINGS LTD
155 FAIRVEST PROPERTY HOLDINGS LTD
156 FALCON INVESTMENT HOLDINGS SOCIETE ANONYME
157 FARITEC HOLDINGS LTD
158 FASHION AFRICA LTD
159 FIRSTRAND LTD
160 FORIM HOLDINGS LTD
161 FOSCHINI LTD
162 FREE STATE DEVELOPMENT & INVEST CORP LTD
163 FRONTRANGE LTD
164 GENCOR LTD
165 GILBOA PROPERTIES LTD
166 GLENRAND MIB LTD
167 GLOBAL TECHNOLOGY LTD
168 GLOBAL VILLAGE HOLDINGS LTD
169 GLODINA HOLDINGS LTD
170 GOLD EDGE HOLDINGS LTD
171 GOLD FIELDS LTD
172 GOLD REEF CASINO RESORTS LTD
173 GOOD CAPE LTD
174 GRINDROD LTD
175 GRINTEK LTD
176 GROUP FIVE LTD
177 GROWTHPOINT PROPERTIES LTD
178 HARMONY GOLD MINING COMPANY LTD
179 HERITAGE COLLECTION HOLDINGS LTD
180 HIGHVELD STEEL & VANADIUM CORPORATION LTD
181 HOSKEN CONSOLIDATED INVESTMENTS LTD
182 HOUSE OF BUSBY LTD (THE)
183 HOWDEN AFRICA HOLDINGS LTD
184 HUDACO INDUSTRIES LTD
185 HYPROP INVESTMENTS LTD
186 IDION TECHNOLOGY HOLDINGS LTD
187 IFOUR PROPERTIES LTD
188 ILIAD AFRICA LTD
189 ILLOVO SUGAR LTD
190 IMPALA PLATINUM HOLDINGS LTD
191 IMPERIAL HOLDINGS LTD
192 IMR INVESTMENTS LTD
193 INCENTIVE HOLDINGS LTD
194 INDEPENDENT FINANCIAL SERVICES LTD
195 INDEQUITY GROUP LTD
196 INFOWAVE HOLDINGS LTD
197 INMINS LTD
198 INSURANCE OUTSOURCING MANAGERS HOLDINGS LTD

199 INTEGREAR LTD
200 INTERCONNECTIVE SOLUTIONS LTD
201 INTERTRADING LTD
202 INTERVID LTD
203 INVESTEC LTD
204 INVESTEC PLC
205 INVICTA HOLDINGS LTD
206 ISCOR LTD
207 IST GROUP LTD
208 ITALTILE LTD
209 JASCO ELECTRONICS HOLDINGS LTD
210 JCI LTD
211 JD GROUP LTD
212 JIGSAW HOLDINGS LTD
213 JOHN DANIEL HOLDINGS LIMITED
214 JOHNNIC COMMUNICATIONS LTD
215 JOHNNIC HOLDINGS LTD
216 KAGISO MEDIA LTD
217 KAIROS INDUSTRIAL HOLDINGS LTD
218 KELGRAN LTD
219 KERSAF INVESTMENTS LTD
220 KING CONSOLIDATED HOLDINGS LTD
221 KOLOSUS HOLDINGS LTD
222 KUMBA RESOURCES LTD
223 KWV BELEGGINGS BPK
224 LA GROUP LTD
225 LABAT AFRICA LTD
226 LEISURENET LTD
227 LIBERTY GROUP LTD
228 LIBERTY HOLDINGS LTD
229 LIBERTY INTERNATIONAL PLC
230 LONDON FINANCE & INVESTMENT GROUP PLC
231 LONMIN PLC
232 LONRHO AFRICA PLC
233 LYONS FINANCIAL SOLUTIONS HOLDINGS LTD
234 M CUBED HOLDINGS LTD
235 MARSHALLS LTD
236 MARTPROP PROPERTY FUND
237 MASONITE (AFRICA) LTD
238 MASSMART HOLDINGS LTD
239 MATHOMO GROUP LTD
240 MATODZI RESOURCES LIMITED
241 MAXTEC LTD
242 MCCARTHY LTD
243 MEDI-CLINIC CORPORATION LTD
244 MERCANTILE LISBON BANK HOLDINGS LTD
245 MESSINA LTD
246 METAIR INVESTMENTS LTD
247 METBOARD PROPERTIES LTD
248 METOREX LTD

249 METRO CASH & CARRY LTD
250 MGX HOLDINGS LTD
251 MICROMEGA HOLDINGS LTD
252 MILLIONAIR CHARTER LTD
253 MOBILE INDUSTRIES LTD
254 MONEY WEB HOLDINGS LTD
255 MONTEAGLE SOCIETE ANONYME
256 MORIBO LEISURE LTD
257 MOULDED MEDICAL SUPPLIES LTD
258 MR PRICE GROUP LTD
259 MTN GROUP LTD
260 MURRAY AND ROBERTS HOLDINGS LTD
261 MUSTEK LTD
262 MUTUAL & FEDERAL INSURANCE COMPANY LTD
263 MVELAPHANDA RESOURCES LTD
264 NAMIBIAN SEA PRODUCTS LTD
265 NAMPAK LTD
266 NASPERS LTD N
267 NEDCOR LTD
268 NET 1 APPLIED TECHNOLOGY HOLDINGS LTD
269 NETWORK HEALTHCARE HOLDINGS LTD
270 NEW AFRICA CAPITAL LTD
271 NEW AFRICA INVESTMENTS LTD
272 NEW CLICKS HOLDINGS LTD
273 NICTUS LTD
274 NORTHAM PLATINUM LTD
275 NORTHERN ENGINEERING INDUSTRIES (AFRICA) LTD
276 NOVA EDUCATION AND TECHNOLOGY HOLDINGS LTD
277 NU-WORLD HOLDINGS LTD
278 OAKFIELD THOROUGHBREDS & LEISURE IND LTD
279 OCEANA GROUP LTD
280 OCTODEC INVESTMENTS LTD
281 OLD MUTUAL PLC
282 OMEGA ALPHA INTERNATIONAL IT HOLDINGS LTD
283 OMNIA HOLDINGS LTD
284 ONELOGIX GROUP LTD
285 OSI HOLDINGS LTD
286 OTR MINING LTD
287 PACIFIC HOLDINGS LTD
288 PALABORA MINING CO LTD
289 PALS HOLDINGS LTD
290 PANGBOURNE PROPERTIES LTD
291 PARACON HOLDINGS LTD
292 PARAMOUNT PROPERTY FUND LTD
293 PASDEC RESOURCES SA LTD
294 PEPKOR LTD
295 PEREGRINE HOLDINGS LTD
296 PETRA MINING LTD
297 PHUMELELA GAMING AND LEISURE LTD
298 PICK N PAY HOLDINGS LTD

299 PICK N PAY STORES LTD
300 PINNACLE TECHNOLOGY HOLDINGS LTD
301 PREMIER GROUP LTD (THE)
302 PREMIUM PROPERTIES LTD
303 PRETORIA PORTLAND CEMENT COMPANY LTD
304 PRIMA PROPERTY TRUST
305 PRIMEDIA LTD
306 PRIMEGRO PROPERTIES LTD
307 PRIMESERV GROUP LTD
308 PRISM HOLDINGS LTD
309 PROPER GROUP LTD
310 PSG GROUP LTD
311 PUTCO LTD
312 PUTCO PROPERTIES LTD
313 QUYN HOLDINGS LTD
314 RAINBOW CHICKEN LTD
315 RAND LEASES PROPERTIES LTD
316 RANDGOLD & EXPLORATION COMPANY LTD
317 RARE EARTH EXTRACTION COMPANY LTD
318 REAL AFRICA HOLDINGS LTD
319 REBSERVE HOLDINGS LTD
320 REDEFINE INCOME FUND LTD
321 RELYANT RETAIL LTD
322 REMGRO LTD
323 RENTSURE HOLDINGS LTD
324 RESILIENT PROPERTY INCOME FUND LTD
325 RETAIL APPAREL GROUP LTD
326 REUNERT LTD
327 REX TRUEFORM CLOTHING COMPANY LTD
328 RICHEMONT SECURITIES AG
329 RICHWAY RETAIL PROPERTIES LTD
330 RMB HOLDINGS LTD
331 S & J LAND HOLDINGS LTD
332 SA EAGLE INSURANCE COMPANY LTD
333 SA MINERAL RESOURCES CORP LTD
334 SA RETAIL PROPERTIES LTD
335 SAAMBOU HOLDINGS LTD
336 SABLE HOLDINGS LTD
337 SABMILLER PLC
338 SABVEST LTD
339 SAGE GROUP LTD
340 SAIL GROUP LTD
341 SALLIES LTD
342 SAMRAND DEVELOPMENT HOLDINGS LTD
343 SANLAM LTD
344 SANTAM LTD
345 SAPPI LTD
346 SASANI LTD
347 SASFIN HOLDINGS LTD
348 SASOL LTD

349 SCHARRIG MINING LTD
350 SEARDEL INVESTMENT CORPORATION LTD
351 SEKUNJALO INVESTMENTS LTD
352 SETPOINT TECHNOLOGY HOLDINGS LTD
353 SHAWCELL TELECOMMUNICATIONS LTD
354 SHOPRITE HOLDINGS LTD
355 SHOPS FOR AFRICA LTD
356 SILTEK LTD
357 SIMMER AND JACK MINES LTD
358 SOFTLINE LTD
359 SOUTH AFRICAN CHROME AND ALLOYS LTD
360 SOUTHERN ELECTRICITY COMPANY LTD
361 SOUTHERN MINING CORPORATION LTD
362 SOVEREIGN FOOD INVESTMENTS LTD
363 SPANJAARD LTD
364 SPEARHEAD PROPERTY HOLDINGS LTD
365 SPECTRUM SHIPPING LTD
366 SPESCOM LTD
367 SPUR CORPORATION LTD
368 SQUARE ONE SOLUTIONS GROUP LTD
369 STANDARD BANK GROUP LTD
370 STEERS HOLDINGS LTD
371 STEINHOFF INTERNATIONAL HOLDINGS LTD
372 STELLA VISTA TECHNOLOGIES LTD
373 STILFONTEIN GOLD MINING COMPANY LTD
374 STOCKS HOTELS & RESORTS LTD
375 STRATCORP LTD
376 SUB NIGEL GOLD MINING COMPANY LTD
377 SUN INTERNATIONAL (SOUTH AFRICA) LTD
378 SUPER GROUP LTD
379 SYCOM PROPERTY FUND
380 SYNERGY HOLDINGS LTD
381 TELKOM SA LIMITED
382 TEREXKO LTD
383 TERRAFIN HOLDINGS LTD
384 THABEX EXPLORATION LTD
385 TIGER BRANDS LTD
386 TIGER WHEELS LTD
387 TIGON LTD
388 TISEC LTD
389 TONGAAT-HULETT GROUP LTD
390 TOP INFO TECHNOLOGY HOLDINGS LTD
391 TOURISM INVESTMENT CORPORATION LTD
392 TRADEHOLD LTD
393 TRANS HEX GROUP LTD
394 TRANSPACO LTD
395 TREMATON CAPITAL INVESTMENTS LTD
396 TRENCOR LTD
397 TRUWORTHS INTERNATIONAL LTD
398 UCS GROUP LTD

399 UNITED SERVICE TECHNOLOGIES LTD
400 UNITRANS LTD
401 UNIVERSAL GROWTH HOLDINGS LTD
402 VAALAUTO LTD
403 VAALTRUCAR LTD
404 VALUE GROUP LTD
405 VENFIN LTD
406 VENTER LEISURE & COMMERCIAL TRAILERS LTD
407 VESTA TECHNOLOGY HOLDINGS LTD
408 VIKING INVESTMENTS & ASSET MANAGEMENT LTD
409 VILLAGE MAIN REEF GOLD MINING COMPANY LTD
410 W B HOLDINGS LTD
411 WANKIE COLLIERY COMPANY LTD
412 WESCO INVESTMENTS LTD
413 WESTERN AREAS LTD
414 WETHERLYS INVESTMENT HOLDINGS LTD
415 WHETSTONE INDUSTRIAL HOLDINGS LTD
416 WILSON BAYLY HOLMES-OVCON LTD
417 WINECORP LTD
418 WINHOLD LTD
419 WOOLTRU LTD
420 WOOLWORTHS HOLDINGS LTD
421 Y3K GROUP LTD
422 YORK TIMBER ORGANISATION LTD
423 ZAMBIA COPPER INVESTMENTS LTD
424 ZAPTRONIX LTD
425 ZARARA ENERGY LTD
426 ZELTIS HOLDINGS LTD
427 ZENITH CONCESSIONS LTD

APPENDIX B
LIST OF COMPANIES DISPLAYING THE KEY VARIABLE OF STAFF COSTS WITH TOTALS FOR 2001

	COMPANY NAME	STAFF COSTS	VALUE ADDED
1	ABSA GROUP LTD	4,480,000	19,087,000
2	ACUITY GROUP HOLDINGS LTD	22,883	2,672
3	ADCORP HOLDINGS LTD	230,542	109,233
4	ADVTECH LTD	228,797	34,682
5	AECI LTD	1,123,000	-80,000
6	AFGRI LTD	365,114	393,162
7	AFRICAN BANK INVESTMENTS LTD	332,000	1,503,551
8	AFRICAN HARVEST LTD	84,124	27,992
9	AFRICAN MEDIA ENTERTAINMENT LTD	25,327	14,849
10	AFRICAN OXYGEN LTD	1,249,078	1,027,838
11	AFROX HEALTHCARE LTD	967,183	493,010
12	AG INDUSTRIES LTD	86,516	94,219
13	ALACRITY FINANCIAL SERVICES LTD	59,570	-5,833
14	ALLIANCE PHARMACEUTICALS LTD	30,158	5,389
15	ALLIED ELECTRONICS CORPORATION L	1,656,000	1,059,831
16	ALLIED TECHNOLOGIES LTD	470,000	499,531
17	ALUDIE LTD	13,234	-1,274
18	AMALGAMATED APPLIANCE HOLDINGS I	89,764	39,269
19	AMALGAMATED BEVERAGE INDUSTRIES	542,000	770,000
20	AMB HOLDINGS LTD	50,651	326,293
21	ANGLO AMERICAN PLATINUM CORPORA	2,958,000	12,017,400
22	ANGLOGOLD LTD	4,663,000	3,655,000
23	ANGLOVAAL INDUSTRIES LTD	1,078,600	793,900
24	ANGLOVAAL MINING LTD	475,000	857,000
25	APPLETON LTD	44,497	25,720
26	APS TECHNOLOGIES LTD	9,502	-15,541
27	ARGENT INDUSTRIAL LTD	32,199	36,838
28	ASPEN PHARMACARE HOLDINGS LTD	205,034	359,295
29	ASSMANG LTD	237,333	507,533
30	ASSORE LTD	156,878	289,596
31	AST GROUP LTD	532,920	108,731
32	ASTRAL FOODS LTD	201,613	266,780
33	ASTRAPAK LTD	118,246	101,117
34	AVENG LTD	1,385,600	897,300
35	AVGOLD LTD	93,055	58,641
36	AVIS SOUTHERN AFRICA LTD	297,463	817,786
37	BARLOWORLD LTD	4,366,000	2,427,000
38	BARNARD JACOBS MELLET HOLDINGS L	84,936	61,411
39	BASIL READ HOLDINGS LTD	144,313	1,918
40	BEARING MAN LTD	74,681	65,942
41	BELL EQUIPMENT LTD	259,972	259,866
42	BICC CAFCA LTD	153,634	461,713
43	BIDVEST GROUP LTD (THE)	3,413,006	1,992,528
44	BRAIT SA	117,000	202,400
45	BRANDCORP HOLDINGS LTD	68,723	48,900

46	BRIDGESTONE FIRESTONE MAXIPREST	150,904	91,401
47	BRIMSTONE INVESTMENT CORPORATIC	41,065	23,262
48	BUILDMAX LTD	21,523	9,746
49	BYTES TECHNOLOGY GROUP LTD	188,117	-35,390
50	CADIZ HOLDINGS LTD	24,067	105,441
51	CAPITAL ALLIANCE HOLDINGS LTD	66,831	406,190
52	CARGO CARRIERS LTD	83,000	33,153
53	CASHBUILD LTD	81,030	32,278
54	CAXTON CTP PUBLISHERS AND PRINTEI	449,614	412,213
55	CERAMIC INDUSTRIES LTD	46,419	143,325
56	CHEMICAL SERVICES LTD	328,200	237,800
57	CITY LODGE HOTELS LTD	42,875	93,350
58	COMAIR LTD	129,782	151,142
59	COMBINED MOTOR HOLDINGS LTD	107,720	75,924
60	COMMAND HOLDINGS LTD	71,613	-168
61	COMMERCIAL FINANCE COMPANY LTD	1,947	36,636
62	COMPAREX HOLDINGS LTD	1,693,814	617,978
63	CONCOR LTD	254,751	54,486
64	CONTROL INSTRUMENTS GROUP LTD	62,382	8,419
65	CORONATION HOLDINGS LTD	272,000	746,000
66	CORPCAPITAL LTD	43,534	462,208
67	CROOKES BROTHERS LTD	43,052	30,856
68	CS COMPUTER SERVICES HOLDINGS LT	76,174	30,994
69	DATATEC LTD	1,620,000	1,782,000
70	DECILLION LTD	233,736	108,701
71	DELTA ELECTRICAL INDUSTRIES LTD	195,909	395,726
72	DIGICORE HOLDINGS LTD	30,064	47,913
73	DISCOVERY HOLDINGS LTD	205,000	395,000
74	DISTELL GROUP LTD	653,478	433,020
75	DISTRIBUTION & WAREHOUSING NETW(	59,328	43,234
76	DNA SUPPLY CHAIN INVESTMENTS LTD	110,573	91,233
77	DORBYL LTD	901,322	193,218
78	DURBAN ROODEPOORT DEEP LTD	678,029	-141,211
79	EC-HOLDINGS LTD	18,897	1,515
80	EDGARS CONSOLIDATED STORES LTD	963,500	543,500
81	ELECTRONIC MEDIA NETWORK & SUPEI	5,029	160,842
82	ELLERINE HOLDINGS LTD	483,874	381,995
83	ENVIROSERV HOLDINGS LTD	111,382	55,113
84	EXCELLERATE HOLDINGS LTD	49,531	19,420
85	EXPLORER CORPORATION HOLDINGS L	1,417	-3,880
86	FARITEC HOLDINGS LTD	40,949	23,398
87	FORIM HOLDINGS LTD	30,264	6,597
88	FOSCHINI LTD	505,400	334,600
89	GLENRAND MIB LTD	302,116	118,856
90	GLOBAL TECHNOLOGY LTD	245,371	159,329
91	GLODINA HOLDINGS LTD	32,998	-4,623
92	GOLD EDGE HOLDINGS LTD	2,445	6,465

93	GOLD FIELDS LTD	3,032,200	-890,700
94	GRINDROD LTD	207,275	251,223
95	GRINTEK LTD	280,309	212,773
96	HERITAGE COLLECTION HOLDINGS LTD	24,753	-49,271
97	HIGHVELD STEEL & VANADIUM CORPOF	748,563	-403,284
98	HOMECHOICE HOLDINGS LTD	67,117	-53,923
99	HUDACO INDUSTRIES LTD	220,798	117,030
100	IDION TECHNOLOGY HOLDINGS LTD	151,346	780
101	ILIAD AFRICA LTD	57,101	43,277
102	ILLOVO SUGAR LTD	908,000	967,900
103	IMPALA PLATINUM HOLDINGS LTD	1,734,700	7,104,000
104	IMPERIAL HOLDINGS LTD	2,663,000	3,289,000
105	IMR INVESTMENTS LTD	13,428	13,978
106	INDEQUITY GROUP LTD	2,207	3,456
107	INMINS LTD	27,104	14,104
108	INTERVID LTD	23,953	42,524
109	INVESTEC LTD	1,832,000	11,912,000
110	IPROP HOLDINGS LTD	9,843	54,571
111	ISCOR LTD	2,974,000	1,125,000
112	IST GROUP LTD	57,933	27,485
113	JASCO ELECTRONICS HOLDINGS LTD	62,895	-17,587
114	JD GROUP LTD	639,000	560,700
115	JOHNNIC COMMUNICATIONS LTD	1,203,700	3,086,200
116	JOHNNIC HOLDINGS LTD	1,025,900	3,757,000
117	KELGRAN LTD	55,300	34,232
118	KERSAF INVESTMENTS LTD	688,000	272,297
119	KOLOSUS HOLDINGS LTD	181,021	-75,316
120	LA GROUP LTD	60,099	70,188
121	LIBERTY GROUP LTD	843,539	3,922,200
122	MASONITE (AFRICA) LTD	68,215	23,602
123	MASSMART HOLDINGS LTD	778,900	373,800
124	MAXTEC LTD	12,761	-10,300
125	MCCARTHY LTD	484,838	-869,325
126	MEDI-CLINIC CORPORATION LTD	719,138	479,437
127	MERCANTILE LISBON BANK HOLDINGS L	189,365	251,961
128	METAIR INVESTMENTS LTD	258,026	149,231
129	METJE & ZIEGLER LTD	41,275	1,201
130	METOREX LTD	187,994	119,345
131	METRO CASH & CARRY LTD	1,756,064	445,542
132	MGX HOLDINGS LTD	220,180	153,975
133	MR PRICE GROUP LTD	300,025	194,231
134	MTN GROUP LTD	631,200	2,873,400
135	MURRAY AND ROBERTS HOLDINGS LTD	1,616,900	607,500
136	MUSTEK LTD	108,358	150,250
137	MUTUAL & FEDERAL INSURANCE COMP/	459,000	1,021,000
138	NAMPAK LTD	2,208,900	1,288,100
139	NEDCOR LTD	2,928,000	13,587,000

140	NET 1 APPLIED TECHNOLOGY HOLDING	134,002	166,364
141	NETWORK HEALTHCARE HOLDINGS LTI	1,292,600	764,200
142	NEW AFRICA CAPITAL LTD	563,000	863,000
143	NEW CLICKS HOLDINGS LTD	596,472	366,124
144	NICTUS LTD	7,626	4,624
145	NINIAN & LESTER HOLDINGS LTD	109,551	22,909
146	NU-WORLD HOLDINGS LTD	44,459	55,909
147	OCEANA GROUP LTD	181,501	264,071
148	OMNIA HOLDINGS LTD	189,256	85,653
149	OSI HOLDINGS LTD	14,337	-589
150	OZZ LTD	146,994	52,187
151	PACIFIC HOLDINGS LTD	3,005	22
152	PALABORA MINING CO LTD	338,519	534,350
153	PARACON HOLDINGS LTD	47,051	53,750
154	PEPKOR LTD	691,443	170,425
155	PEREGRINE HOLDINGS LTD	27,711	142,506
156	PETRA MINING LTD	2,798	20,822
157	PICK N PAY STORES LTD	1,564,000	722,100
158	PINNACLE TECHNOLOGY HOLDINGS LTI	13,461	8,471
159	PRETORIA PORTLAND CEMENT COMPAI	410,200	765,700
160	PRIMEDIA LTD	319,390	163,935
161	PRIMEGRO PROPERTIES LTD	8,429	271,699
162	PRIMESERV GROUP LTD	65,056	56,747
163	PRISM HOLDINGS LTD	54,719	80,849
164	PROFURN LTD	621,704	-447,238
165	PSG GROUP LTD	204,610	525,648
166	PSG INVESTMENT BANK HOLDINGS LTD	66,796	448,227
167	PUTCO LTD	322,145	66,004
168	REAL AFRICA HOLDINGS LTD	6,328	-250,931
169	REBSERVE HOLDINGS LTD	793,913	555,032
170	REF FINANCE & INVESTMENT CORPORA	611	-4,699
171	RELYANT RETAIL LTD	489,587	226,736
172	REMGRO LTD	1,063,000	7,371,000
173	RENTSURE HOLDINGS LTD	48,692	20,471
174	REUNERT LTD	411,500	683,800
175	REX TRUEFORM CLOTHING COMPANY L	100,913	12,197
176	S & J LAND HOLDINGS LTD	1,169	-66,728
177	SA MINERAL RESOURCES CORP LTD	2,163	-2,495
178	SABMILLER PLC	421,000	682,000
179	SAGE GROUP LTD	101,650	103,651
180	SALLIES LTD	9,041	11,041
181	SANLAM LTD	1,916,000	6,668,000
182	SANTAM LTD	481,289	520,148
183	SAPPI LTD	707,000	593,000
184	SASANI LTD	83,687	64,282
185	SASOL LTD	4,957,000	13,680,000
186	SCHARRIG MINING LTD	31,234	39,931

187	SEARDEL INVESTMENT CORPORATION I	701,553	176,823
188	SETPOINT TECHNOLOGY HOLDINGS LTI	51,367	-3,971
189	SHOPRITE HOLDINGS LTD	1,689,647	582,642
190	SIMMER AND JACK MINES LTD	7,519	-371
191	SOFTLINE LTD	225,787	616,433
192	SOVEREIGN FOOD INVESTMENTS LTD	38,397	22,482
193	SPEARHEAD PROPERTY HOLDINGS LTD	3,438	74,538
194	SPUR CORPORATION LTD	25,355	43,929
195	STANDARD BANK GROUP LTD	5,242,000	25,000,000
196	STEERS HOLDINGS LTD	36,540	34,377
197	STELLA VISTA TECHNOLOGIES LTD	2,743	4,720
198	STILFONTEIN GOLD MINING COMPANY L	43	621
199	STOCKS HOTELS & RESORTS LTD	18,785	-1,057
200	SUN INTERNATIONAL (SOUTH AFRICA) L	547,669	424,836
201	SUPER GROUP LTD	531,947	820,517
202	TIGER BRANDS LTD	1,695,200	2,476,800
203	TIGER WHEELS LTD	377,873	194,076
204	TONGAAT-HULETT GROUP LTD	901,000	1,204,000
205	TRADEHOLD LTD	959,137	315,052
206	TRANSPACO LTD	51,806	13,262
207	TREMATON CAPITAL INVESTMENTS LTD	251	-653,732
208	TRUWORTHS INTERNATIONAL LTD	240,064	360,085
209	UCS GROUP LTD	76,816	62,347
210	UNITRANS LTD	617,304	422,918
211	VALUE GROUP LTD	143,069	62,036
212	VESTA TECHNOLOGY HOLDINGS LTD	14,609	-13,782
213	WANKIE COLLIERY COMPANY LTD	1,126,721	1,117,547
214	WESCO INVESTMENTS LTD	859,711	380,234
215	WILSON BAYLY HOLMES-OVCON LTD	187,351	117,229
216	WINECORP LTD	4,474	6,260
217	WINHOLD LTD	61,568	25,895
218	WOMEN INVESTMENT PORTFOLIO HOLI	30,202	50,841
219	WOOLTRU LTD	494,700	278,200
220	WOOLWORTHS HOLDINGS LTD	1,098,100	690,000
221	Y3K GROUP LTD	7,588	-2,776
222	YORK TIMBER ORGANISATION LTD	21,747	6,320
223	ZAPTRONIX LTD	7,063	-4,412
224	ZARARA ENERGY LTD	6,812	-74,201
	TOTAL	115,574,963	188,816,803

APPENDIX C
LIST OF COMPANIES INCLUDED IN FINAL DATA SET/SAMPLE WITH TOTALS FOR 2001

	COMPANY NAME	STAFF COSTS	VALUE ADDED
1	AECI LTD	1,123,000	-80,000
2	AFGRI LTD	365,114	393,162
3	AFRICAN OXYGEN LTD	1,249,078	1,027,838
4	AFROX HEALTHCARE LTD	967,183	493,010
5	AG INDUSTRIES LTD	86,516	94,219
6	ALLIED ELECTRONICS CORPORATION L	1,656,000	1,059,831
7	ALLIED TECHNOLOGIES LTD	470,000	499,531
8	AMALGAMATED BEVERAGE INDUSTRIES	542,000	770,000
9	ANGLO AMERICAN PLATINUM CORPORA	2,958,000	12,017,400
10	ANGLOGOLD LTD	4,663,000	3,655,000
11	ANGLOVAAL INDUSTRIES LTD	1,078,600	793,900
12	ANGLOVAAL MINING LTD	475,000	857,000
13	APPLETON LTD	44,497	25,720
14	ARGENT INDUSTRIAL LTD	32,199	36,838
15	ASPEN PHARMACARE HOLDINGS LTD	205,034	359,295
16	ASSMANG LTD	237,333	507,533
17	ASSORE LTD	156,878	289,596
18	ASTRAL FOODS LTD	201,613	266,780
19	ASTRAPAK LTD	118,246	101,117
20	AVENG LTD	1,385,600	897,300
21	AVGOLD LTD	93,055	58,641
22	AVIS SOUTHERN AFRICA LTD	297,463	817,786
23	BARLOWORLD LTD	4,366,000	2,427,000
24	BARNARD JACOBS MELLET HOLDINGS L	84,936	61,411
25	BEARING MAN LTD	74,681	65,942
26	BELL EQUIPMENT LTD	259,972	259,866
27	BICC CAFCA LTD	153,634	461,713
28	BIDVEST GROUP LTD (THE)	3,413,006	1,992,528
29	BRAIT SA	117,000	202,400
30	BRANDCORP HOLDINGS LTD	68,723	48,900
31	BRIDGESTONE FIRESTONE MAXIPREST	150,904	91,401
32	CADIZ HOLDINGS LTD	24,067	105,441
33	CAXTON CTP PUBLISHERS AND PRINTEI	449,614	412,213
34	CERAMIC INDUSTRIES LTD	46,419	143,325
35	CHEMICAL SERVICES LTD	328,200	237,800
36	CITY LODGE HOTELS LTD	42,875	93,350
37	COMAIR LTD	129,782	151,142
38	COMBINED MOTOR HOLDINGS LTD	107,720	75,924
39	COMMERCIAL FINANCE COMPANY LTD	1,947	36,636
40	CORPCAPITAL LTD	43,534	462,208
41	CROOKES BROTHERS LTD	43,052	30,856
42	DATATEC LTD	1,620,000	1,782,000
43	DELTA ELECTRICAL INDUSTRIES LTD	195,909	395,726
44	DIGICORE HOLDINGS LTD	30,064	47,913
45	DISCOVERY HOLDINGS LTD	205,000	395,000
46	DISTELL GROUP LTD	653,478	433,020
47	DISTRIBUTION & WAREHOUSING NETW(	59,328	43,234
48	DNA SUPPLY CHAIN INVESTMENTS LTD	110,573	91,233

49	EDGARS CONSOLIDATED STORES LTD	963,500	543,500
50	ELECTRONIC MEDIA NETWORK & SUPEI	5,029	160,842
51	ELLERINE HOLDINGS LTD	483,874	381,995
52	ENVIROSERV HOLDINGS LTD	111,382	55,113
53	FARITEC HOLDINGS LTD	40,949	23,398
54	FOSCHINI LTD	505,400	334,600
55	GLENRAND MIB LTD	302,116	118,856
56	GLOBAL TECHNOLOGY LTD	245,371	159,329
57	GOLD EDGE HOLDINGS LTD	2,445	6,465
58	GRINDROD LTD	207,275	251,223
59	GRINTEK LTD	280,309	212,773
60	HUDACO INDUSTRIES LTD	220,798	117,030
61	ILIAD AFRICA LTD	57,101	43,277
62	ILLOVO SUGAR LTD	908,000	967,900
63	IMPALA PLATINUM HOLDINGS LTD	1,734,700	7,104,000
64	IMPERIAL HOLDINGS LTD	2,663,000	3,289,000
65	IMR INVESTMENTS LTD	13,428	13,978
66	INDEQUITY GROUP LTD	2,207	3,456
67	INTERVID LTD	23,953	42,524
68	IPROP HOLDINGS LTD	9,843	54,571
69	JD GROUP LTD	639,000	560,700
70	JOHNNIC COMMUNICATIONS LTD	1,203,700	3,086,200
71	JOHNNIC HOLDINGS LTD	1,025,900	3,757,000
72	KELGRAN LTD	55,300	34,232
73	LA GROUP LTD	60,099	70,188
74	LIBERTY GROUP LTD	843,539	3,922,200
75	MEDI-CLINIC CORPORATION LTD	719,138	479,437
76	METAIR INVESTMENTS LTD	258,026	149,231
77	METOREX LTD	187,994	119,345
78	MGX HOLDINGS LTD	220,180	153,975
79	MR PRICE GROUP LTD	300,025	194,231
80	MTN GROUP LTD	631,200	2,873,400
81	MUSTEK LTD	108,358	150,250
82	MUTUAL & FEDERAL INSURANCE COMP/	459,000	1,021,000
83	NAMPAK LTD	2,208,900	1,288,100
84	NET 1 APPLIED TECHNOLOGY HOLDING	134,002	166,364
85	NETWORK HEALTHCARE HOLDINGS LTI	1,292,600	764,200
86	NEW AFRICA CAPITAL LTD	563,000	863,000
87	NEW CLICKS HOLDINGS LTD	596,472	366,124
88	NICTUS LTD	7,626	4,624
89	NU-WORLD HOLDINGS LTD	44,459	55,909
90	OCEANA GROUP LTD	181,501	264,071
91	PALABORA MINING CO LTD	338,519	534,350
92	PARACON HOLDINGS LTD	47,051	53,750
93	PEREGRINE HOLDINGS LTD	27,711	142,506
94	PETRA MINING LTD	2,798	20,822
95	PICK N PAY STORES LTD	1,564,000	722,100
96	PINNACLE TECHNOLOGY HOLDINGS LTI	13,461	8,471
97	PRETORIA PORTLAND CEMENT COMPAI	410,200	765,700
98	PRIMEDIA LTD	319,390	163,935

99	PRIMEGRO PROPERTIES LTD	8,429	271,699
100	PRIMESERV GROUP LTD	65,056	56,747
101	PRISM HOLDINGS LTD	54,719	80,849
102	REBSERVE HOLDINGS LTD	793,913	555,032
103	REMGRO LTD	1,063,000	7,371,000
104	REUNERT LTD	411,500	683,800
105	SABMILLER PLC	421,000	682,000
106	SAGE GROUP LTD	101,650	103,651
107	SALLIES LTD	9,041	11,041
108	SANLAM LTD	1,916,000	6,668,000
109	SANTAM LTD	481,289	520,148
110	SAPPI LTD	707,000	593,000
111	SASANI LTD	83,687	64,282
112	SASOL LTD	4,957,000	13,680,000
113	SCHARRIG MINING LTD	31,234	39,931
114	SOFTLINE LTD	225,787	616,433
115	SOVEREIGN FOOD INVESTMENTS LTD	38,397	22,482
116	SPEARHEAD PROPERTY HOLDINGS LTD	3,438	74,538
117	SPUR CORPORATION LTD	25,355	43,929
118	STEERS HOLDINGS LTD	36,540	34,377
119	STELLA VISTA TECHNOLOGIES LTD	2,743	4,720
120	SUN INTERNATIONAL (SOUTH AFRICA) L	547,669	424,836
121	SUPER GROUP LTD	531,947	820,517
122	TIGER BRANDS LTD	1,695,200	2,476,800
123	TONGAAT-HULETT GROUP LTD	901,000	1,204,000
124	TRUWORTHS INTERNATIONAL LTD	240,064	360,085
125	UCS GROUP LTD	76,816	62,347
126	UNITRANS LTD	617,304	422,918
127	WANKIE COLLIERY COMPANY LTD	1,126,721	1,117,547
128	WILSON BAYLY HOLMES-OVCON LTD	187,351	117,229
129	WINECORP LTD	4,474	6,260
130	WOOLWORTHS HOLDINGS LTD	1,098,100	690,000
	TOTAL	72,893,080	112,009,122

APPENDIX D
LIST OF COMPANIES INCLUDED IN FINAL DATA SET/SAMPLE FOR 2001

High Knowledge-Base Group

NAME	INDUSTRY
COMMERCIAL FINANCE COMPANY LTD	Business Service
REMGRO LTD	Business Service
UCS GROUP LTD	Business Service
NET 1 APPLIED TECHNOLOGY HOLDINGS LTD	Business Service
SOFTLINE LTD	Business Service
CADIZ HOLDINGS LTD	Business Service
PARACON HOLDINGS LTD	Business Service
GLOBAL TECHNOLOGY LTD	Business Service
PEREGRINE HOLDINGS LTD	Business Service
PETRA MINING LTD	Business Service
APPLETON LTD	Business Service
STELLA VISTA TECHNOLOGIES LTD	Business Service
PRISM HOLDINGS LTD	Business Service
PRIMESERV GROUP LTD	Business Service
FARITEC HOLDINGS LTD	Business Service
PINNACLE TECHNOLOGY HOLDINGS LTD	Business Service
ENVIROSERV HOLDINGS LTD	Business Service
BIDVEST GROUP LTD (THE)	Business Service
NAMPAK LTD	Business Service
BRAIT SA	Business Service
MUSTEK LTD	Business Service
IMR INVESTMENTS LTD	Business Service
DNA SUPPLY CHAIN INVESTMENTS LTD	Business Service

DATATEC LTD	Business Service
CORPCAPITAL LTD	Business Service
REBSERVE HOLDINGS LTD	Business Service
ASTRAPAK LTD	Business Service
BARNARD JACOBS MELLET HOLDINGS LTD	Business Service
MGX HOLDINGS LTD	Business Service
INTERVID LTD	Business Service
AFRICAN OXYGEN LTD	Chemicals & Phar. Prods
AECI LTD	Chemicals & Phar. Prods
CHEMICAL SERVICES LTD	Chemicals & Phar. Prods
ASPEN PHARMACARE HOLDINGS LTD	Chemicals & Phar. Prods
SASANI LTD	Communication
PRIMEDIA LTD	Communication
ELECTRONIC MEDIA NETWORK & SUPERSPORT INTL HLD LTD	Communication
JOHNNIC HOLDINGS LTD	Communication
MTN GROUP LTD	Communication
CAXTON CTP PUBLISHERS AND PRINTERS	Communication
JOHNNIC COMMUNICATIONS LTD	Communication
NU-WORLD HOLDINGS LTD	Electronic and Electrical Prods
DIGICORE HOLDINGS LTD	Electronic and Electrical Prods
DELTA ELECTRICAL INDUSTRIES LTD	Electronic and Electrical Prods
ALLIED ELECTRONICS CORPORATION LTD	Electronic and Electrical Prods

ALLIED TECHNOLOGIES LTD	Electronic and Electrical Prods
BICC CAFCA LTD	Electronic and Electrical Prods
REUNERT LTD	Electronic and Electrical Prods
GRINTEK LTD	Electronic and Electrical Prods
INDEQUITY GROUP LTD	Finance and Insurance
SANTAM LTD	Finance and Insurance
MUTUAL & FEDERAL INSURANCE COMPANY LTD	Finance and Insurance
NEW AFRICA CAPITAL LTD	Finance and Insurance
SAGE GROUP LTD	Finance and Insurance
LIBERTY GROUP LTD	Finance and Insurance
DISCOVERY HOLDINGS LTD	Finance and Insurance
SANLAM LTD	Finance and Insurance
GLENRAND MIB LTD	Finance and Insurance
IPROP HOLDINGS LTD	Finance and Insurance
PRIMEGRO PROPERTIES LTD	Finance and Insurance
SPEARHEAD PROPERTY HOLDINGS LTD	Finance and Insurance
GOLD EDGE HOLDINGS LTD	Finance and Insurance
MEDI-CLINIC CORPORATION LTD	Health & Social Services
AFROX HEALTHCARE LTD	Health & Social Services
NETWORK HEALTHCARE HOLDINGS LTD	Health & Social Services

Low Knowledge-Base Group

NAME	INDUSTRY
CROOKES BROTHERS LTD	Accomodation, Food & Beverages
SPUR CORPORATION LTD	Accomodation, Food & Beverages
ANGLOVAAL INDUSTRIES LTD	Accomodation, Food & Beverages
SUN INTERNATIONAL (SOUTH AFRICA) LTD	Accomodation, Food & Beverages
TONGAAT-HULETT GROUP LTD	Accomodation, Food & Beverages
SOVEREIGN FOOD INVESTMENTS LTD	Accomodation, Food & Beverages
AMALGAMATED BEVERAGE INDUSTRIES LTD	Accomodation, Food & Beverages
CITY LODGE HOTELS LTD	Accomodation, Food & Beverages
DISTELL GROUP LTD	Accomodation, Food & Beverages
OCEANA GROUP LTD	Accomodation, Food & Beverages
SABMILLER PLC	Accomodation, Food & Beverages
STEERS HOLDINGS LTD	Accomodation, Food & Beverages
ASTRAL FOODS LTD	Accomodation, Food & Beverages

AFGRI LTD	Accomodation, Food & Beverages
ILLOVO SUGAR LTD	Accomodation, Food & Beverages
WINECORP LTD	Accomodation, Food & Beverages
TIGER BRANDS LTD	Accomodation, Food & Beverages
CERAMIC INDUSTRIES LTD	Construction
PRETORIA PORTLAND CEMENT COMPANY LTD	Construction
ILIAD AFRICA LTD	Construction
AG INDUSTRIES LTD	Construction
DISTRIBUTION & WAREHOUSING NETWORK LTD	Construction
WILSON BAYLY HOLMES-OVCON LTD	Construction
AVENG LTD	Construction
ARGENT INDUSTRIAL LTD	Construction
HUDACO INDUSTRIES LTD	Construction
AVGOLD LTD	Mines
SCHARRIG MINING LTD	Mines
ANGLOVAAL MINING LTD	Mines
SALLIES LTD	Mines
ASSORE LTD	Mines
KELGRAN LTD	Mines
SASOL LTD	Mines
ANGLO AMERICAN PLATINUM CORPORATION LTD	Mines
METOREX LTD	Mines
PALABORA MINING CO LTD	Mines
ASSMANG LTD	Mines
IMPALA PLATINUM HOLDINGS LTD	Mines
WANKIE COLLIERY COMPANY LTD	Mines
ANGLOGOLD LTD	Mines

SAPPI LTD	Mines
TRUWORTHS INTERNATIONAL LTD	Retail Trade
ELLERINE HOLDINGS LTD	Retail Trade
BRANDCORP HOLDINGS LTD	Retail Trade
FOSCHINI LTD	Retail Trade
WOOLWORTHS HOLDINGS LTD	Retail Trade
EDGARS CONSOLIDATED STORES LTD	Retail Trade
MR PRICE GROUP LTD	Retail Trade
LA GROUP LTD	Retail Trade
NEW CLICKS HOLDINGS LTD	Retail Trade
JD GROUP LTD	Retail Trade
BEARING MAN LTD	Retail Trade
NICTUS LTD	Retail Trade
PICK N PAY STORES LTD	Retail Trade
BELL EQUIPMENT LTD	Transportation
BARLOWORLD LTD	Transportation
METAIR INVESTMENTS LTD	Transportation
BRIDGESTONE FIRESTONE MAXIPREST LTD	Transportation
COMBINED MOTOR HOLDINGS LTD	Transportation
UNITRANS LTD	Transportation
COMAIR LTD	Transportation
SUPER GROUP LTD	Transportation
IMPERIAL HOLDINGS LTD	Transportation
GRINDROD LTD	Transportation
AVIS SOUTHERN AFRICA LTD	Transportation

APPENDIX E
LIST OF LOW KNOWLEDGE-BASE COMPANIES
FOR 2001

	COMPANY NAME	MAJOR
1	CROOKES BROTHERS LTD	Accomodation, Food & Beverages
2	SPUR CORPORATION LTD	Accomodation, Food & Beverages
3	ANGLOVAAL INDUSTRIES LTD	Accomodation, Food & Beverages
4	SUN INTERNATIONAL (SOUTH AFRICA) L	Accomodation, Food & Beverages
5	TONGAAT-HULETT GROUP LTD	Accomodation, Food & Beverages
6	SOVEREIGN FOOD INVESTMENTS LTD	Accomodation, Food & Beverages
7	AMALGAMATED BEVERAGE INDUSTRIES	Accomodation, Food & Beverages
8	CITY LODGE HOTELS LTD	Accomodation, Food & Beverages
9	DISTELL GROUP LTD	Accomodation, Food & Beverages
10	OCEANA GROUP LTD	Accomodation, Food & Beverages
11	SABMILLER PLC	Accomodation, Food & Beverages
12	STEERS HOLDINGS LTD	Accomodation, Food & Beverages
13	ASTRAL FOODS LTD	Accomodation, Food & Beverages
14	AFGRI LTD	Accomodation, Food & Beverages
15	ILLOVO SUGAR LTD	Accomodation, Food & Beverages
16	WINECORP LTD	Accomodation, Food & Beverages
17	TIGER BRANDS LTD	Accomodation, Food & Beverages
18	CERAMIC INDUSTRIES LTD	Construction
19	PRETORIA PORTLAND CEMENT COMPAI	Construction
20	ILIAD AFRICA LTD	Construction
21	AG INDUSTRIES LTD	Construction
22	DISTRIBUTION & WAREHOUSING NETW	Construction
23	WILSON BAYLY HOLMES-OVCON LTD	Construction
24	AVENG LTD	Construction
25	ARGENT INDUSTRIAL LTD	Construction
26	HUDACO INDUSTRIES LTD	Construction
27	AVGOLD LTD	Mines
28	SCHARRIG MINING LTD	Mines
29	ANGLOVAAL MINING LTD	Mines
30	SALLIES LTD	Mines
31	ASSORE LTD	Mines
32	KELGRAN LTD	Mines
33	SASOL LTD	Mines
34	ANGLO AMERICAN PLATINUM CORPORA	Mines
35	METOREX LTD	Mines
36	PALABORA MINING CO LTD	Mines
37	ASSMANG LTD	Mines
38	IMPALA PLATINUM HOLDINGS LTD	Mines
39	WANKIE COLLIERY COMPANY LTD	Mines
40	ANGLOGOLD LTD	Mines
41	SAPPI LTD	Mines
42	TRUWORTHS INTERNATIONAL LTD	Retail Trade

43	ELLERINE HOLDINGS LTD	Retail Trade
44	BRANDCORP HOLDINGS LTD	Retail Trade
45	FOSCHINI LTD	Retail Trade
46	WOOLWORTHS HOLDINGS LTD	Retail Trade
47	EDGARS CONSOLIDATED STORES LTD	Retail Trade
48	MR PRICE GROUP LTD	Retail Trade
49	LA GROUP LTD	Retail Trade
50	NEW CLICKS HOLDINGS LTD	Retail Trade
51	JD GROUP LTD	Retail Trade
52	BEARING MAN LTD	Retail Trade
53	NICTUS LTD	Retail Trade
54	PICK N PAY STORES LTD	Retail Trade
55	BELL EQUIPMENT LTD	Transportation
56	BARLOWORLD LTD	Transportation
57	METAIR INVESTMENTS LTD	Transportation
58	BRIDGESTONE FIRESTONE MAXIPREST	Transportation
59	COMBINED MOTOR HOLDINGS LTD	Transportation
60	UNITRANS LTD	Transportation
61	COMAIR LTD	Transportation
62	SUPER GROUP LTD	Transportation
63	IMPERIAL HOLDINGS LTD	Transportation
64	GRINDROD LTD	Transportation
65	AVIS SOUTHERN AFRICA LTD	Transportation

APPENDIX F
LIST OF HIGH KNOWLEDGE-BASE COMPANIES FOR 2001

	COMPANY NAME	MAJOR
1	COMMERCIAL FINANCE COMPANY LTD	Business Service
2	REMGRO LTD	Business Service
3	UCS GROUP LTD	Business Service
4	NET 1 APPLIED TECHNOLOGY HOLDING	Business Service
5	SOFTLINE LTD	Business Service
6	CADIZ HOLDINGS LTD	Business Service
7	PARACON HOLDINGS LTD	Business Service
8	GLOBAL TECHNOLOGY LTD	Business Service
9	PEREGRINE HOLDINGS LTD	Business Service
10	PETRA MINING LTD	Business Service
11	APPLETON LTD	Business Service
12	STELLA VISTA TECHNOLOGIES LTD	Business Service
13	PRISM HOLDINGS LTD	Business Service
14	PRIMESERV GROUP LTD	Business Service
15	FARITEC HOLDINGS LTD	Business Service
16	PINNACLE TECHNOLOGY HOLDINGS LTI	Business Service
17	ENVIROSERV HOLDINGS LTD	Business Service
18	BIDVEST GROUP LTD (THE)	Business Service
19	NAMPAK LTD	Business Service
20	BRAIT SA	Business Service
21	MUSTEK LTD	Business Service
22	IMR INVESTMENTS LTD	Business Service
23	DNA SUPPLY CHAIN INVESTMENTS LTD	Business Service
24	DATATEC LTD	Business Service
25	CORPCAPITAL LTD	Business Service
26	REBSERVE HOLDINGS LTD	Business Service
27	ASTRAPAK LTD	Business Service
28	BARNARD JACOBS MELLET HOLDINGS L	Business Service
29	MGX HOLDINGS LTD	Business Service
30	INTERVID LTD	Business Service
31	AFRICAN OXYGEN LTD	Chemicals & Phar. Prods
32	AECI LTD	Chemicals & Phar. Prods
33	CHEMICAL SERVICES LTD	Chemicals & Phar. Prods
34	ASPEN PHARMACARE HOLDINGS LTD	Chemicals & Phar. Prods
35	SASANI LTD	Communication
36	PRIMEDIA LTD	Communication
37	ELECTRONIC MEDIA NETWORK & SUPEI	Communication
38	JOHNNIC HOLDINGS LTD	Communication
39	MTN GROUP LTD	Communication
40	CAXTON CTP PUBLISHERS AND PRINTEI	Communication
41	JOHNNIC COMMUNICATIONS LTD	Communication
42	NU-WORLD HOLDINGS LTD	Electronic and Electrical Prods
43	DIGICORE HOLDINGS LTD	Electronic and Electrical Prods
44	DELTA ELECTRICAL INDUSTRIES LTD	Electronic and Electrical Prods
45	ALLIED ELECTRONICS CORPORATION L	Electronic and Electrical Prods

46	ALLIED TECHNOLOGIES LTD	Electronic and Electrical Prods
47	BICC CAFCA LTD	Electronic and Electrical Prods
48	REUNERT LTD	Electronic and Electrical Prods
49	GRINTEK LTD	Electronic and Electrical Prods
50	INDEQUITY GROUP LTD	Finance and Insurance
51	SANTAM LTD	Finance and Insurance
52	MUTUAL & FEDERAL INSURANCE COMP/	Finance and Insurance
53	NEW AFRICA CAPITAL LTD	Finance and Insurance
54	SAGE GROUP LTD	Finance and Insurance
55	LIBERTY GROUP LTD	Finance and Insurance
56	DISCOVERY HOLDINGS LTD	Finance and Insurance
57	SANLAM LTD	Finance and Insurance
58	GLENRAND MIB LTD	Finance and Insurance
59	IPROP HOLDINGS LTD	Finance and Insurance
60	PRIMEGRO PROPERTIES LTD	Finance and Insurance
61	SPEARHEAD PROPERTY HOLDINGS LTD	Finance and Insurance
62	GOLD EDGE HOLDINGS LTD	Finance and Insurance
63	MEDI-CLINIC CORPORATION LTD	Health & Social Services
64	AFROX HEALTHCARE LTD	Health & Social Services
65	NETWORK HEALTHCARE HOLDINGS LTI	Health & Social Services

APPENDIX G
HISTOGRAMS

Low Knowledge-Base (Untransformed Histograms)

Figure 1

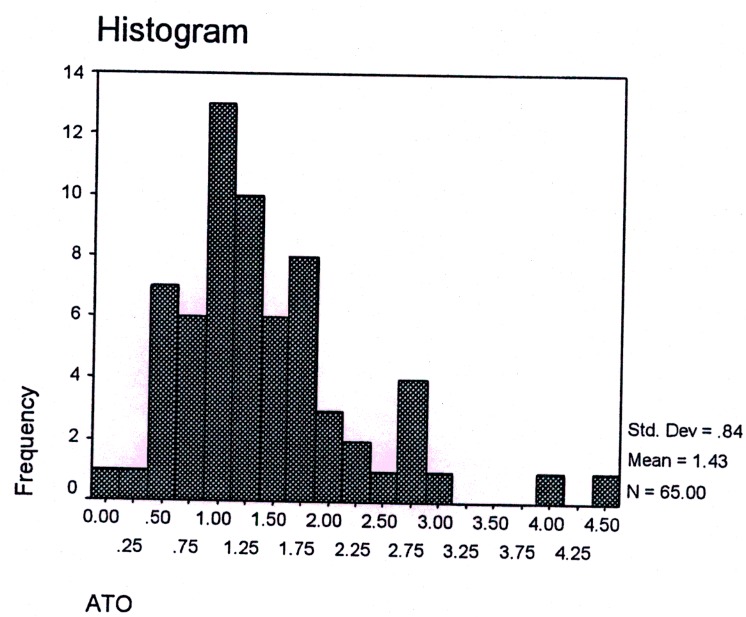


Figure 2

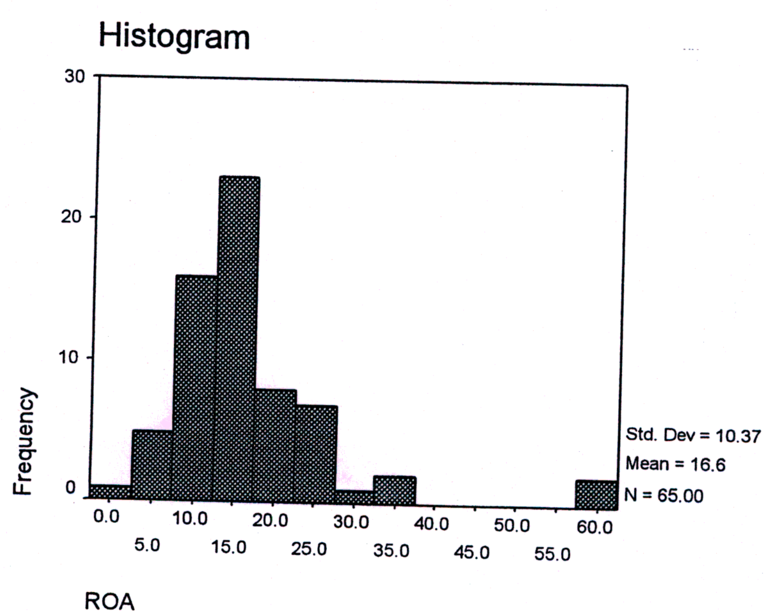


Figure 3

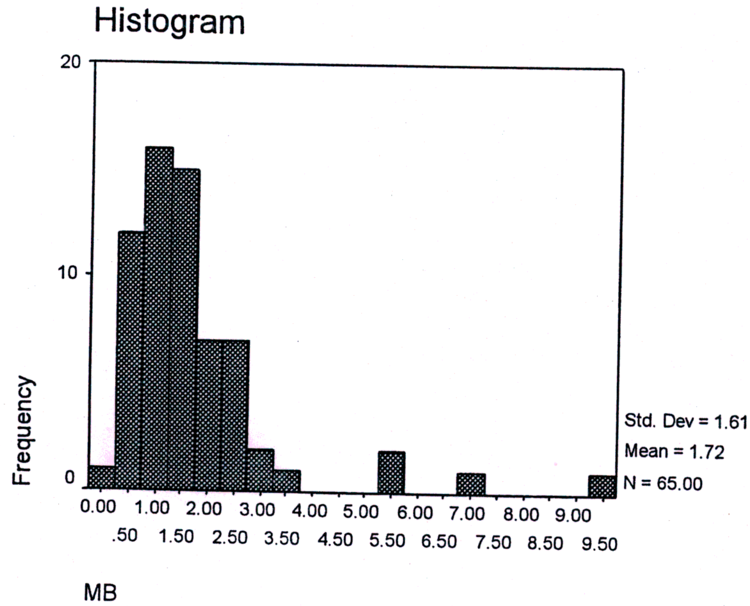


Figure 4

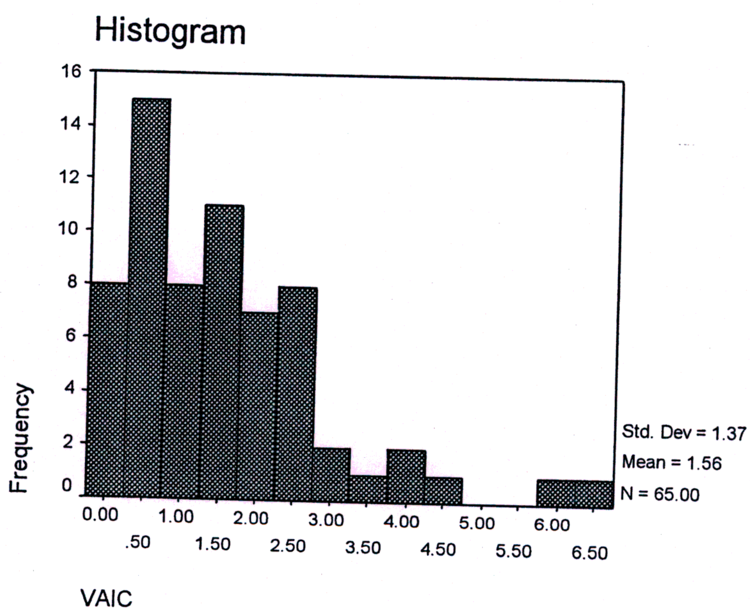


Figure 5

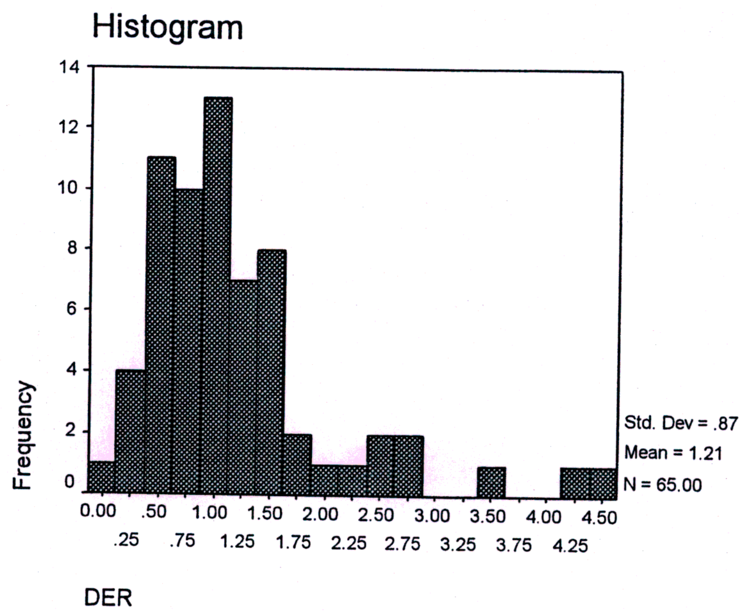


Figure 6

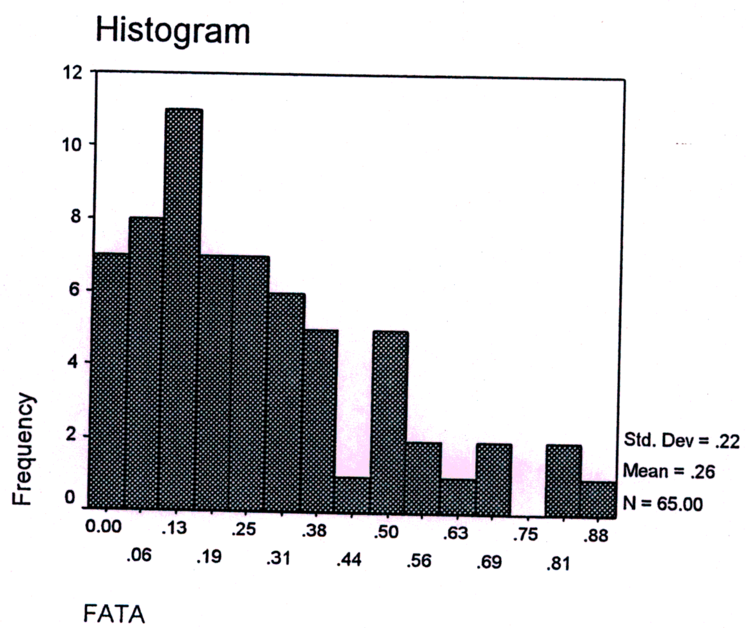


Figure 7

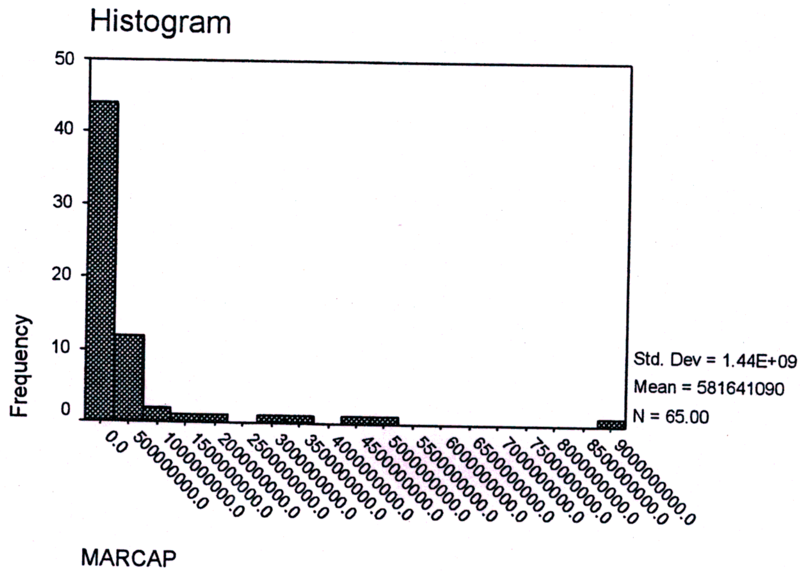


Figure 8

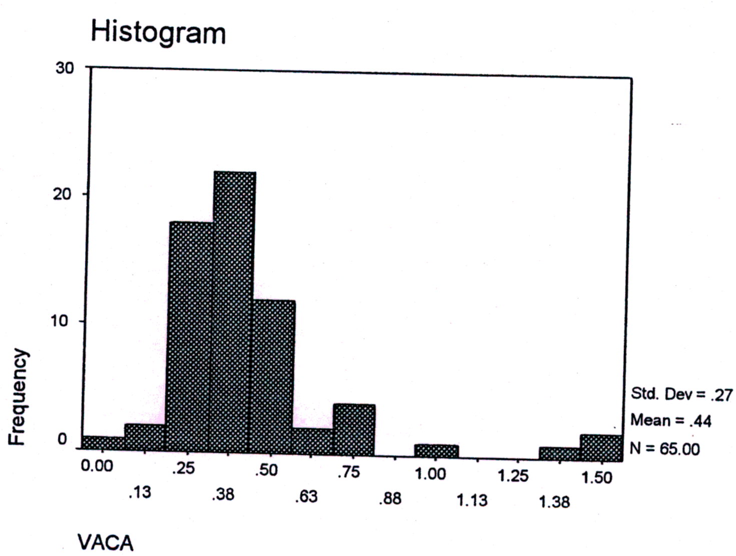


Figure 9

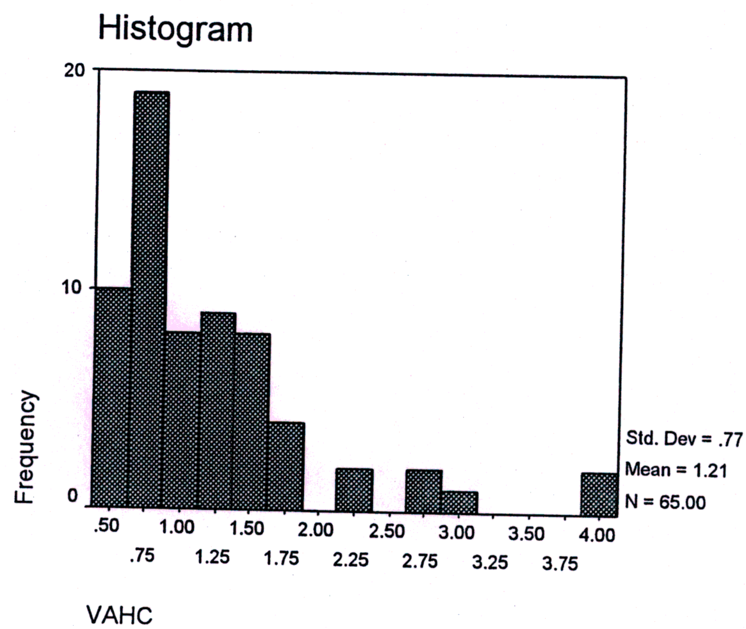
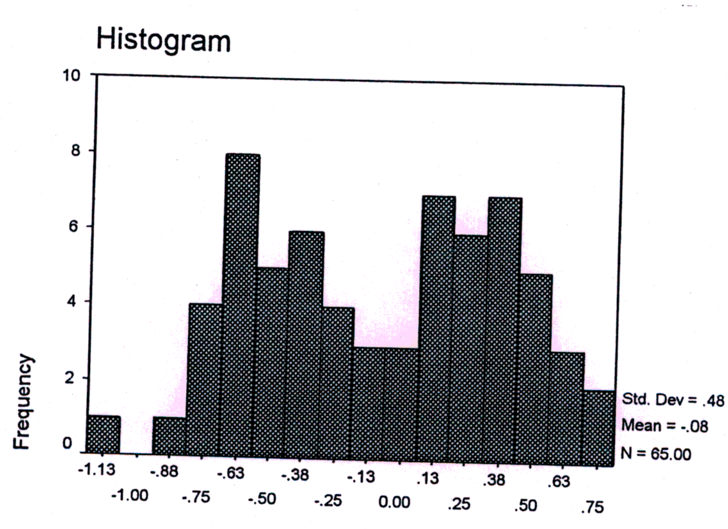


Figure 10



Low Knowledge-Base (Transformed Histograms)

Figure 11

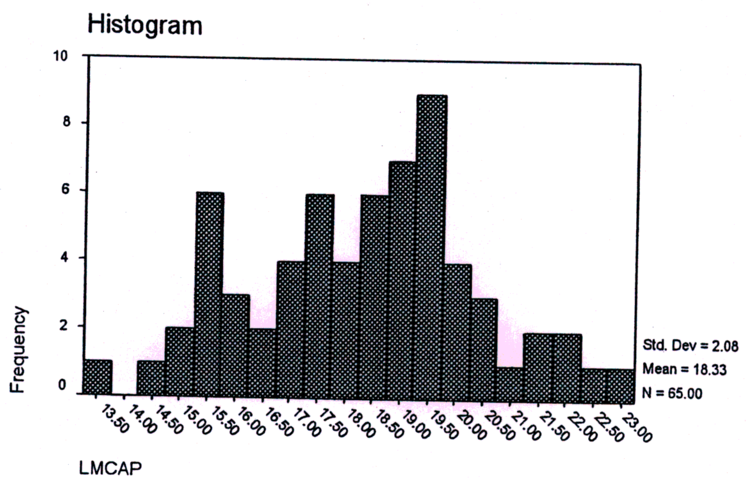


Figure 12

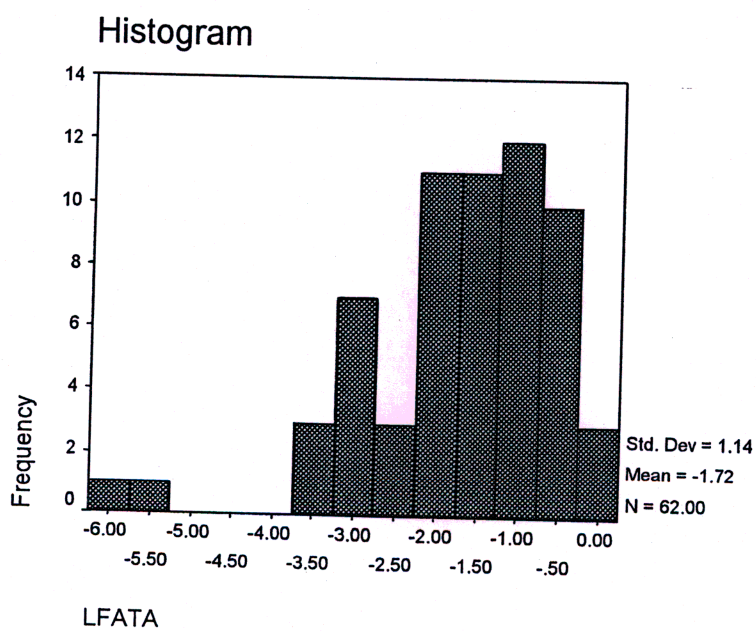


Figure 13

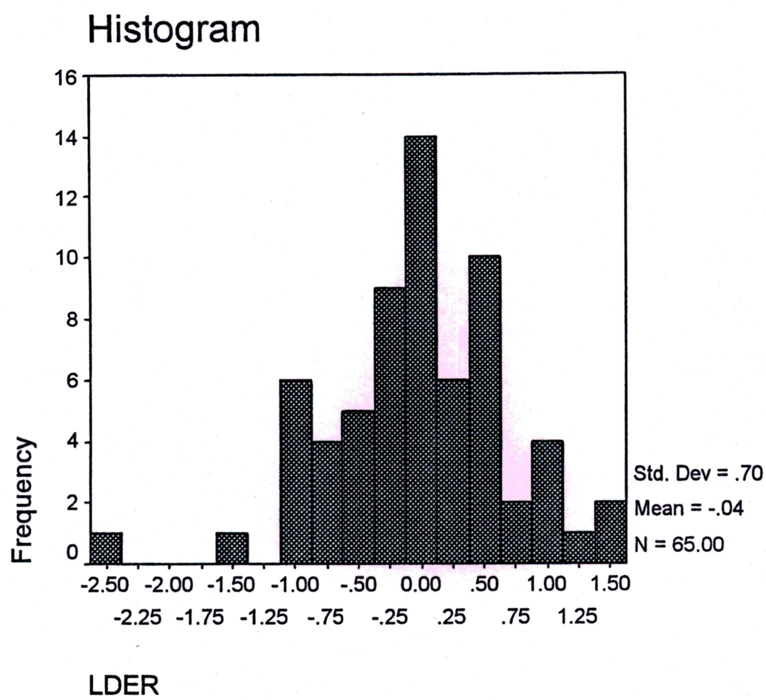


Figure 14

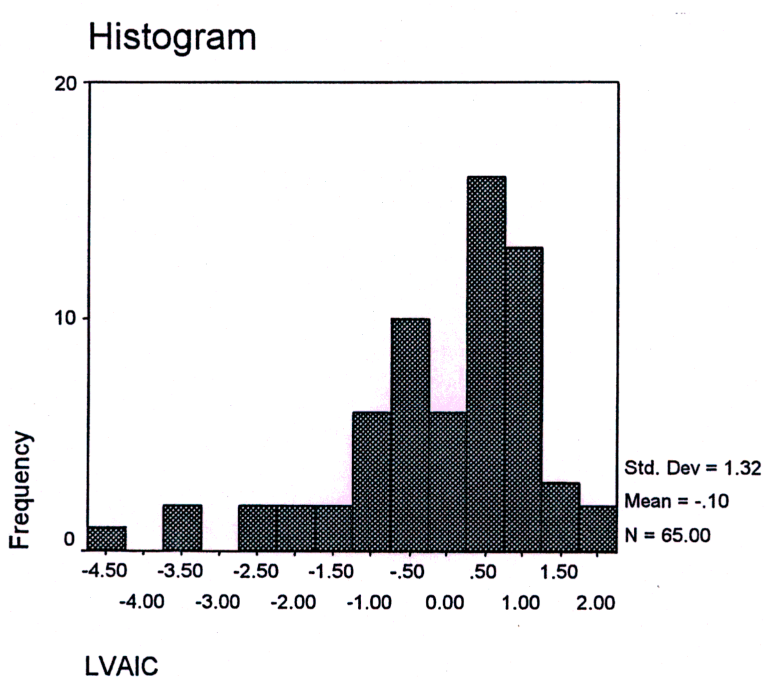


Figure 15

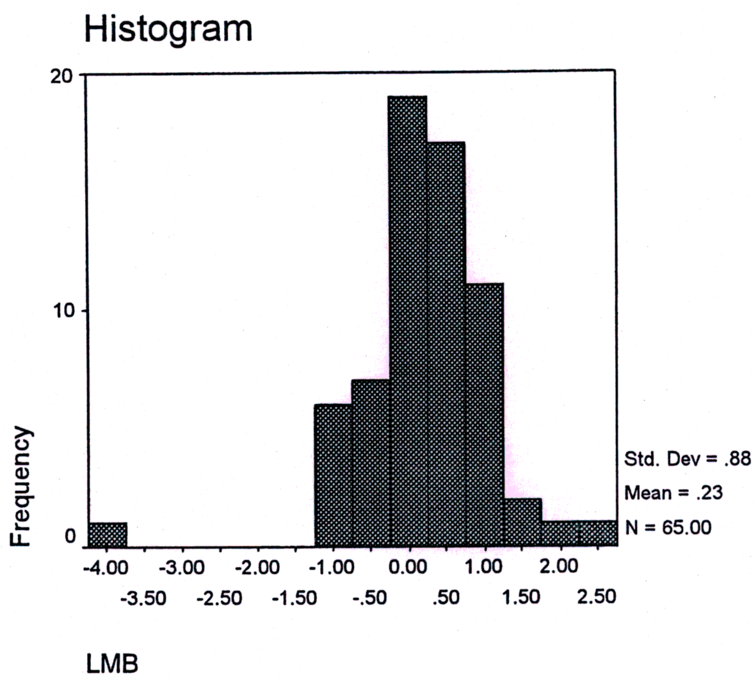


Figure 16

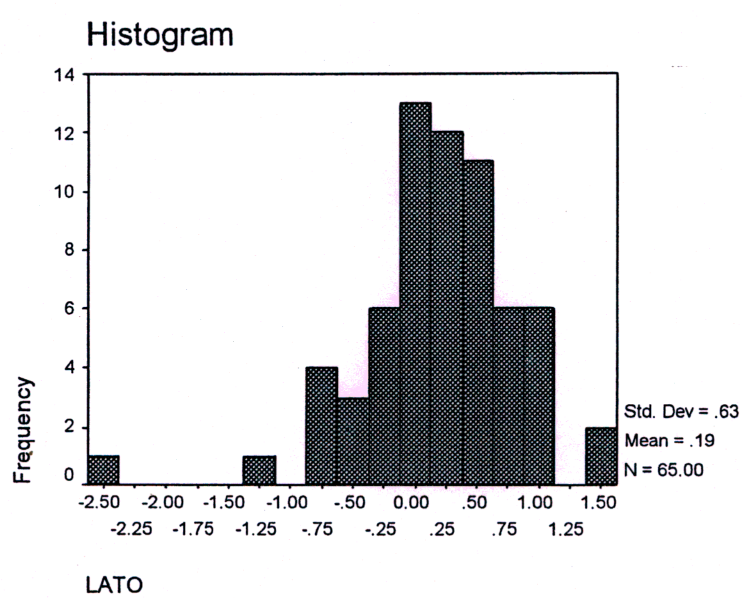


Figure 17

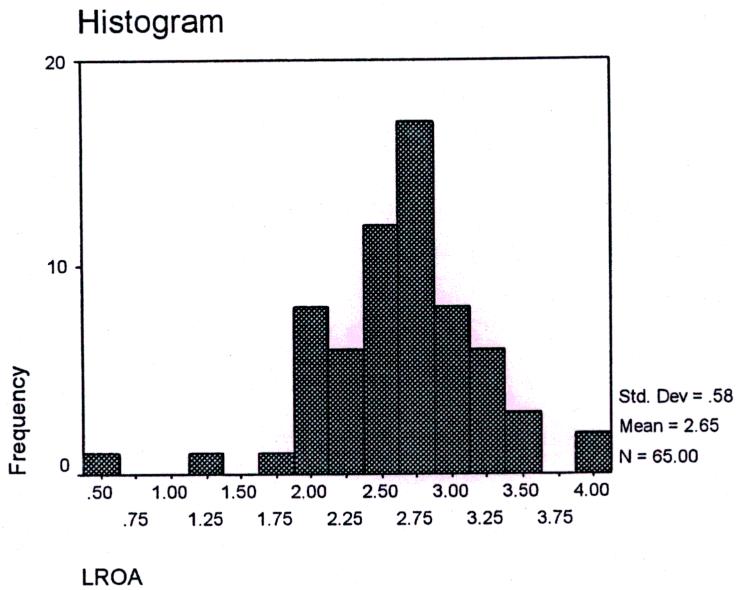


Figure 18

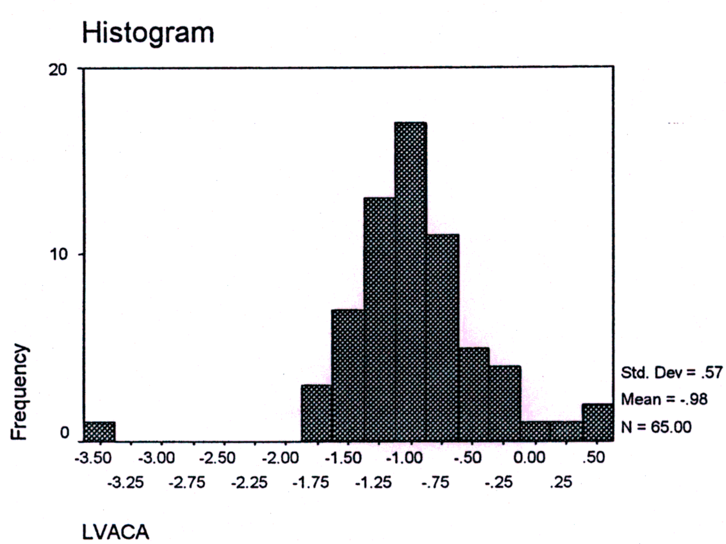


Figure 19

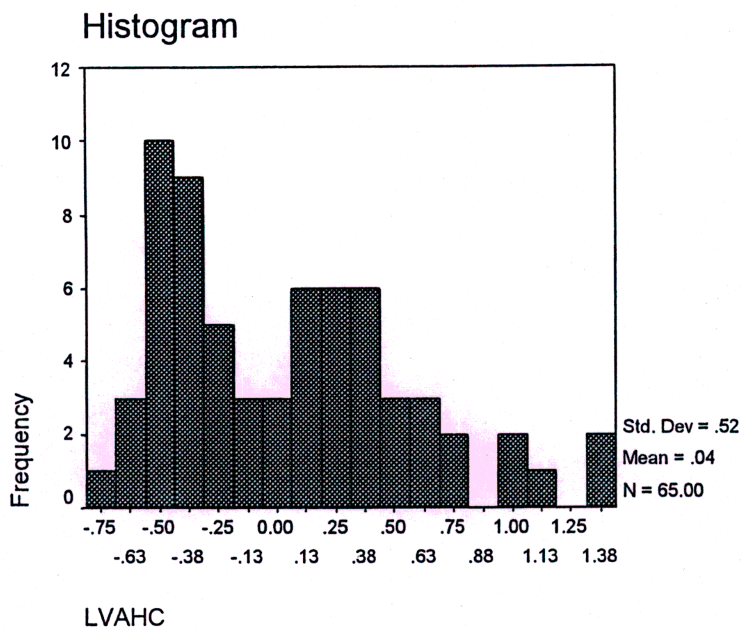
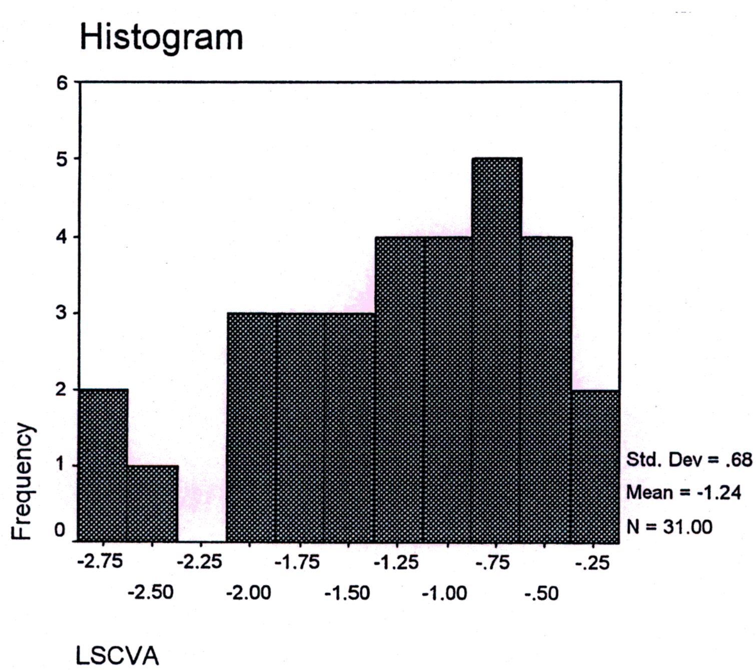


Figure 20



High Knowledge-Base (Untransformed Histograms)

Figure 21

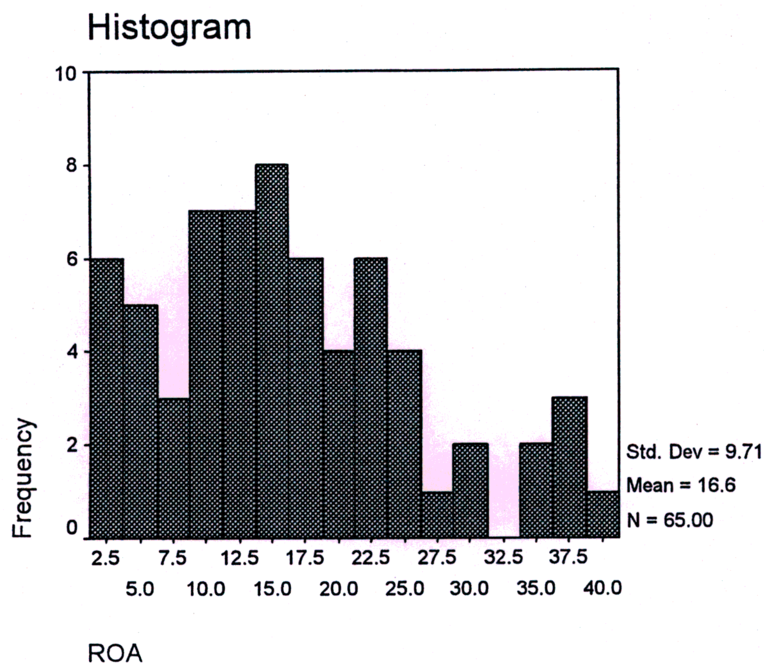


Figure 22

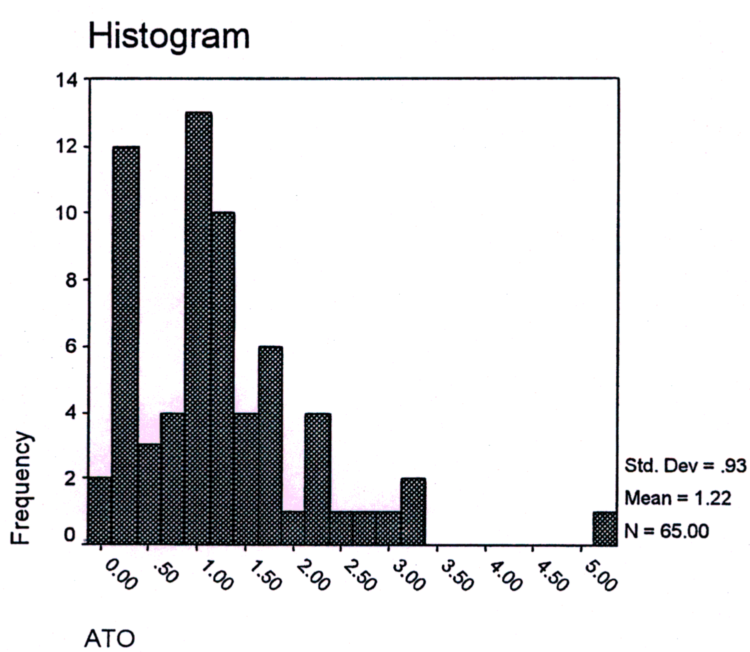


Figure 23

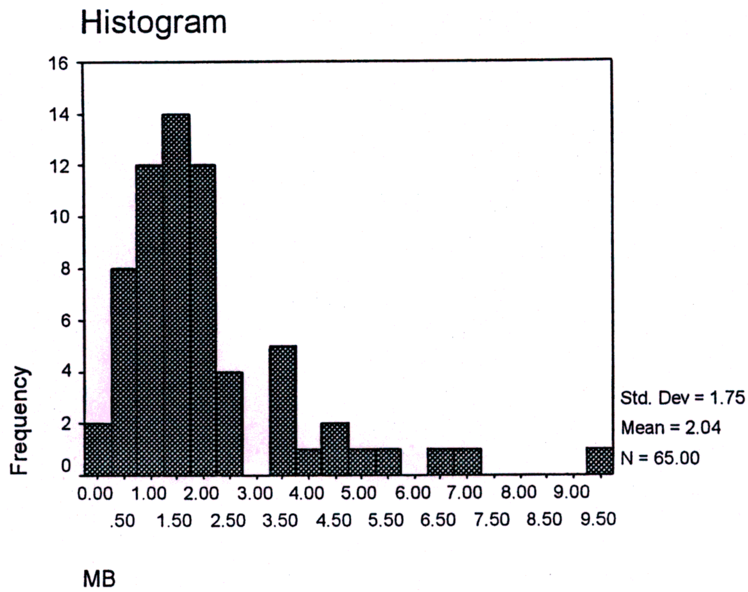


Figure 24

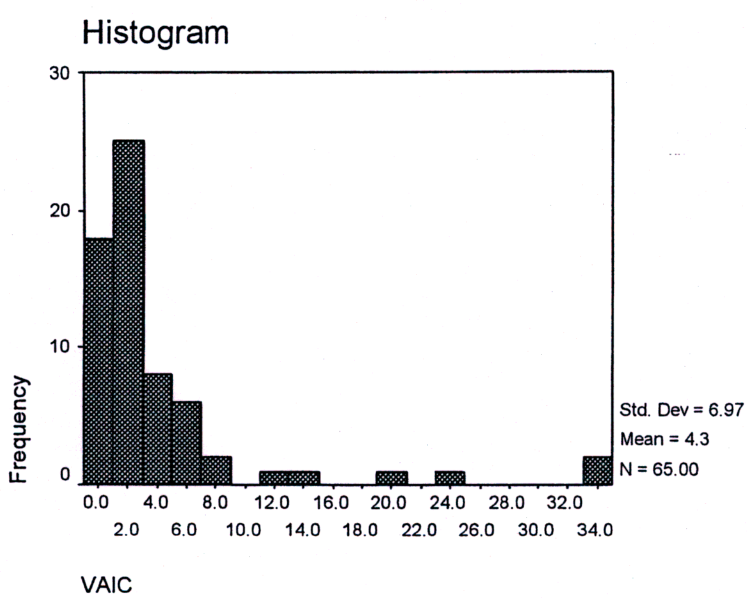


Figure 25

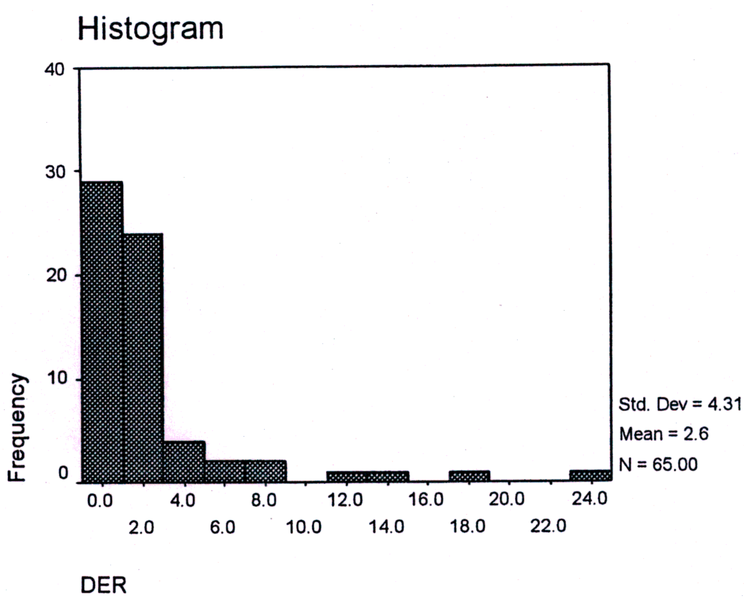


Figure 26

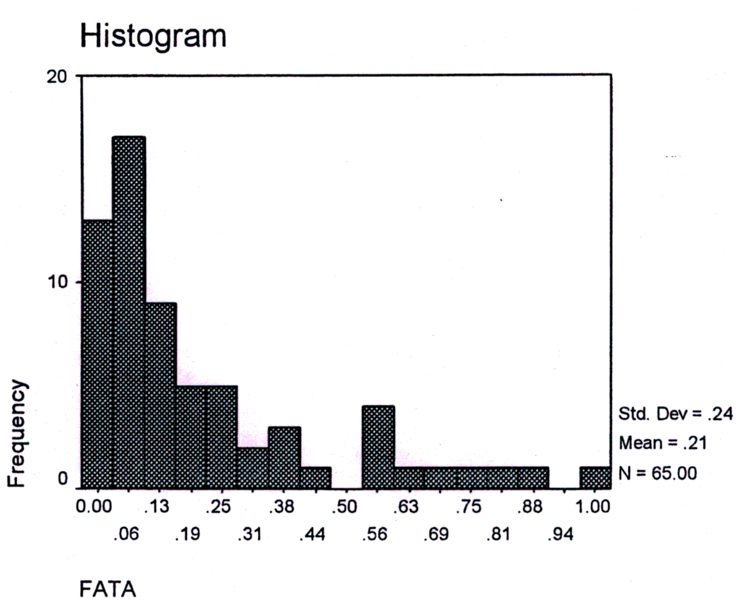


Figure 27

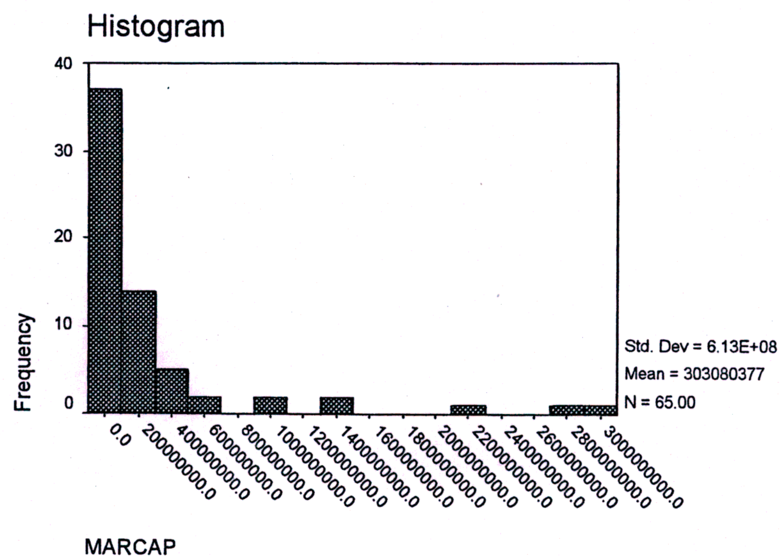


Figure 28

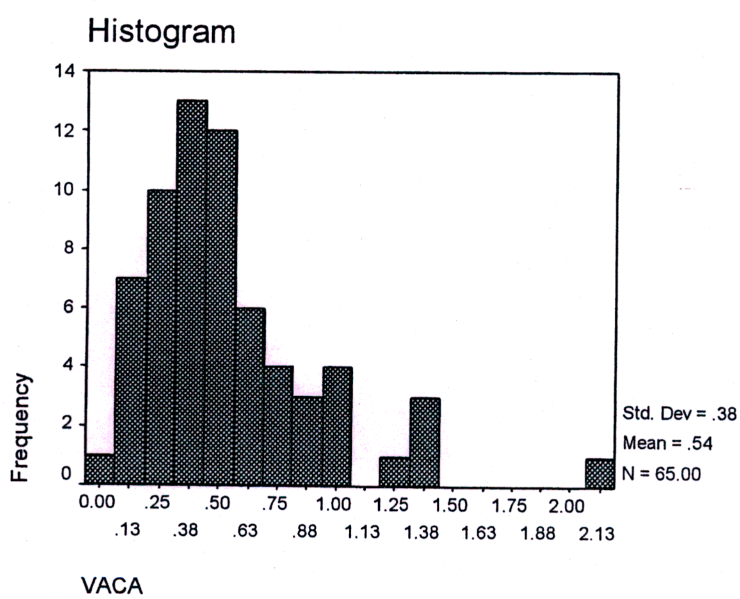


Figure 29

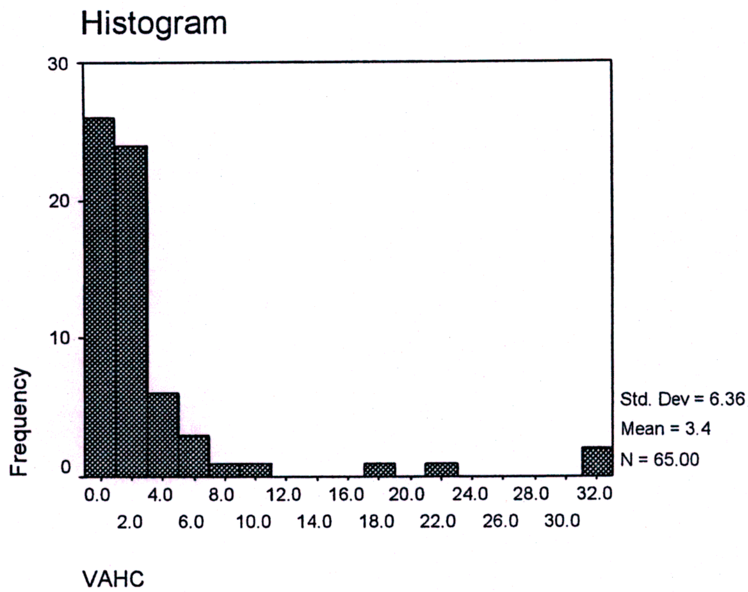
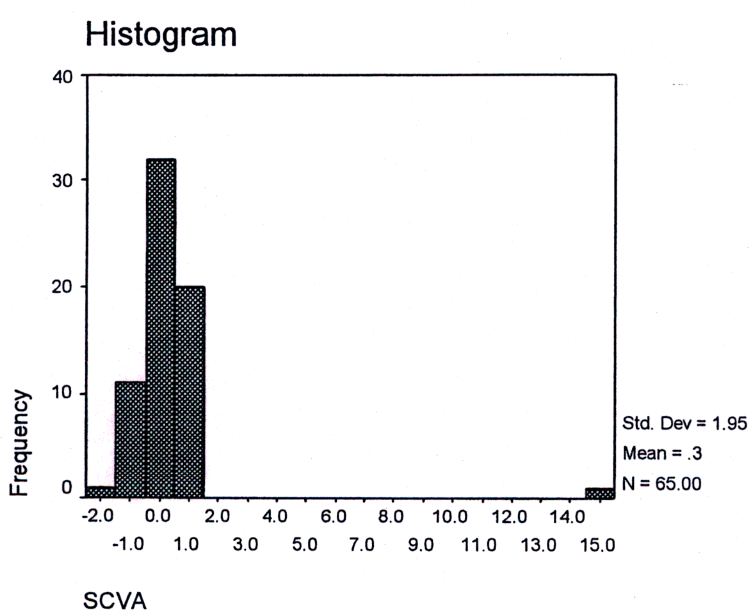


Figure 30



High Knowledge-Base (Transformed Histograms)

Figure 31

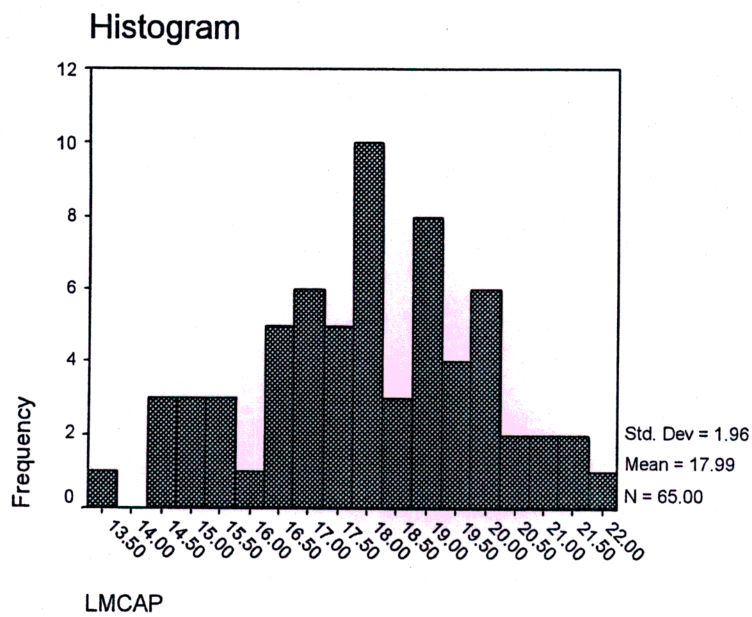


Figure 32

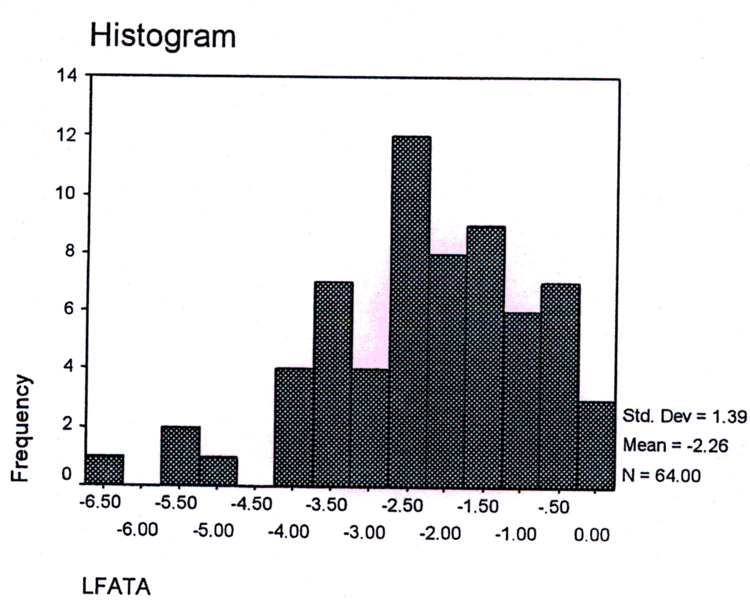


Figure 33

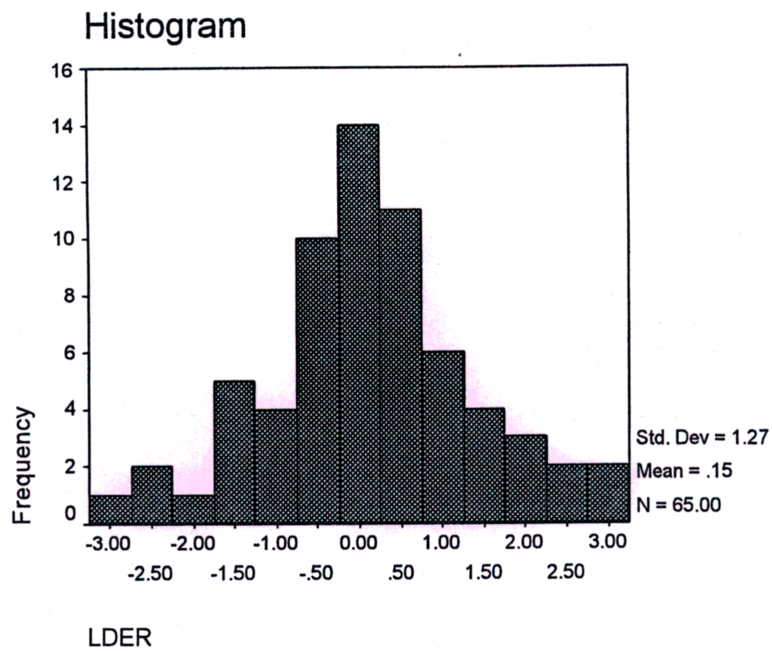


Figure 34

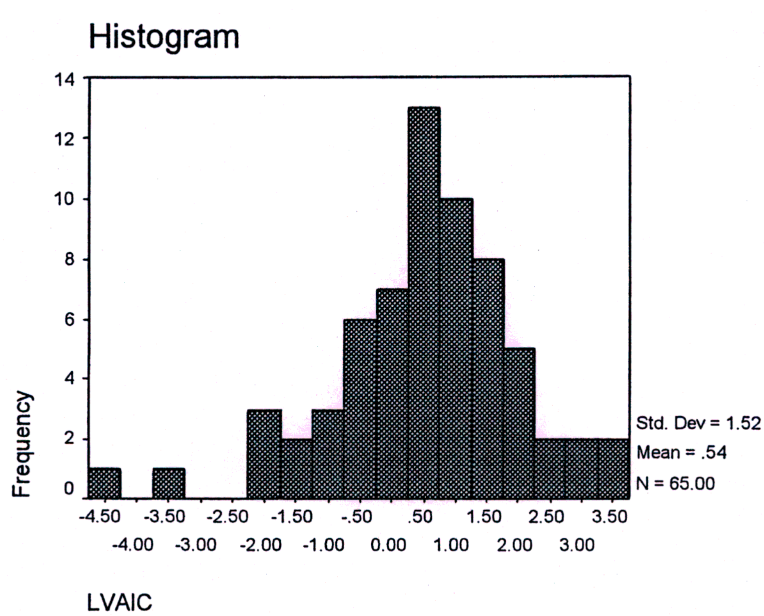


Figure 35

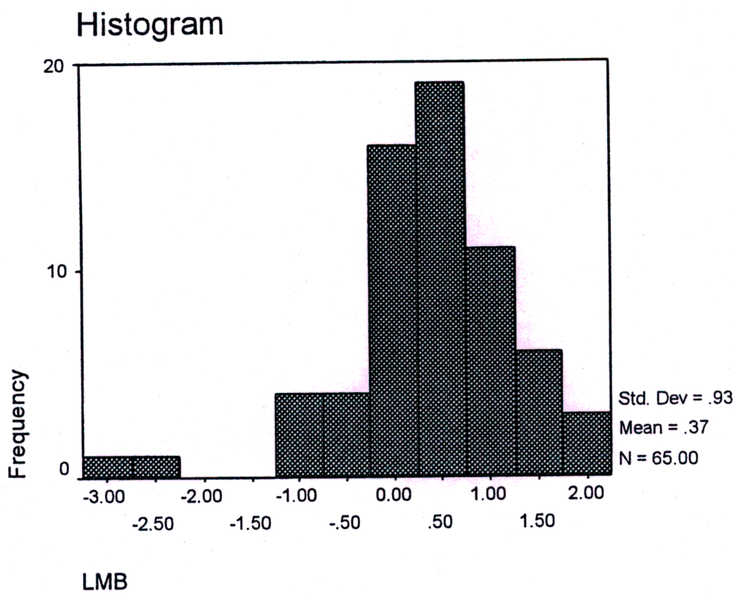

Histogram
20
10
0
Frequency
Std. Dev = .93
Mean = .37
N = 65.00
-3.00
-2.00
-1.00
0.00
1.00
2.00
-2.50
-1.50
-.50
.50
1.50
LMB

Figure 36

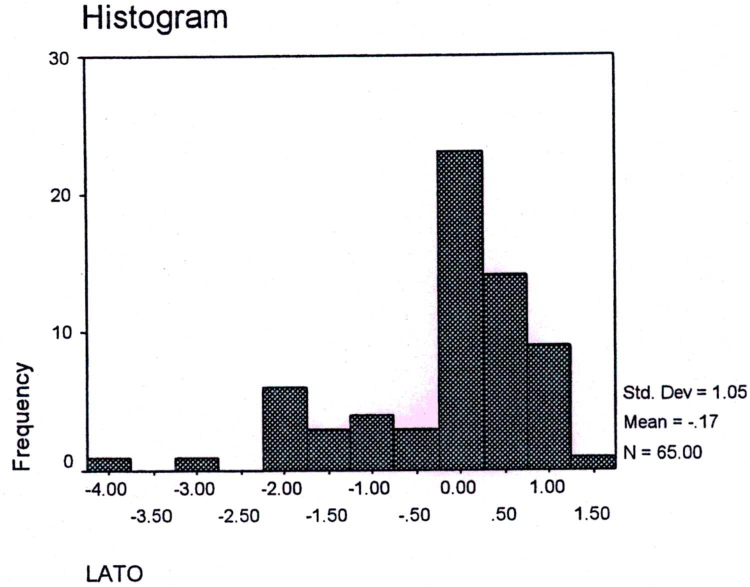


Figure 37

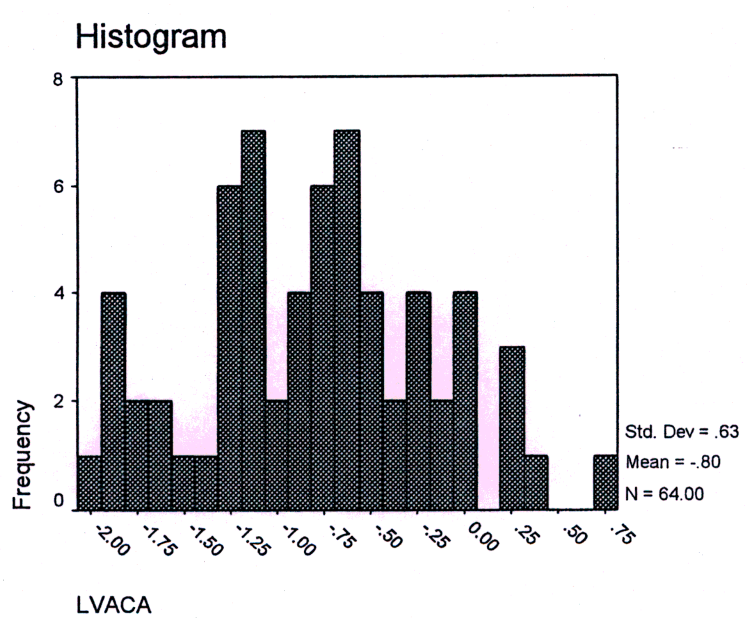


Figure 38

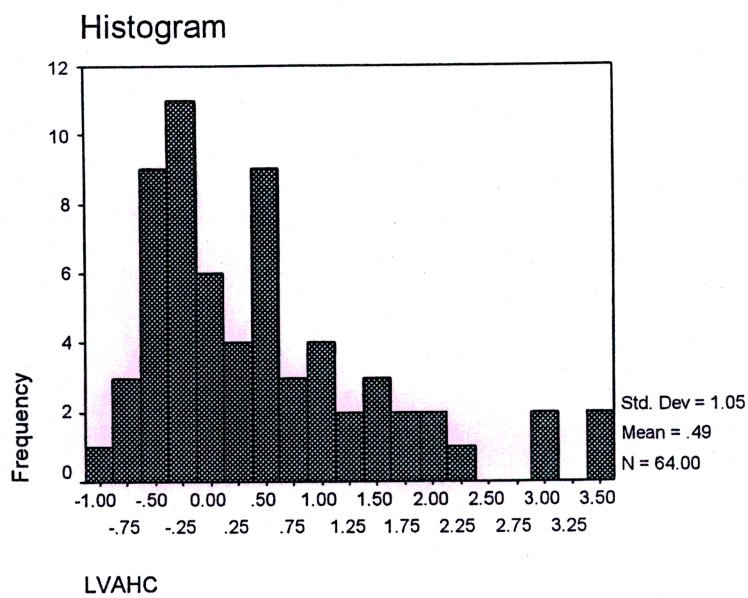
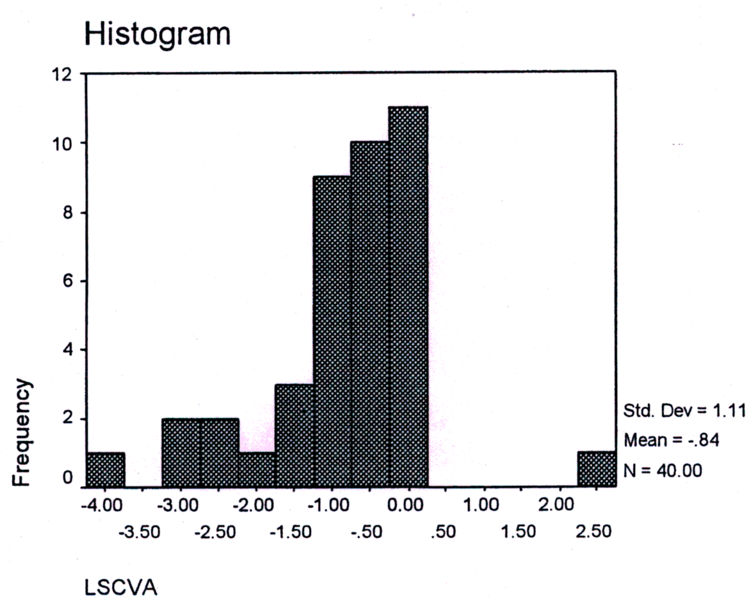


Figure 39



Model 3

Untransformed histograms

Figure 40

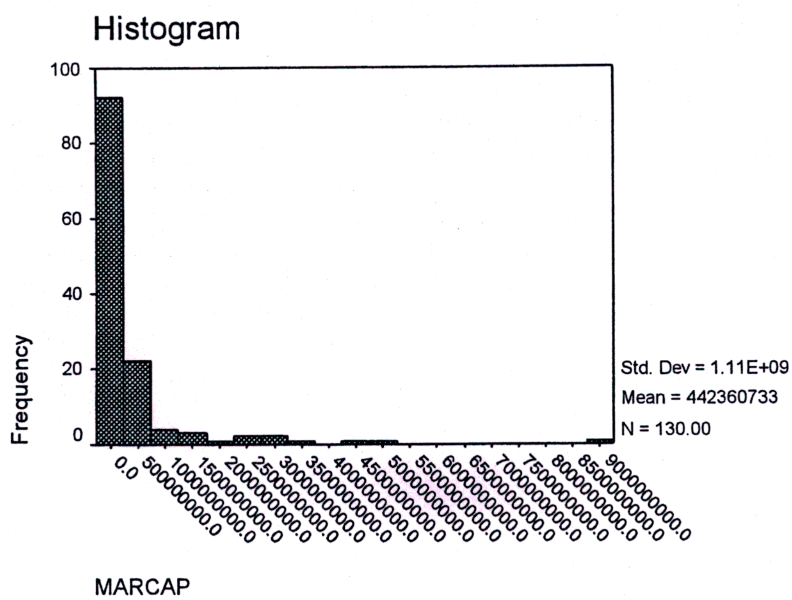


Figure 41

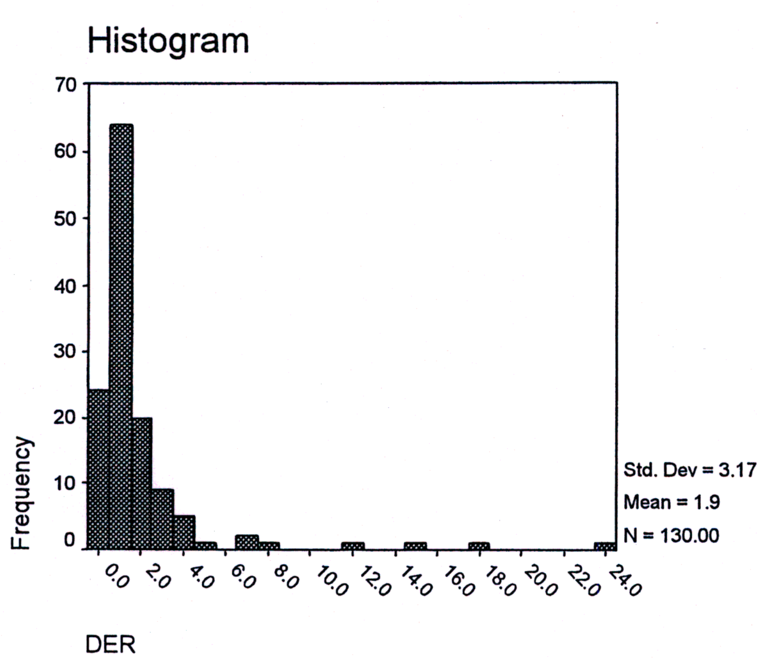


Figure 42

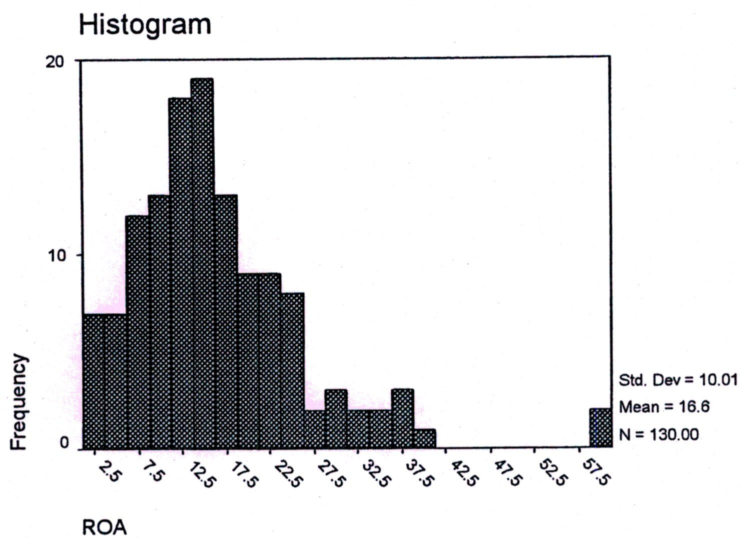


Figure 43

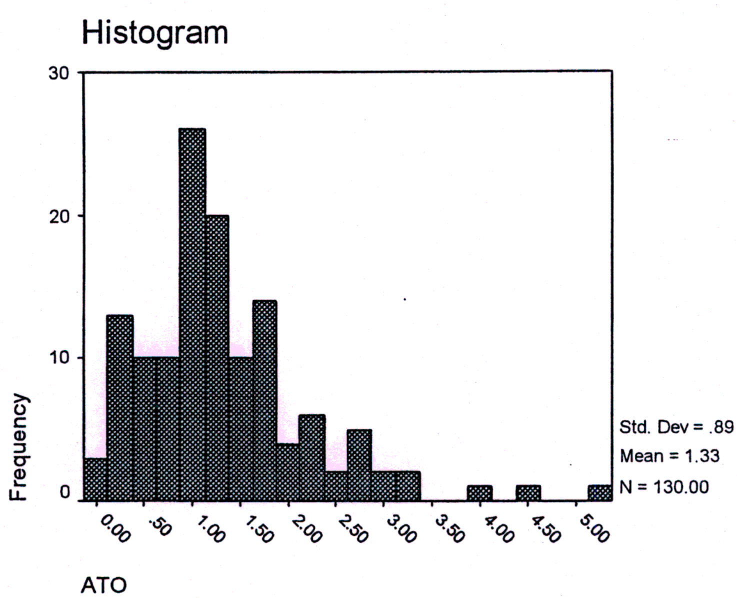


Figure 44

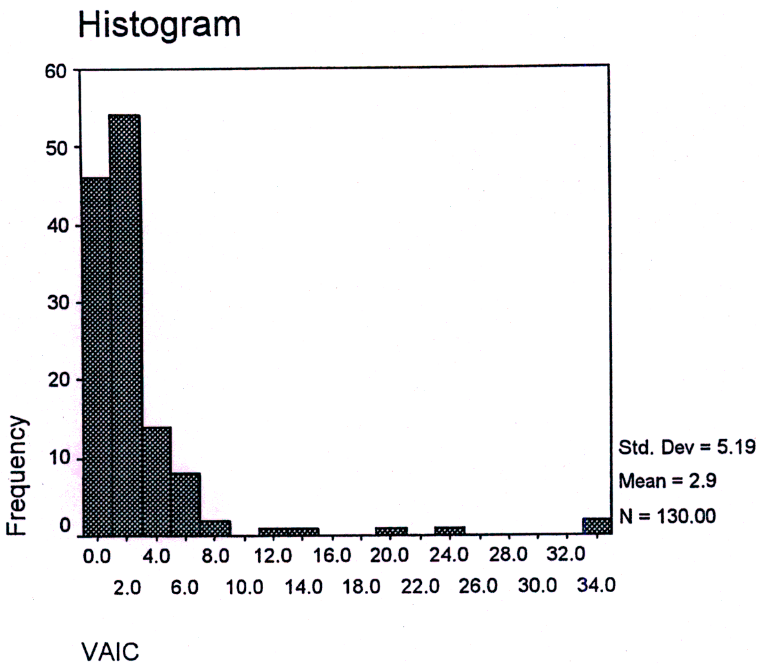


Figure 45

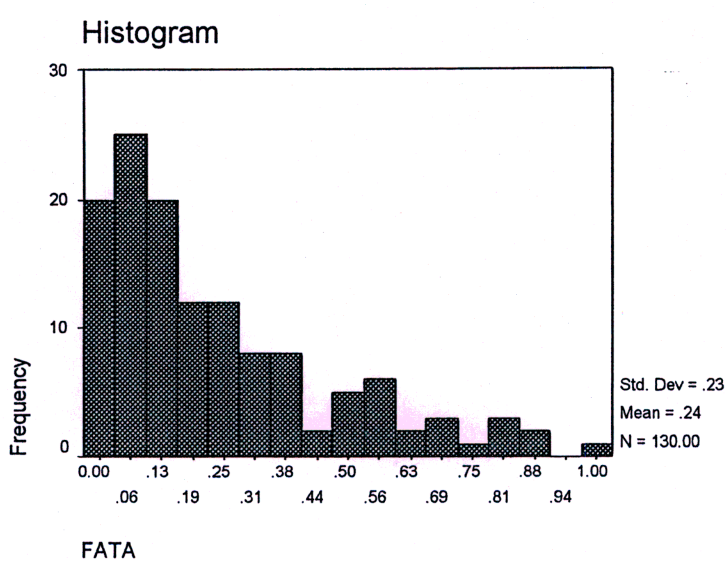
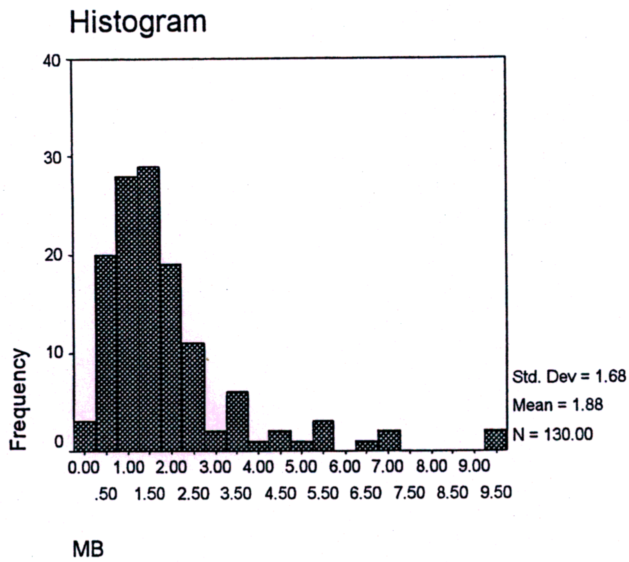


Figure 46


Histogram
Frequency
40
30
20
10
0
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00
.50 1.50 2.50 3.50 4.50 5.50 6.50 7.50 8.50 9.50
Std. Dev = 1.68
Mean = 1.88
N = 130.00
MB

Transformed histograms

Figure 47

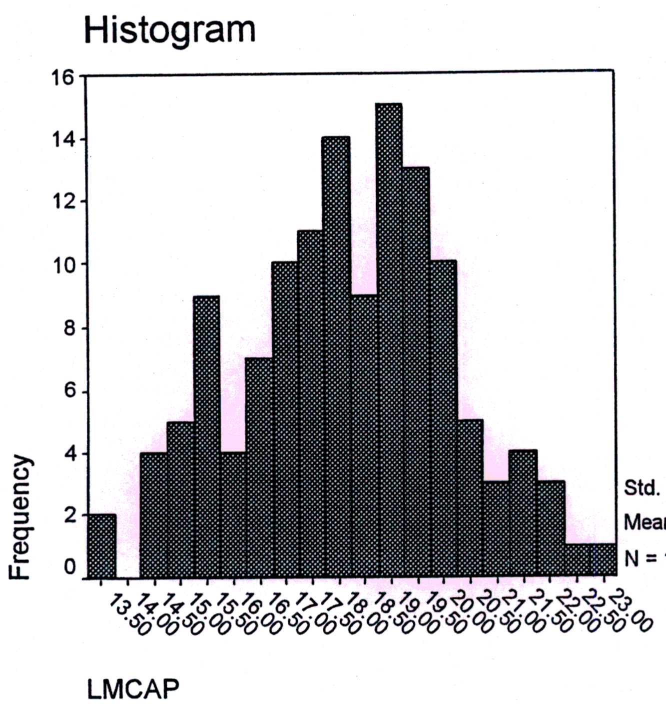


Figure 48

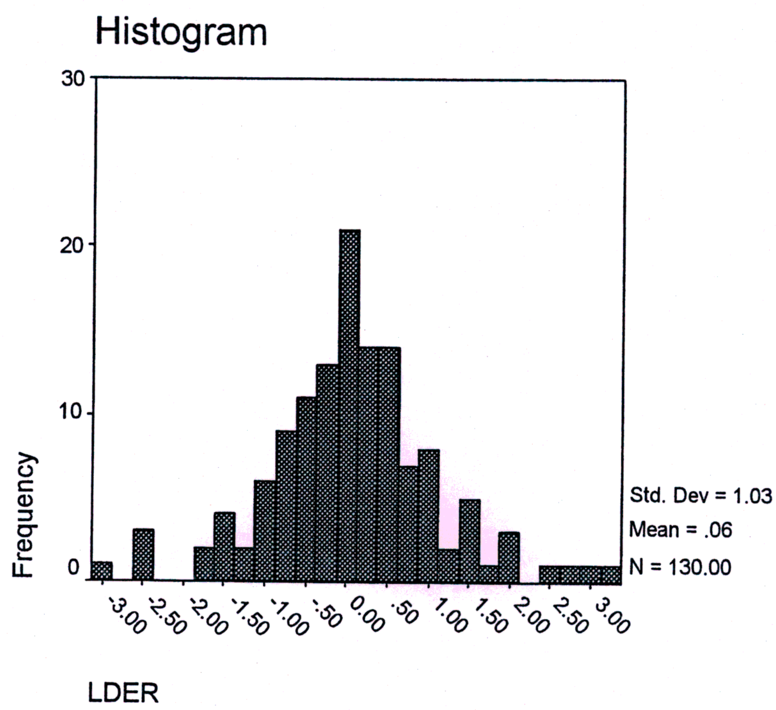

Histogram
30
20
10
0
Frequency
-3.00
-2.50
-2.00
-1.50
-1.00
-.50
0.00
.50
1.00
1.50
2.00
2.50
3.00
Std. Dev = 1.03
Mean = .06
N = 130.00
LDER

Figure 49

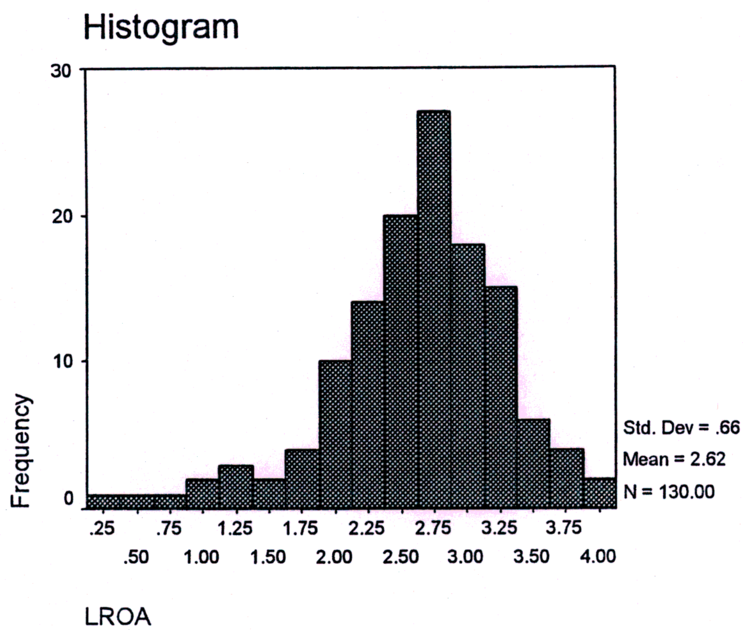


Figure 50

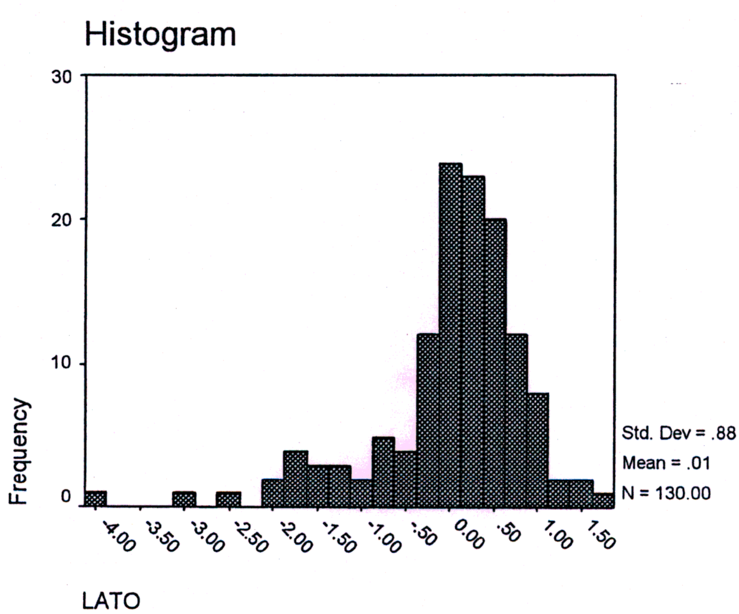


Figure 51

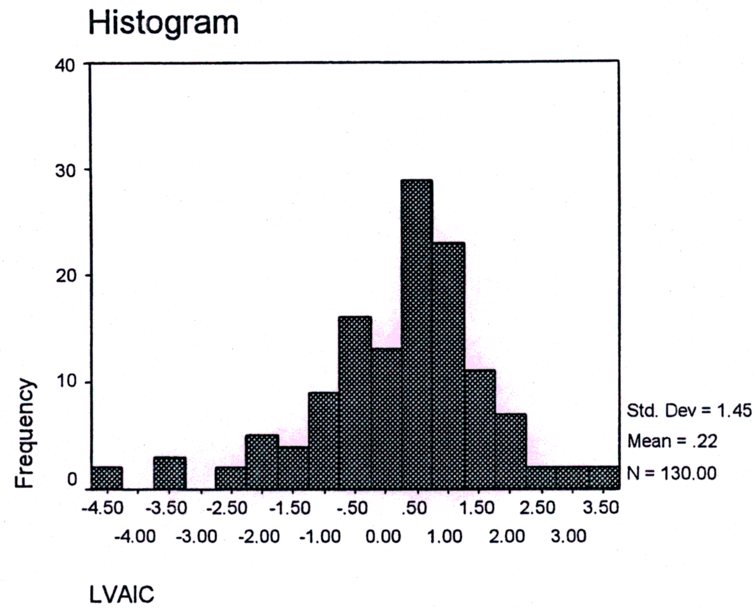


Figure 52

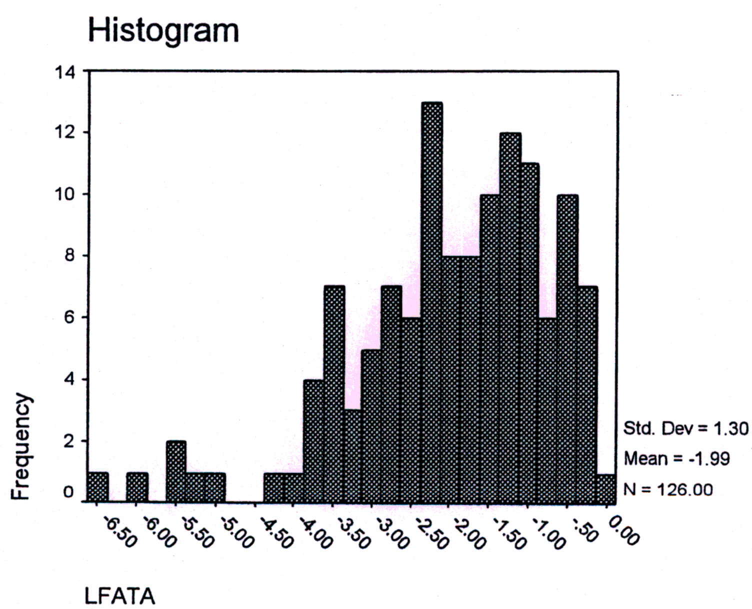
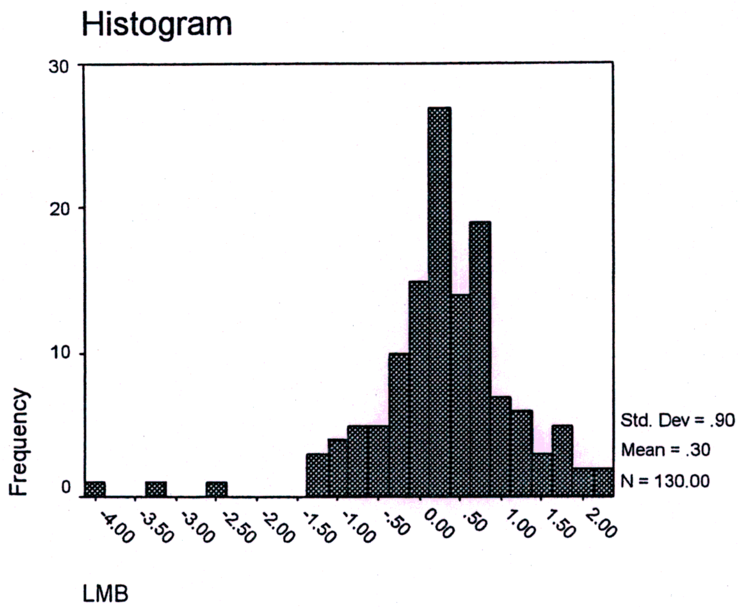


Figure 53


Histogram
30
20
10
0
Frequency
-4.00
-3.50
-3.00
-2.50
-2.00
-1.50
-1.00
-.50
0.00
.50
1.00
1.50
2.00
Std. Dev = .90
Mean = .30
N = 130.00
LMB

APPENDIX H
TABLES

Table 1

Summary of differences between the Industrial Age and Information Age

	INDUSTRIAL AGE	INFORMATION AGE
1	Mass production	Mass customisation
2	Labour serves tools	Tools serve labour
3	Labour performs repetitive tasks	Labour applies knowledge
4	Command and control structure	Common control structure
5	Capital intensive	Knowledge intensive
6	Capitalists own means of production	Labour owns means of production
7	Capital is primary driver	Knowledge is primary driver

Table 1b

Time line – history of the Intellectual Capital Movement

1980	Itami publishes "Mobilising Invisible Assets"
1981	Hall establishes company to commercialise research on human values
1986	Sveiby publishes "The Know How Company" on managing intangible assets
1986	Teece publishes seminal paper on extracting value from innovation
1988	Sveiby publishes "The New Annual Report" introducing knowledge capital
1989	Sveiby publishes "The Invisible Balance Sheet"
1989	Sullivan begins research into commercialising innovation
1990	Sveiby publishes "Knowledge Management"
1991	Skandia organises first corporate Intellectual Capital function
1992	Stewart publishes "Brainpower" article in Fortune
1993	St. Onge establishes concept of customer capital
1994	Stewart publishes "Intellectual Capital" article in Fortune
1995	Edvinsson re-labels intangible assets as "Intellectual Capital"
1995	First Skandia public report on Intellectual Capital
1996	SEC symposium on measuring Intellectual Capital and Intangible Assets
1996	Lev founds Intangibles Research at New York University
1997	Sveiby Publishes "The New Organisational Wealth"
1997	Edvinsson and Malone publish "Intellectual Capital"
1997	Stewart publishes "Intellectual Capital"
1998	Sullivan publishes "Profiting from Intellectual Capital"

Table 2

Classification of intellectual capital

	HUMAN CAPITAL	ORGANISATIONAL/STRUCTURAL CAPITAL	
		Internal Capital	External Capital
Sveiby (1997)	Employee Competence: Involves capacity to act in a wide variety of situations to create both intangible and tangible assets	Internal Structure Capital: Internal structure includes patents, concepts, models and computer and administration systems	External Capital Structure: The external structure includes relationships with customers and suppliers, also encompasses brand names, trademarks and the company's image and reputation
Kaplan and Norton (1996)	Learning and Growth: Learning and growth measures address the question – can we improve and create value	Internal Business Processes: Internal business processes measures address the question – What must we excel at	Customers: Customers measures address the question – How do our customers see us
Stewart (1997)	Human Capital: Money talks, but it does not think: machines perform, often better than any human being can, but do not invent. The primary purpose of human capital is innovation – whether of new products and services, or of improving business processes	Organisational Capital: Knowledge that does not go home at night, it belongs to the organisation as a whole. It can be reproduced and shared e.g. technologies, inventions, data, publications, strategy, culture, structures and systems, organisational routines and procedures	Customers Capital: The value of its franchise, its ongoing relationships with the people or organisations to which it sells, market share, customer retention, defection rates, and per customer profitability

Edvinsson (1997)	Human Capital: Combined knowledge, skill, innovativeness and ability of the company's individual employees, also includes the company's values, culture and philosophy	Organisational Capital: Hardware and software, databases, organisational structure, patents, trademarks, and everything else of organisational capability, that supports employee's productivity, everything left at the office when employees go home. Unlike human capital structural capital can be traded		Customer's Capital: Customer relationships developed with essential customers. It also includes knowledge about customers. Because customers don't necessarily know what they want especially when it involves new products, service and technology Company must know about customer tastes and needs so it can anticipate and channel their demand
Danish Agency for Development of Trade and Industry (1997, 1998 and 1999)	Human Resource: This category covers statements about the composition, management and satisfaction of the human resources	Process: This category typically covers statements about the scope, equipment and efficiency of business activities	Technology: This category typically covers statements about the scope, function and application of the IT system	Customers: This category covers statements about the composition, management and satisfaction of the customers

Table 3

Examples of the Component-by-Component approach

	MAJOR PROPONENT	DESCRIPTION	SUITABILITY WITHIN THE RESEARCH CONTEXT
Technology Broker	Brooking (1996) DIC	Value of intellectual capital of a firm is assessed based on diagnostic analysis of a firm's response to twenty questions covering four major components of intellectual capital	Measurement model is subjective. Questions must be evaluated for relevance. Not suitable within the research context
Citation-Weighted Patents	Bontis (1996) DIC	A technology factor is calculated on the patents developed by a firm. Intellectual capital and its performance are measured based on the impact of research and development efforts on a series of indices, such as number of patents and cost of patents to sales turnover, that describe the firm's patents	Patents form part of structural capital. Measurement model does not capture most of the components of intellectual capital. Not suitable within the research context
Inclusive Valuation Methodology (IVM)	McPherson (1998) DIC	Uses hierarchies of weighted indicators that are combined, and focuses on relative rather than absolute values. Combined Value Added = Monetary Value Added combined with Intangible Value Added	Measurement model appears to be too complex. Not suitable within the research context
The Value Explorer™	Andriessen and Tiessen (2000) DIC	Accounting methodology proposed by KPMG for calculating and allocating value to five types of intangible assets: (1) Assets and endowments, (2) Skills and tacit knowledge, (3) Collective values and norms, (4) Technology and explicit knowledge, (5) Primary and management processes	Taking the context of the research into consideration, not suitable within the research context
Intellectual Asset Valuation	Sullivan (2000) DIC	Methodology for assessing the value of Intellectual Property	Intellectual property forms part of structural capital. Measurement model does not capture most of the components of intellectual capital. Not suitable within the research context
Total Value Creation TVC™	Anderson and Mclean (2000) DIC	A project initiated by the Canadian Institute of Chartered Accountants. TVC uses discounted projected cash flows to re examine how events affect planned activities	Taking the context of the research into consideration, not suitable within the research context

Accounting for the Future (AFTF)	Nash H (1998) DIC	A system of projected discounted cash flows. The difference between AFTF value at the end and beginning of the period is the value added during the period.	Taking the context of the research into consideration, not suitable within the research context
Human Capital Intelligence	Jac Fitz-Enz SC	Sets of human capital indicators are collected and benchmarked against a database	Taking the context of the research into consideration, not suitable within the research context
Skandia Navigator™	Edvinsson and Malone (1997) SC	Intellectual capital is measured through the analysis of up to 164 metrics (91 intellectually based and 73 traditional metrics) that cover five components: (1) Financial, (2) Customer, (3) Process, (4) Renewal and Development, (5) Human	Taking the context of the research into consideration, not suitable within the research context
Value Chain Scoreboard™	Lev B. (2002) SC	A matrix of non-financial indicators arranged in three categories according to the cycle of development. Discovery/Learning, Implementation, and Commercialisation	Taking the context of the research into consideration, not suitable within the research context
IC – Index™	Roos, Roos, Dragonetti, and Edvinsson (1997) SC	Consolidates all individual indicators representing intellectual properties and components into a single index. Changes in the index are then related to changes in the firm's market valuation	Measurement model too complex, taking the context of the research into consideration, not suitable within the research context
Intangible Asset Monitor	Sveiby (1997) SC	Management selects indicators, based on strategic objectives of the firm, to measure four aspects of creating value from intangible assets. (1) Growth, (2) Renewal, (3) Utilisation/Efficiency and (4) Risk reduction/Stability	Taking the context of the research into consideration, not suitable within the research context
Balanced Scorecard	Kaplan and Norton (1992) SC	A company's performance is measured by indicators covering four major focus perspectives: (1) Financial, (2) Customer, (3) Internal process, and (4) Learning perspective	Taking the context of the research into consideration, not suitable within the research context

Table 4

Examples of the Organisational Level/Financial Basis approach

	MAJOR PROPONENT	DESCRIPTION	SUITABILITY WITHIN THE RESEARCH CONTEXT
Tobins q	Stewart (1997) Bontis (1999) MCM	The q is the ratio of the stock market value of the firm divided by the replacement cost of its assets. Changes in q provide a proxy for measuring effective performance or not of a firm's intellectual capital	Stock market value is not an appropriate measure within the context of this research
Investor Assigned Market Value (IAMV™)	Stanfield (1998) MCM	Takes a company's true value to be its stock market value and divides it by its intangible assets + (Realised intellectual capital + intellectual capital Erosion + Sustainable Competitive Advantage)	Stock market value is not an appropriate measure within the context of this research
Market to Book Value	Stewart (1997) Luthy (1998) MCM	The value of intellectual capital is considered to be the difference between the firm's stock market value and the company's book value	Stock market value is not an appropriate measure within the context of this research
Economic Value Added (EVA™)	Stewart (1997) ROA	Calculated by adjusting the firm's disclosed profit with charges related to intangibles. Changes in EVA provide an indication of whether the firm's intellectual capital is productive or not.	Measurement model too complex. Complicated adjustment procedures are required. Not suitable within the research context
Human Resource Costing and Accounting (HRCA)	Johannsson (1996) ROA	Calculates the hidden impact of HR related costs which reduce a firm's profits. Adjustments are made to the profit and loss. Intellectual capital is measures by calculation of the contribution of human assets held by the company divided by capitalised salary expenditures	Measurement model does not capture most of the components of intellectual capital. Human capital only one aspect of intellectual capital. Not suitable within the research context
Calculated Intangible Value	Stewart (1997) Luthy (1998) ROA	Calculates the excess return on hard assets the uses this figure as a basis for determining the proportion of return attributable to intangible assets	Measurement model too complex, not suitable within the research context
Knowledge Capital Earnings	Lev (1997) ROA	Knowledge capital earnings are calculated as the portion of normalised earnings over and above expected earnings attributable to book assets	Measurement model too complex, not suitable within the research context
Value Added Intellectual Coefficient (VAIC™)	Pulic (1997) ROA According to Sveiby (2001) this measurement technique does of quite fit any of the categories	Measures how efficiently intellectual capital and capital employed create value based on the relationship of three major components: (1) Capital employed, (2) Human capital, (3) Structural capital	Measurement model too complex, suitable within the research context

Table 5

Formal illustration of the calculation of each variable using the VAIC™ methodology (Mitchell Williams, 2000; Mitchell Williams, 2001):

INTEREST EXPENSE (I)	R214,700,000
Depreciation Expense (DP)	R228,200,000
Dividends (D)	R284,900,000
Corporate Taxation (T)	R555,300,000
Equity of Minority Shareholders in Net Income of Subsidiaries (M)	R286,200,000
Profits Retained for the Year (R)	R471,500,000
Book Value of Net Assets (CA)	R3,978,100,000
Staff Costs (Salaries and Wages) (HC)	R1,749,700,000
VA = I + DP + D + T + M + R	R2,040,100,000
VACA = VA/CA	R2,040,100,000 / R3,978,100,000 = 0.513
VAHC = VA/HC	R2,040,100,000 / R1,748,700,000 = 1.167
SC = VA-HC	R2,040,100,000 – R1,748,700,000 = R291,400,000
SCVA = SC/VA	R291,400,000 / R2,040,100,000 = 0.143
VAIC™ = VACA + VAHC + SCVA	1.823

Table 6

Dummy variable analysis – High knowledge-base group

(G)	INDUSTRY	X1	X2	X3	X4	X5
G1	Business Service	1	0	0	0	0
G2	Chemical and Pharmaceutical Products	0	1	0	0	0
G3	Communications	0	0	1	0	0
G4	Electronic and Electrical Products	0	0	0	1	0
G5	Finance, Insurance and Real Estate	0	0	0	0	1
G6	Health and Social Services	0	0	0	0	0

Table 7

Dummy variable analysis – Low knowledge-base group

(G)	INDUSTRY	X1	X2	X3	X4
G1	Accommodation, Food and Beverage	1	0	0	0
G2	Construction	0	1	0	0
G3	Mining	0	0	1	0
G4	Retail Trade	0	0	0	1
G5	Accommodation Food and Beverage	0	0	0	0

Table 8

Rand Values of Value Added and Staff Costs

KEY VARIABLE	TOTAL FOR POPULATION (224 COMPANIES) APPENDIX B – R000'S	TOTAL FOR FINAL DATA SET (130 COMPANIES) APPENDIX C – R000'S	PERCE NTAGE - %
Value Added	188,816,803	112,009,122	59
Staff Costs	115,574,963	72,893,080	63

Table 9

Low knowledge-base industries and frequency (listed in Appendix E)

INDUSTRY	FREQUENCY	PERCENTAGE - %	CUMULATIVE PERCENTAGE - %
Accommodation, Food and Beverage	17	26	26
Construction	9	14	40
Mines	15	23	63
Retail Trade	13	21	84
Transport	11	16	100
Total	65	100	100

Table 10

High knowledge-base industries and frequency (listed in Appendix F)

INDUSTRY	FREQUENCY	PERCENTAGE - %	CUMULATIVE PERCENTAGE - %
Business Service	30	46	46
Chemical	4	6	52
Communication	7	11	63
Electronic and Electrical	8	12	75
Finance, Insurance and Real Estate	13	20	95
Health and Social Services	3	5	100
Total	65	100	100

Table 11

Tests of normality for low knowledge-base group (untransformed)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ATO	.129	65	.009	.894	65	.000
ROA	.174	65	.000	.784	65	.000
MB	.206	65	.000	.684	65	.000
VAIC	.129	65	.009	.872	65	.000
DER	.159	65	.000	.827	65	.000
FATA	.120	65	.021	.911	65	.000
MARCAP	.356	65	.000	.435	65	.000

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
VACA	.230	65	.000	.748	65	.000
VAHC	.176	65	.000	.771	65	.000
SCVA	.099	65	.182	.961	65	.038

a. Lilliefors Significance Correction

Table 12

Tests of normality (transformed)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LMCAP	.061	65	.200*	.988	65	.784
LFATA	.109	62	.066	.896	62	.000
LDER	.084	65	.200*	.979	65	.348
LVAIC	.149	65	.001	.890	65	.000
LMB	.128	65	.010	.891	65	.000
LATO	.097	65	.200*	.947	65	.007
LROA	.076	65	.200*	.952	65	.013

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LVACA	.126	65	.012	.884	65	.000
LVAHC	.132	65	.007	.935	65	.002
LSCVA	.106	31	.200*	.950	31	.152

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 13

Tests of normality for high knowledge-base group (untransformed)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ROA	.093	65	.200*	.954	65	.017
ATO	.127	65	.011	.881	65	.000
MB	.208	65	.000	.800	65	.000
VAIC	.271	65	.000	.566	65	.000
DER	.294	65	.000	.554	65	.000
FATA	.201	65	.000	.789	65	.000
MARCAP	.311	65	.000	.521	65	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
VACA	.150	65	.001	.862	65	.000
VAHC	.310	65	.000	.473	65	.000
SCVA	.358	65	.000	.355	65	.000

a. Lilliefors Significance Correction

Table 14

Tests of normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LMCAP	.056	65	.200*	.989	65	.821
LFATA	.085	64	.200*	.965	64	.068
LDER	.069	65	.200*	.988	65	.772
LVAIC	.088	65	.200*	.964	65	.057
LMB	.115	65	.033	.929	65	.001
LATO	.206	65	.000	.891	65	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LVACA	.049	64	.200*	.986	64	.695
LVAHC	.139	64	.004	.889	64	.000
LSCVA	.207	40	.000	.865	40	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 15

Descriptive statistics for low knowledge-base group (untransformed data)

Descriptive Statistics

	N	Mean	Std. Deviation
IA	65	183891.0	638457.02185
FA	65	1171179	3349615.603
VAIC	65	1.5625	1.37196
VAHC	65	1.2060	.77292
FATA	65	.2637	.21945
Valid N (listwise)	65		

Table 16

Descriptive statistics for the high knowledge-base group (untransformed data)

Descriptive Statistics

	N	Mean	Std. Deviation
IA	65	735600.5	2702644.409
FA	65	849052.5	1757922.037
VAHC	65	3.3875	6.36355
VAIC	65	4.2657	6.97203
FATA	65	.2112	.24090
Valid N (listwise)	65		

Table 17

Group statistics and independent samples test (untransformed data)

Group Statistics

	BASE	N	Mean	Std. Deviation	Std. Error Mean
VAHC	1.00	65	3.3875	6.36355	.78930
	2.00	65	1.2060	.77292	.09587

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAHC	Equal variances assumed	19.974	.000	2.744	128	.007	2.1815	.79510	.60821	3.75470
	Equal variances not assumed			2.744	65.888	.008	2.1815	.79510	.59393	3.76898

Table 18

Group statistics and independent samples test (untransformed data)

Group Statistics

	BASE	N	Mean	Std. Deviation	Std. Error Mean
VAIC	1.00	65	4.2657	6.97203	.86477
	2.00	65	1.5625	1.37196	.17017

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VAIC	Equal variances assumed	19.051	.000	3.067	128	.003	2.7032	.88136	.95932	4.44715
	Equal variances not assumed			3.067	68.949	.003	2.7032	.88136	.94495	4.46152

Table 19

Correlation between value added and structural capital

Correlations [a]

			VAPULIC	STRCAP
Spearman's rho	VAPULIC	Correlation Coefficient	1.000	.240**
		Sig. (2-tailed)	.	.006
	STRCAP	Correlation Coefficient	.240**	1.000
		Sig. (2-tailed)	.006	.

**. Correlation is significant at the .01 level (2-tailed).

a. Listwise N = 130

Table 20

Correlation between value added and human capital

Correlations [a]

			VAPULIC	SW
Spearman's rho	VAPULIC	Correlation Coefficient	1.000	.880**
		Sig. (2-tailed)	.	.000
	SW	Correlation Coefficient	.880**	1.000
		Sig. (2-tailed)	.000	.

**. Correlation is significant at the .01 level (2-tailed).

a. Listwise N = 130

Table 21

Correlation between value added and physical capital

Correlations [a]

			VAPULIC	OSHI
Spearman's rho	VAPULIC	Correlation Coefficient	1.000	.900**
		Sig. (2-tailed)	.	.000
	OSHI	Correlation Coefficient	.900**	1.000
		Sig. (2-tailed)	.000	.

**. Correlation is significant at the .01 level (2-tailed).

a. Listwise N = 130

Table 22

Descriptive statistics for low knowledge-base group (untransformed data)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
VACA	65	.03	1.48	.4381	.27367
VAHC	65	.46	4.10	1.2060	.77292
SCVA	65	-1.17	.76	-.0817	.47585
Valid N (listwise)	65				

Table 23

Correlation analysis for low knowledge-base group

Correlations

		LROA	LATO	LMB	LDER	LMCAP	X1	X2	X3	X4	LVACA	LVAHC	LSCVA
LROA	Pearson Correl	1	.381*	.376*	.160	.166	.110	.093	-.180	-.069	.775*	.550*	.416*
	Sig. (1-tailed)	.	.001	.001	.102	.093	.192	.232	.076	.292	.000	.000	.010
	N	65	65	65	65	65	65	65	65	65	65	65	31
LATO	Pearson Correl	.381*	1	.080	.451*	-.243*	-.031	.181	-.517*	.239*	.478*	-.335*	-.394*
	Sig. (1-tailed)	.001	.	.263	.000	.025	.403	.074	.000	.028	.000	.003	.014
	N	65	65	65	65	65	65	65	65	65	65	65	31
LMB	Pearson Correl	.376*	.080	1	.168	.687*	.068	.016	-.059	-.013	.325*	.336*	.428*
	Sig. (1-tailed)	.001	.263	.	.091	.000	.296	.449	.319	.460	.004	.003	.008
	N	65	65	65	65	65	65	65	65	65	65	65	31
LDER	Pearson Correl	.160	.451*	.168	1	.062	-.031	.103	-.086	-.082	.558*	-.048	-.224
	Sig. (1-tailed)	.102	.000	.091	.	.313	.403	.207	.247	.259	.000	.351	.113
	N	65	65	65	65	65	65	65	65	65	65	65	31
LMCA	Pearson Correl	.166	-.243*	.687*	.062	1	-.024	-.158	.191	-.069	.169	.313*	.401*
	Sig. (1-tailed)	.093	.025	.000	.313	.	.425	.104	.064	.292	.089	.006	.013
	N	65	65	65	65	65	65	65	65	65	65	65	31
X1	Pearson Correl	.110	-.031	.068	-.031	-.024	1	-.239*	-.326*	-.298*	.037	.095	-.177
	Sig. (1-tailed)	.192	.403	.296	.403	.425	.	.028	.004	.008	.385	.225	.170
	N	65	65	65	65	65	65	65	65	65	65	65	31
X2	Pearson Correl	.093	.181	.016	.103	-.158	-.239*	1	-.220*	-.200	.058	-.044	-.109
	Sig. (1-tailed)	.232	.074	.449	.207	.104	.028	.	.039	.055	.323	.365	.279
	N	65	65	65	65	65	65	65	65	65	65	65	31
X3	Pearson Correl	-.180	-.517*	-.059	-.086	.191	-.326*	-.220*	1	-.274*	-.115	.304*	.394*
	Sig. (1-tailed)	.076	.000	.319	.247	.064	.004	.039	.	.014	.180	.007	.014
	N	65	65	65	65	65	65	65	65	65	65	65	31
X4	Pearson Correl	-.069	.239*	-.013	-.082	-.069	-.298*	-.200	-.274*	1	-.076	-.329*	-.108
	Sig. (1-tailed)	.292	.028	.460	.259	.292	.008	.055	.014	.	.274	.004	.281
	N	65	65	65	65	65	65	65	65	65	65	65	31
LVACA	Pearson Correl	.775*	.478*	.325*	.558*	.169	.037	.058	-.115	-.076	1	.455*	.334*
	Sig. (1-tailed)	.000	.000	.004	.000	.089	.385	.323	.180	.274	.	.000	.033
	N	65	65	65	65	65	65	65	65	65	65	65	31
LVAHC	Pearson Correl	.550*	-.335*	.336*	-.048	.313*	.095	-.044	.304*	-.329*	.455*	1	.872*
	Sig. (1-tailed)	.000	.003	.003	.351	.006	.225	.365	.007	.004	.000	.	.000
	N	65	65	65	65	65	65	65	65	65	65	65	31
LSCVA	Pearson Correl	.416*	-.394*	.428*	-.224	.401*	-.177	-.109	.394*	-.108	.334*	.872*	1
	Sig. (1-tailed)	.010	.014	.008	.113	.013	.170	.279	.014	.281	.033	.000	.
	N	31	31	31	31	31	31	31	31	31	31	31	31

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 24

Multicollinearity analysis for low knowledge-base group

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	LVACA	.377	2.655
	LVAHC	.113	8.813
	LSCVA	.098	10.178
	X1	.397	2.520
	X2	.608	1.645
	X3	.465	2.149
	X4	.523	1.913
	LDER	.405	2.468
	LMCAP	.757	1.321

a. Dependent Variable: LATO

Table 25

Multicollinearity analysis for low knowledge-base group (removing LSCVA from model)

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	LVACA	.393	2.544
	LVAHC	.456	2.195
	X1	.515	1.943
	X2	.624	1.602
	X3	.470	2.127
	X4	.543	1.843
	LDER	.533	1.878
	LMCAP	.863	1.159

a. Dependent Variable: LMB

Table 26

Research results - Equation 17 (Removing LSCVA from model)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.836[a]	.699	.656	.37144

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.929	8	2.241	16.244	.000[a]
	Residual	7.726	56	.138		
	Total	25.656	64			

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

b. Dependent Variable: LATO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.923	.471		4.084	.000
	LVACA	.766	.130	.691	5.912	.000
	LVAHC	-.611	.132	-.503	-4.625	.000
	X1	-.135	.146	-.094	-.924	.360
	X2	2.357E-02	.169	.013	.140	.889
	X3	-.414	.159	-.277	-2.595	.012
	X4	2.463E-02	.156	.016	.158	.875
	LDER	2.124E-02	.091	.023	.234	.816
	LMCAP	-4.58E-02	.024	-.151	-1.910	.061

a. Dependent Variable: LATO

Table 27

Research results – Equation 18 (Removing LSCVA from model)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.863[a]	.745	.708	.31329

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.049	8	2.006	20.438	.000[a]
	Residual	5.497	56	.098		
	Total	21.545	64			

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

b. Dependent Variable: LROA

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.373	.397		8.493	.000
	LVACA	.851	.109	.838	7.786	.000
	LVAHC	.219	.111	.197	1.967	.054
	X1	2.611E-02	.123	.020	.212	.833
	X2	.105	.142	.063	.734	.466
	X3	-.206	.135	-.151	-1.535	.130
	X4	1.668E-02	.132	.012	.126	.900
	LDER	-.264	.077	-.318	-3.440	.001
	LMCAP	6.243E-03	.020	.022	.309	.759

a. Dependent Variable: LROA

Table 28

Research results – Equation 19 (Removing LSCVA from model)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.756[a]	.572	.511	.61332

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.123	8	3.515	9.346	.000[a]
	Residual	21.065	56	.376		
	Total	49.188	64			

a. Predictors: (Constant), LMCAP, X1, LDER, X2, LVAHC, X4, X3, LVACA

b. Dependent Variable: LMB

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.952	.777		-6.370	.000
	LVACA	9.925E-02	.214	.065	.464	.645
	LVAHC	.301	.218	.178	1.378	.174
	X1	.182	.241	.092	.754	.454
	X2	.339	.279	.135	1.216	.229
	X3	-.276	.263	-.134	-1.049	.299
	X4	.266	.258	.122	1.030	.307
	LDER	.108	.150	.086	.720	.474
	LMCAP	.283	.040	.672	7.140	.000

a. Dependent Variable: LMB

Table 29

Descriptive statistics (untransformed data)

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
VACA	65	-.04	2.15	.5398	.37796
VAHC	65	-.07	32.23	3.3875	6.36355
SCVA	65	-1.54	15.04	.3384	1.94821
Valid N (listwise)	65				

Table 30

Correlation analysis for high knowledge-base group

Correlations

		ROA	LATO	LMB	LDER	LMCAP	X1	X2	X3	X4	X5	LVACA	LVAHC	LSCVA
ROA	Pearson Correlation	1	.270*	.073	-.080	.057	.017	.030	-.026	.323**	-.324**	.371**	.134	-.091
	Sig. (1-tailed)	.	.015	.281	.262	.326	.445	.407	.418	.004	.004	.001	.146	.289
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
LATO	Pearson Correlation	.270*	1	-.056	-.037	-.098	-.013	.119	.109	.266*	-.394**	.172	-.578**	-.361*
	Sig. (1-tailed)	.015	.	.328	.384	.219	.459	.173	.194	.016	.001	.087	.000	.011
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
LMB	Pearson Correlation	.073	-.056	1	.281*	.461**	-.154	.103	.100	-.141	.159	.364**	.071	-.182
	Sig. (1-tailed)	.281	.328	.	.012	.000	.111	.207	.214	.131	.103	.002	.288	.131
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
LDER	Pearson Correlation	-.080	-.037	.281*	1	-.045	-.093	.122	.174	-.037	.015	.542**	.059	.165
	Sig. (1-tailed)	.262	.384	.012	.	.361	.231	.167	.083	.384	.451	.000	.322	.155
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
LMCAP	Pearson Correlation	.057	-.098	.461**	-.045	1	-.281*	.147	.220*	-.065	.074	.010	.072	.074
	Sig. (1-tailed)	.326	.219	.000	.361	.	.012	.122	.039	.302	.278	.469	.286	.326
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
X1	Pearson Correlation	.017	-.013	-.154	-.093	-.281*	1	-.237*	-.322**	-.347**	-.463**	-.208*	-.118	-.105
	Sig. (1-tailed)	.445	.459	.111	.231	.012	.	.029	.004	.002	.000	.049	.177	.259
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
X2	Pearson Correlation	.030	.119	.103	.122	.147	-.237*	1	-.089	-.096	-.128	.117	-.101	.373**
	Sig. (1-tailed)	.407	.173	.207	.167	.122	.029	.	.240	.224	.155	.179	.214	.009
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
X3	Pearson Correlation	-.026	.109	.100	.174	.220*	-.322**	-.089	1	-.130	-.174	.053	.134	.173
	Sig. (1-tailed)	.418	.194	.214	.083	.039	.004	.240	.	.151	.083	.340	.145	.143
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
X4	Pearson Correlation	.323**	.266*	-.141	-.037	-.065	-.347**	-.096	-.130	1	-.187	.182	-.071	-.152
	Sig. (1-tailed)	.004	.016	.131	.384	.302	.002	.224	.151	.	.068	.076	.290	.175
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
X5	Pearson Correlation	-.324**	-.394**	.159	.015	.074	-.463**	-.128	-.174	-.187	1	.026	.268*	-.060
	Sig. (1-tailed)	.004	.001	.103	.451	.278	.000	.155	.083	.068	.	.420	.016	.358
	N	65	65	65	65	65	65	65	65	65	65	64	64	40
LVACA	Pearson Correlation	.371**	.172	.364**	.542**	.010	-.208*	.117	.053	.182	.026	1	.127	.096
	Sig. (1-tailed)	.001	.087	.002	.000	.469	.049	.179	.340	.076	.420	.	.159	.280
	N	64	64	64	64	64	64	64	64	64	64	64	64	39
LVAHC	Pearson Correlation	.134	-.578**	.071	.059	.072	-.118	-.101	.134	-.071	.268*	.127	1	.716**
	Sig. (1-tailed)	.146	.000	.288	.322	.286	.177	.214	.145	.290	.016	.159	.	.000
	N	64	64	64	64	64	64	64	64	64	64	64	64	39
LSCVA	Pearson Correlation	-.091	-.361*	-.182	.165	.074	-.105	.373**	.173	-.152	-.060	.096	.716**	1
	Sig. (1-tailed)	.289	.011	.131	.155	.326	.259	.009	.143	.175	.358	.280	.000	.
	N	40	40	40	40	40	40	40	40	40	40	39	39	40

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Table 31

Multicollinearity analysis for high knowledge-base group

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	LVACA	.614	1.629
	LVAHC	.218	4.583
	LSCVA	.207	4.838
	X1	.146	6.836
	X2	.361	2.769
	X3	.296	3.379
	X4	.273	3.661
	X5	.177	5.665
	LDER	.614	1.629
	LMCAP	.842	1.187

a. Dependent Variable: LATO

Table 32

Research results – Equation 17

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.816[a]	.666	.562	.77696

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	34.851	9	3.872	6.415	.000[a]
	Residual	17.506	29	.604		
	Total	52.357	38			

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

b. Dependent Variable: LATO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.454	1.352		1.815	.080
	LVACA	.591	.242	.357	2.443	.021
	LVAHC	-.678	.208	-.555	-3.262	.003
	LSCVA	-.179	.195	-.146	-.919	.366
	X2	.726	.859	.099	.844	.405
	X3	1.921	.544	.503	3.530	.001
	X4	.675	.398	.210	1.695	.101
	X5	-.156	.306	-.062	-.511	.613
	LDER	-.250	.123	-.307	-2.033	.051
	LMCAP	-.118	.069	-.211	-1.699	.100

a. Dependent Variable: LATO

Table 33

Research results – Equation 18

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.732[a]	.536	.392	8.58989

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2475.124	9	275.014	3.727	.003[a]
	Residual	2139.802	29	73.786		
	Total	4614.926	38			

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

b. Dependent Variable: ROA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	35.590	14.950		2.381	.024
	LVACA	8.884	2.676	.571	3.320	.002
	LVAHC	-.800	2.299	-.070	-.348	.730
	LSCVA	.949	2.151	.082	.441	.662
	X2	13.927	9.501	.202	1.466	.153
	X3	5.605	6.016	.156	.932	.359
	X4	5.381	4.403	.178	1.222	.232
	X5	-8.119	3.381	-.344	-2.402	.023
	LDER	-3.297	1.361	-.430	-2.422	.022
	LMCAP	-.411	.767	-.078	-.535	.596

a. Dependent Variable: ROA

Table 34

Research results

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.582[a]	.339	.133	.91564

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.443	9	1.383	1.649	.148[a]
	Residual	24.314	29	.838		
	Total	36.756	38			

a. Predictors: (Constant), LMCAP, LVAHC, X5, X2, LDER, X4, X3, LVACA, LSCVA

b. Dependent Variable: LMB

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-2.510	1.594		-1.575	.126
	LVACA	.352	.285	.253	1.233	.228
	LVAHC	.102	.245	.100	.417	.680
	LSCVA	-.310	.229	-.301	-1.351	.187
	X2	.822	1.013	.134	.812	.424
	X3	.127	.641	.040	.197	.845
	X4	-.419	.469	-.156	-.892	.380
	X5	.106	.360	.051	.295	.770
	LDER	9.495E-02	.145	.139	.654	.518
	LMCAP	.157	.082	.335	1.922	.065

a. Dependent Variable: LMB

Table 35

Summary of results

PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	HO NULL HYPOTHESES
Productivity	Asset Turnover Ratio	Accepted
Profitability	Return on Assets	Accepted
Market Valuation	Price to Book Ratio	Accepted

Table 36

Summary of results

PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	HO NULL HYPOTHESES
Productivity	Asset Turnover Ratio	Accepted
Profitability	Return on Assets	Accepted
Market Valuation	Price to Book Ratio	Accepted

Table 37

Summary of the within knowledge-base group analysis

MODEL	H	PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	GROUP
A	H4	Productivity	Asset Turnover Ratio (ln)	Low Knowledge-Base
B	H4	Productivity	Asset Turnover Ratio (ln)	High Knowledge-Base
C	H5	Profitability	Return on Assets(ln)	Low Knowledge-Base
D	H5	Profitability	Return on Assets	High Knowledge-Base
E	H6	Market Valuation	Price to Book Ratio(ln)	Low Knowledge-Base
F	H6	Market Valuation	Price to Book Ratio(ln)	High Knowledge-Base

Table 38

Descriptive statistics of the low knowledge-base group

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	65	1.53	60.61	16.5906	10.36981
ATO	65	.09	4.61	1.4331	.84300
MB	65	.02	9.72	1.7230	1.61148
VAIC	65	.01	6.32	1.5625	1.37196
Valid N (listwise)	65				

Table 39

Descriptive statistics of the high knowledge-base group

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	65	1.43	39.53	16.6052	9.71303
ATO	65	.02	5.28	1.2240	.92978
MB	65	.04	9.42	2.0385	1.74789
VAIC	65	.01	34.55	4.2657	6.97203
Valid N (listwise)	65				

Table 40

Correlation analysis for Model A

Correlations

		X1	X2	X3	X4	LMCAP	LDER	LVAIC	LROA	LFATA	LATO
X1	Pearson Correlation	1	-.239*	-.326**	-.298**	-.024	-.031	.178	.110	.278*	-.031
	Sig. (1-tailed)	.	.028	.004	.008	.425	.403	.078	.192	.014	.403
	N	65	65	65	65	65	65	65	65	62	65
X2	Pearson Correlation	-.239*	1	-.220*	-.200	-.158	.103	-.073	.093	-.013	.181
	Sig. (1-tailed)	.028	.	.039	.055	.104	.207	.281	.232	.460	.074
	N	65	65	65	65	65	65	65	65	62	65
X3	Pearson Correlation	-.326**	-.220*	1	-.274*	.191	-.086	.181	-.180	-.219*	-.517**
	Sig. (1-tailed)	.004	.039	.	.014	.064	.247	.075	.076	.044	.000
	N	65	65	65	65	65	65	65	65	62	65
X4	Pearson Correlation	-.298**	-.200	-.274*	1	-.069	-.082	-.263*	-.069	-.197	.239*
	Sig. (1-tailed)	.008	.055	.014	.	.292	.259	.017	.292	.063	.028
	N	65	65	65	65	65	65	65	65	62	65
LMCAP	Pearson Correlation	-.024	-.158	.191	-.069	1	.062	.146	.166	-.145	-.243*
	Sig. (1-tailed)	.425	.104	.064	.292	.	.313	.123	.093	.130	.025
	N	65	65	65	65	65	65	65	65	62	65
LDER	Pearson Correlation	-.031	.103	-.086	-.082	.062	1	.075	.160	-.067	.451**
	Sig. (1-tailed)	.403	.207	.247	.259	.313	.	.278	.102	.302	.000
	N	65	65	65	65	65	65	65	65	62	65
LVAIC	Pearson Correlation	.178	-.073	.181	-.263*	.146	.075	1	.507**	-.038	-.156
	Sig. (1-tailed)	.078	.281	.075	.017	.123	.278	.	.000	.386	.107
	N	65	65	65	65	65	65	65	65	62	65
LROA	Pearson Correlation	.110	.093	-.180	-.069	.166	.160	.507**	1	-.316**	.381**
	Sig. (1-tailed)	.192	.232	.076	.292	.093	.102	.000	.	.006	.001
	N	65	65	65	65	65	65	65	65	62	65
LFATA	Pearson Correlation	.278*	-.013	-.219*	-.197	-.145	-.067	-.038	-.316**	1	-.046
	Sig. (1-tailed)	.014	.460	.044	.063	.130	.302	.386	.006	.	.362
	N	62	62	62	62	62	62	62	62	62	62
LATO	Pearson Correlation	-.031	.181	-.517**	.239*	-.243*	.451**	-.156	.381**	-.046	1
	Sig. (1-tailed)	.403	.074	.000	.028	.025	.000	.107	.001	.362	.
	N	65	65	65	65	65	65	65	65	62	65

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Table 41

Research results – Equation 20

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.806[a]	.649	.589	.40606

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LROA

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.879	9	1.764	10.700	.000[a]
	Residual	8.574	52	.165		
	Total	24.453	61			

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LROA

b. Dependent Variable: LATO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.256	.555		.461	.647
	X1	-.179	.164	-.125	-1.087	.282
	X2	-7.37E-02	.190	-.041	-.388	.700
	X3	-.434	.188	-.291	-2.305	.025
	X4	.158	.180	.100	.874	.386
	LMCAP	-7.36E-02	.026	-.242	-2.794	.007
	LDER	.359	.077	.397	4.684	.000
	LROA	.561	.126	.514	4.467	.000
	LFATA	4.817E-02	.056	.087	.866	.391
	LVAIC	-.148	.051	-.310	-2.891	.006

a. Dependent Variable: LATO

Table 42

Multicollinearity analysis for Model A

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.517	1.935
	X2	.624	1.603
	X3	.445	2.250
	X4	.522	1.917
	LMCAP	.904	1.106
	LDER	.928	1.077
	LROA	.486	2.058
	LFATA	.670	1.493
	LVAIC	.552	1.813

a. Dependent Variable: LATO

Table 43

Correlation analysis for Model B

Correlations

		X1	X2	X3	X4	X5	LMCAP	LDER	ROA	LFATA	LVAIC	LATO
X1	Pearson Correlation	1	-.237*	-.322**	-.347**	-.463**	-.281*	-.093	.017	-.291**	-.147	-.013
	Sig. (1-tailed)	.	.029	.004	.002	.000	.012	.231	.445	.010	.122	.459
	N	65	65	65	65	65	65	65	65	64	65	65
X2	Pearson Correlation	-.237*	1	-.089	-.096	-.128	.147	.122	.030	.168	.069	.119
	Sig. (1-tailed)	.029	.	.240	.224	.155	.122	.167	.407	.092	.292	.173
	N	65	65	65	65	65	65	65	65	64	65	65
X3	Pearson Correlation	-.322**	-.089	1	-.130	-.174	.220*	.174	-.026	.221*	.095	.109
	Sig. (1-tailed)	.004	.240	.	.151	.083	.039	.083	.418	.039	.225	.194
	N	65	65	65	65	65	65	65	65	64	65	65
X4	Pearson Correlation	-.347**	-.096	-.130	1	-.187	-.065	-.037	.323**	.016	.039	.266*
	Sig. (1-tailed)	.002	.224	.151	.	.068	.302	.384	.004	.451	.378	.016
	N	65	65	65	65	65	65	65	65	64	65	65
X5	Pearson Correlation	-.463**	-.128	-.174	-.187	1	.074	.015	-.324**	-.071	.237*	-.394**
	Sig. (1-tailed)	.000	.155	.083	.068	.	.278	.451	.004	.288	.029	.001
	N	65	65	65	65	65	65	65	65	64	65	65
LMCAP	Pearson Correlation	-.281*	.147	.220*	-.065	.074	1	-.045	.057	-.056	.108	-.098
	Sig. (1-tailed)	.012	.122	.039	.302	.278	.	.361	.326	.330	.196	.219
	N	65	65	65	65	65	65	65	65	64	65	65
LDER	Pearson Correlation	-.093	.122	.174	-.037	.015	-.045	1	-.080	.191	.077	-.037
	Sig. (1-tailed)	.231	.167	.083	.384	.451	.361	.	.262	.065	.272	.384
	N	65	65	65	65	65	65	65	65	64	65	65
ROA	Pearson Correlation	.017	.030	-.026	.323**	-.324**	.057	-.080	1	.121	.153	.270*
	Sig. (1-tailed)	.445	.407	.418	.004	.004	.326	.262	.	.170	.112	.015
	N	65	65	65	65	65	65	65	65	64	65	65
LFATA	Pearson Correlation	-.291**	.168	.221*	.016	-.071	-.056	.191	.121	1	-.060	.170
	Sig. (1-tailed)	.010	.092	.039	.451	.288	.330	.065	.170	.	.319	.090
	N	64	64	64	64	64	64	64	64	64	64	64
LVAIC	Pearson Correlation	-.147	.069	.095	.039	.237*	.108	.077	.153	-.060	1	-.428**
	Sig. (1-tailed)	.122	.292	.225	.378	.029	.196	.272	.112	.319	.	.000
	N	65	65	65	65	65	65	65	65	64	65	65
LATO	Pearson Correlation	-.013	.119	.109	.266*	-.394**	-.098	-.037	.270*	.170	-.428**	1
	Sig. (1-tailed)	.459	.173	.194	.016	.001	.219	.384	.015	.090	.000	.
	N	65	65	65	65	65	65	65	65	64	65	65

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Table 44

Research results – Equation 20

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.661[a]	.437	.331	.85674

a. Predictors: (Constant), LVAIC, X4, LFATA, LMCAP, LDER, X2, X5, ROA, X3, X1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30.174	10	3.017	4.111	.000[a]
	Residual	38.902	53	.734		
	Total	69.076	63			

a. Predictors: (Constant), LVAIC, X4, LFATA, LMCAP, LDER, X2, X5, ROA, X3, X1

b. Dependent Variable: LATO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.283	1.313		-.215	.830
	X1	.666	.626	.320	1.065	.292
	X2	1.405	.728	.325	1.931	.059
	X3	1.310	.675	.391	1.941	.058
	X4	1.326	.669	.419	1.980	.053
	X5	.408	.681	.157	.599	.552
	LMCAP	-4.44E-02	.062	-.083	-.719	.475
	LDER	-4.92E-02	.090	-.060	-.547	.587
	ROA	2.695E-02	.013	.250	2.070	.043
	LFATA	5.396E-02	.091	.072	.592	.556
	LVAIC	-.356	.084	-.515	-4.227	.000

a. Dependent Variable: LATO

Table 45

Multicollinearity analysis for Model B

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.118	8.478
	X2	.375	2.667
	X3	.262	3.816
	X4	.237	4.216
	X5	.155	6.472
	LMCAP	.797	1.255
	LDER	.890	1.124
	ROA	.729	1.372
	LFATA	.721	1.387
	LVAIC	.716	1.397

a. Dependent Variable: LATO

Table 46

Correlation analysis for Model C

Correlations

		X1	X2	X3	X4	LMCAP	LDER	LATO	LFATA	LVAIC	LROA
X1	Pearson Correlation	1	-.239*	-.326**	-.298**	-.024	-.031	-.031	.278*	.178	.110
	Sig. (1-tailed)	.	.028	.004	.008	.425	.403	.403	.014	.078	.192
	N	65	65	65	65	65	65	65	62	65	65
X2	Pearson Correlation	-.239*	1	-.220*	-.200	-.158	.103	.181	-.013	-.073	.093
	Sig. (1-tailed)	.028	.	.039	.055	.104	.207	.074	.460	.281	.232
	N	65	65	65	65	65	65	65	62	65	65
X3	Pearson Correlation	-.326**	-.220*	1	-.274*	.191	-.086	-.517**	-.219*	.181	-.180
	Sig. (1-tailed)	.004	.039	.	.014	.064	.247	.000	.044	.075	.076
	N	65	65	65	65	65	65	65	62	65	65
X4	Pearson Correlation	-.298**	-.200	-.274*	1	-.069	-.082	.239*	-.197	-.263*	-.069
	Sig. (1-tailed)	.008	.055	.014	.	.292	.259	.028	.063	.017	.292
	N	65	65	65	65	65	65	65	62	65	65
LMCAP	Pearson Correlation	-.024	-.158	.191	-.069	1	.062	-.243*	-.145	.146	.166
	Sig. (1-tailed)	.425	.104	.064	.292	.	.313	.025	.130	.123	.093
	N	65	65	65	65	65	65	65	62	65	65
LDER	Pearson Correlation	-.031	.103	-.086	-.082	.062	1	.451**	-.067	.075	.160
	Sig. (1-tailed)	.403	.207	.247	.259	.313	.	.000	.302	.278	.102
	N	65	65	65	65	65	65	65	62	65	65
LATO	Pearson Correlation	-.031	.181	-.517**	.239*	-.243*	.451**	1	-.046	-.156	.381**
	Sig. (1-tailed)	.403	.074	.000	.028	.025	.000	.	.362	.107	.001
	N	65	65	65	65	65	65	65	62	65	65
LFATA	Pearson Correlation	.278*	-.013	-.219*	-.197	-.145	-.067	-.046	1	-.038	-.316**
	Sig. (1-tailed)	.014	.460	.044	.063	.130	.302	.362	.	.386	.006
	N	62	62	62	62	62	62	62	62	62	62
LVAIC	Pearson Correlation	.178	-.073	.181	-.263*	.146	.075	-.156	-.038	1	.507**
	Sig. (1-tailed)	.078	.281	.075	.017	.123	.278	.107	.386	.	.000
	N	65	65	65	65	65	65	65	62	65	65
LROA	Pearson Correlation	.110	.093	-.180	-.069	.166	.160	.381**	-.316**	.507**	1
	Sig. (1-tailed)	.192	.232	.076	.292	.093	.102	.001	.006	.000	.
	N	65	65	65	65	65	65	65	62	65	65

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Table 47

Research results – Equation 21

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.795[a]	.633	.569	.38089

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LATO

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.991	9	1.443	9.950	.000[a]
	Residual	7.544	52	.145		
	Total	20.535	61			

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LATO

b. Dependent Variable: LROA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.314	.489		2.688	.010
	X1	4.612E-02	.156	.035	.296	.768
	X2	5.005E-02	.178	.030	.281	.780
	X3	-.200	.183	-.147	-1.093	.280
	X4	-.204	.168	-.142	-1.214	.230
	LMCAP	5.721E-02	.025	.205	2.263	.028
	LDER	-.153	.083	-.185	-1.850	.070
	LATO	.494	.111	.539	4.467	.000
	LFATA	-.164	.047	-.323	-3.460	.001
	LVAIC	.240	.040	.548	6.065	.000

a. Dependent Variable: LROA

Table 48

Multicollinearity analysis for Model C

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.499	2.003
	X2	.617	1.621
	X3	.392	2.551
	X4	.518	1.929
	LMCAP	.857	1.167
	LDER	.705	1.418
	LATO	.485	2.061
	LFATA	.812	1.231
	LVAIC	.865	1.156

a. Dependent Variable: LROA

Table 49

Correlation analysis for Model D

Correlations

		ROA	X1	X2	X3	X4	X5	LMCAP	LDER	LATO	LFATA	LVAIC
ROA	Pearson Correlation	1	.017	.030	-.026	.323**	-.324**	.057	-.080	.270*	.121	.153
	Sig. (1-tailed)	.	.445	.407	.418	.004	.004	.326	.262	.015	.170	.112
	N	65	65	65	65	65	65	65	65	65	64	65
X1	Pearson Correlation	.017	1	-.237*	-.322**	-.347**	-.463**	-.281*	-.093	-.013	-.291**	-.147
	Sig. (1-tailed)	.445	.	.029	.004	.002	.000	.012	.231	.459	.010	.122
	N	65	65	65	65	65	65	65	65	65	64	65
X2	Pearson Correlation	.030	-.237*	1	-.089	-.096	-.128	.147	.122	.119	.168	.069
	Sig. (1-tailed)	.407	.029	.	.240	.224	.155	.122	.167	.173	.092	.292
	N	65	65	65	65	65	65	65	65	65	64	65
X3	Pearson Correlation	-.026	-.322**	-.089	1	-.130	-.174	.220*	.174	.109	.221*	.095
	Sig. (1-tailed)	.418	.004	.240	.	.151	.083	.039	.083	.194	.039	.225
	N	65	65	65	65	65	65	65	65	65	64	65
X4	Pearson Correlation	.323**	-.347**	-.096	-.130	1	-.187	-.065	-.037	.266*	.016	.039
	Sig. (1-tailed)	.004	.002	.224	.151	.	.068	.302	.384	.016	.451	.378
	N	65	65	65	65	65	65	65	65	65	64	65
X5	Pearson Correlation	-.324**	-.463**	-.128	-.174	-.187	1	.074	.015	-.394**	-.071	.237*
	Sig. (1-tailed)	.004	.000	.155	.083	.068	.	.278	.451	.001	.288	.029
	N	65	65	65	65	65	65	65	65	65	64	65
LMCAP	Pearson Correlation	.057	-.281*	.147	.220*	-.065	.074	1	-.045	-.098	-.056	.108
	Sig. (1-tailed)	.326	.012	.122	.039	.302	.278	.	.361	.219	.330	.196
	N	65	65	65	65	65	65	65	65	65	64	65
LDER	Pearson Correlation	-.080	-.093	.122	.174	-.037	.015	-.045	1	-.037	.191	.077
	Sig. (1-tailed)	.262	.231	.167	.083	.384	.451	.361	.	.384	.065	.272
	N	65	65	65	65	65	65	65	65	65	64	65
LATO	Pearson Correlation	.270*	-.013	.119	.109	.266*	-.394**	-.098	-.037	1	.170	-.428**
	Sig. (1-tailed)	.015	.459	.173	.194	.016	.001	.219	.384	.	.090	.000
	N	65	65	65	65	65	65	65	65	65	64	65
LFATA	Pearson Correlation	.121	-.291**	.168	.221*	.016	-.071	-.056	.191	.170	1	-.060
	Sig. (1-tailed)	.170	.010	.092	.039	.451	.288	.330	.065	.090	.	.319
	N	64	64	64	64	64	64	64	64	64	64	64
LVAIC	Pearson Correlation	.153	-.147	.069	.095	.039	.237*	.108	.077	-.428**	-.060	1
	Sig. (1-tailed)	.112	.122	.292	.225	.378	.029	.196	.272	.000	.319	.
	N	65	65	65	65	65	65	65	65	65	64	65

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 50

Research results – Equation 21

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.571[a]	.326	.199	8.69501

a. Predictors: (Constant), LVAIC, X4, LFATA, LMCAP, LDER, X2, X5, X3, LATO, X1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1936.642	10	193.664	2.562	.013[a]
	Residual	4006.969	53	75.603		
	Total	5943.611	63			

a. Predictors: (Constant), LVAIC, X4, LFATA, LMCAP, LDER, X2, X5, X3, LATO, X1

b. Dependent Variable: ROA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.423	13.186		1.094	.279
	X1	-5.640	6.370	-.292	-.885	.380
	X2	-9.469	7.531	-.236	-1.257	.214
	X3	-10.937	6.928	-.352	-1.579	.120
	X4	-1.158	7.039	-.039	-.165	.870
	X5	-12.974	6.704	-.538	-1.935	.058
	LMCAP	.559	.625	.113	.894	.375
	LDER	-.354	.914	-.046	-.387	.700
	LATO	2.776	1.341	.299	2.070	.043
	LFATA	.733	.923	.105	.794	.431
	LVAIC	2.660	.918	.415	2.899	.005

a. Dependent Variable: ROA

Table 51

Multicollinearity analysis for Model D

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.117	8.533
	X2	.361	2.772
	X3	.256	3.903
	X4	.221	4.526
	X5	.164	6.086
	LMCAP	.801	1.249
	LDER	.888	1.127
	LATO	.609	1.643
	LFATA	.725	1.379
	LVAIC	.620	1.612

a. Dependent Variable: ROA

Table 52

Correlation analysis for Model E

Correlations

		LMB	X1	X2	X3	X4	LMCAP	LDER	LROA	LFATA	LATO	LVAIC
LMB	Pearson Correlation	1	.068	.016	-.059	-.013	.687**	.168	.376**	-.298**	.080	.231*
	Sig. (1-tailed)	.	.296	.449	.319	.460	.000	.091	.001	.009	.263	.032
	N	65	65	65	65	65	65	65	65	62	65	65
X1	Pearson Correlation	.068	1	-.239*	-.326**	-.298**	-.024	-.031	.110	.278*	-.031	.178
	Sig. (1-tailed)	.296	.	.028	.004	.008	.425	.403	.192	.014	.403	.078
	N	65	65	65	65	65	65	65	65	62	65	65
X2	Pearson Correlation	.016	-.239*	1	-.220*	-.200	-.158	.103	.093	-.013	.181	-.073
	Sig. (1-tailed)	.449	.028	.	.039	.055	.104	.207	.232	.460	.074	.281
	N	65	65	65	65	65	65	65	65	62	65	65
X3	Pearson Correlation	-.059	-.326**	-.220*	1	-.274*	.191	-.086	-.180	-.219*	-.517**	.181
	Sig. (1-tailed)	.319	.004	.039	.	.014	.064	.247	.076	.044	.000	.075
	N	65	65	65	65	65	65	65	65	62	65	65
X4	Pearson Correlation	-.013	-.298**	-.200	-.274*	1	-.069	-.082	-.069	-.197	.239*	-.263*
	Sig. (1-tailed)	.460	.008	.055	.014	.	.292	.259	.292	.063	.028	.017
	N	65	65	65	65	65	65	65	65	62	65	65
LMCAP	Pearson Correlation	.687**	-.024	-.158	.191	-.069	1	.062	.166	-.145	-.243*	.146
	Sig. (1-tailed)	.000	.425	.104	.064	.292	.	.313	.093	.130	.025	.123
	N	65	65	65	65	65	65	65	65	62	65	65
LDER	Pearson Correlation	.168	-.031	.103	-.086	-.082	.062	1	.160	-.067	.451**	.075
	Sig. (1-tailed)	.091	.403	.207	.247	.259	.313	.	.102	.302	.000	.278
	N	65	65	65	65	65	65	65	65	62	65	65
LROA	Pearson Correlation	.376**	.110	.093	-.180	-.069	.166	.160	1	-.316**	.381**	.507**
	Sig. (1-tailed)	.001	.192	.232	.076	.292	.093	.102	.	.006	.001	.000
	N	65	65	65	65	65	65	65	65	62	65	65
LFATA	Pearson Correlation	-.298**	.278*	-.013	-.219*	-.197	-.145	-.067	-.316**	1	-.046	-.038
	Sig. (1-tailed)	.009	.014	.460	.044	.063	.130	.302	.006	.	.362	.386
	N	62	62	62	62	62	62	62	62	62	62	62
LATO	Pearson Correlation	.080	-.031	.181	-.517**	.239*	-.243*	.451**	.381**	-.046	1	-.156
	Sig. (1-tailed)	.263	.403	.074	.000	.028	.025	.000	.001	.362	.	.107
	N	65	65	65	65	65	65	65	65	62	65	65
LVAIC	Pearson Correlation	.231*	.178	-.073	.181	-.263*	.146	.075	.507**	-.038	-.156	1
	Sig. (1-tailed)	.032	.078	.281	.075	.017	.123	.278	.000	.386	.107	.
	N	65	65	65	65	65	65	65	65	62	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 53

Research results – Equation 22

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.795[a]	.632	.560	.58173

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LROA, LATO

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.624	10	2.962	8.754	.000[a]
	Residual	17.259	51	.338		
	Total	46.883	61			

a. Predictors: (Constant), LVAIC, LFATA, X2, LDER, LMCAP, X3, X4, X1, LROA, LATO

b. Dependent Variable: LMB

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-5.671	.797		-7.118	.000
	X1	.252	.238	.127	1.057	.296
	X2	.291	.273	.115	1.066	.291
	X3	-.224	.283	-.108	-.790	.433
	X4	2.566E-02	.260	.012	.099	.922
	LMCAP	.307	.040	.729	7.575	.000
	LDER	-2.04E-02	.131	-.016	-.156	.877
	LROA	-5.62E-02	.212	-.037	-.265	.792
	LFATA	-.187	.080	-.244	-2.334	.024
	LATO	.304	.199	.219	1.530	.132
	LVAIC	.118	.079	.178	1.494	.141

a. Dependent Variable: LMB

Table 54

Multicollinearity analysis for Model E

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	X1	.498	2.007
	X2	.616	1.623
	X3	.383	2.610
	X4	.504	1.984
	LMCAP	.780	1.282
	LDER	.662	1.511
	LROA	.367	2.722
	LFATA	.660	1.514
	LATO	.351	2.852
	LVAIC	.507	1.974

a. Dependent Variable: LMB

Table 55

Correlation analysis for Model F

Correlations

		LMB	X1	X2	X3	X4	X5	LMCAP	LDER	ROA	LFATA	LATO	LVAIC
LMB	Pearson Correlation	1	-.154	.103	.100	-.141	.159	.461**	.281*	.073	.094	-.056	.089
	Sig. (1-tailed)	.	.111	.207	.214	.131	.103	.000	.012	.281	.230	.328	.241
	N	65	65	65	65	65	65	65	65	65	64	65	65
X1	Pearson Correlation	-.154	1	-.237*	-.322**	-.347**	-.463**	-.281*	-.093	.017	-.291**	-.013	-.147
	Sig. (1-tailed)	.111	.	.029	.004	.002	.000	.012	.231	.445	.010	.459	.122
	N	65	65	65	65	65	65	65	65	65	64	65	65
X2	Pearson Correlation	.103	-.237*	1	-.089	-.096	-.128	.147	.122	.030	.168	.119	.069
	Sig. (1-tailed)	.207	.029	.	.240	.224	.155	.122	.167	.407	.092	.173	.292
	N	65	65	65	65	65	65	65	65	65	64	65	65
X3	Pearson Correlation	.100	-.322**	-.089	1	-.130	-.174	.220*	.174	-.026	.221*	.109	.095
	Sig. (1-tailed)	.214	.004	.240	.	.151	.083	.039	.083	.418	.039	.194	.225
	N	65	65	65	65	65	65	65	65	65	64	65	65
X4	Pearson Correlation	-.141	-.347**	-.096	-.130	1	-.187	-.065	-.037	.323**	.016	.266*	.039
	Sig. (1-tailed)	.131	.002	.224	.151	.	.068	.302	.384	.004	.451	.016	.378
	N	65	65	65	65	65	65	65	65	65	64	65	65
X5	Pearson Correlation	.159	-.463**	-.128	-.174	-.187	1	.074	.015	-.324**	-.071	-.394**	.237*
	Sig. (1-tailed)	.103	.000	.155	.083	.068	.	.278	.451	.004	.288	.001	.029
	N	65	65	65	65	65	65	65	65	65	64	65	65
LMCAP	Pearson Correlation	.461**	-.281*	.147	.220*	-.065	.074	1	-.045	.057	-.056	-.098	.108
	Sig. (1-tailed)	.000	.012	.122	.039	.302	.278	.	.361	.326	.330	.219	.196
	N	65	65	65	65	65	65	65	65	65	64	65	65
LDER	Pearson Correlation	.281*	-.093	.122	.174	-.037	.015	-.045	1	-.080	.191	-.037	.077
	Sig. (1-tailed)	.012	.231	.167	.083	.384	.451	.361	.	.262	.065	.384	.272
	N	65	65	65	65	65	65	65	65	65	64	65	65
ROA	Pearson Correlation	.073	.017	.030	-.026	.323**	-.324**	.057	-.080	1	.121	.270*	.153
	Sig. (1-tailed)	.281	.445	.407	.418	.004	.004	.326	.262	.	.170	.015	.112
	N	65	65	65	65	65	65	65	65	65	64	65	65
LFATA	Pearson Correlation	.094	-.291**	.168	.221*	.016	-.071	-.056	.191	.121	1	.170	-.060
	Sig. (1-tailed)	.230	.010	.092	.039	.451	.288	.330	.065	.170	.	.090	.319
	N	64	64	64	64	64	64	64	64	64	64	64	64
LATO	Pearson Correlation	-.056	-.013	.119	.109	.266*	-.394**	-.098	-.037	.270*	.170	1	-.428**
	Sig. (1-tailed)	.328	.459	.173	.194	.016	.001	.219	.384	.015	.090	.	.000
	N	65	65	65	65	65	65	65	65	65	64	65	65
LVAIC	Pearson Correlation	.089	-.147	.069	.095	.039	.237*	.108	.077	.153	-.060	-.428**	1
	Sig. (1-tailed)	.241	.122	.292	.225	.378	.029	.196	.272	.112	.319	.000	.
	N	65	65	65	65	65	65	65	65	65	64	65	65

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 56

Research results – Equation 22

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.597[a]	.356	.220	.81810

a. Predictors: (Constant), LMCAP, LDER, X5, X4, LFATA, LVAIC, X2, ROA, X3, LATO, X1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.268	11	1.752	2.617	.010[a]
	Residual	34.803	52	.669		
	Total	54.071	63			

a. Predictors: (Constant), LMCAP, LDER, X5, X4, LFATA, LVAIC, X2, ROA, X3, LATO, X1

b. Dependent Variable: LMB

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.129	1.255		-3.291	.002
	ROA	1.404E-02	.013	.147	1.086	.282
	X1	.251	.604	.136	.416	.679
	X2	.111	.719	.029	.155	.878
	X3	7.352E-03	.667	.002	.011	.991
	X4	-.175	.662	-.062	-.264	.793
	X5	.583	.653	.254	.893	.376
	LDER	.221	.086	.304	2.566	.013
	LFATA	5.876E-02	.087	.088	.673	.504
	LATO	4.744E-02	.131	.054	.362	.719
	LVAIC	-1.32E-02	.093	-.022	-.142	.888
	LMCAP	.231	.059	.489	3.906	.000

a. Dependent Variable: LMB

Table 57

Multicollinearity analysis for Model F

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	ROA	.674	1.483
	X1	.115	8.660
	X2	.350	2.855
	X3	.245	4.087
	X4	.221	4.528
	X5	.153	6.516
	LDER	.885	1.130
	LFATA	.716	1.396
	LATO	.563	1.776
	LVAIC	.535	1.867
	LMCAP	.789	1.267

a. Dependent Variable: LMB

Table 58

Summary of results

PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	INTELLECTUAL CAPITAL PERFORMANCE	HO NULL HYPOTHESES
Productivity	Asset Turnover Ratio	Significant Negative	Not Rejected
Profitability	Return on Assets	Significant Positive	Rejected
Market Valuation	Price to Book Ratio	Not significant	Not Rejected

Table 59

Summary of results

PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	INTELLECTUAL CAPITAL PERFORMANCE	HO NULL HYPOTHESES
Productivity	Asset Turnover Ratio	Significant Negative	Not Rejected
Profitability	Return on Assets	Significant Positive	Rejected
Market Valuation	Price to Book Ratio	Not significant	Not Rejected

Table 60

Example of the interaction of knowledge-base and intellectual capital performance

KB DUMMY VARIABLE	VAIC™	INTERACTION (KB X VAIC™)
0	2	0
1	3	3

Table 61

Tests of normality

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MARCAP	.346	130	.000	.416	130	.000
DER	.288	130	.000	.467	130	.000
ROA	.122	130	.000	.892	130	.000
ATO	.115	130	.000	.901	130	.000
VAIC	.289	130	.000	.478	130	.000
FATA	.155	130	.000	.860	130	.000
MB	.198	130	.000	.747	130	.000

a. Lilliefors Significance Correction

Table 62

Tests of normality for across industry analysis

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
LMCAP	.051	130	.200*	.992	130	.659
LDER	.068	130	.200*	.976	130	.020
LROA	.107	130	.001	.953	130	.000
LATO	.167	130	.000	.889	130	.000
LVAIC	.105	130	.001	.949	130	.000
LFATA	.076	126	.071	.939	126	.000
LMB	.102	130	.002	.917	130	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 63

Descriptive statistics for across industry analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	130	1.43	60.61	16.5979	10.00778
ATO	130	.02	5.28	1.3285	.89021
MB	130	.02	9.72	1.8807	1.68201
VAIC	130	.01	34.55	2.9141	5.18566
KBDV	130	.00	1.00	.2462	.43244
KBVAIC	130	.00	14.93	.6658	1.88061
Valid N (listwise)	130				

Table 64

Correlation data for across industry analysis

Correlations

		LMB	LROA	LATO	KBVAIC	LMCAP	LDER	LVAIC	LFATA
LMB	Pearson Correla	1	.223**	-.023	.136	.563**	.240**	.167*	-.090
	Sig. (1-tailed)	.	.005	.397	.062	.000	.003	.029	.158
	N	130	130	130	130	130	130	130	126
LROA	Pearson Correla	.223**	1	.304**	.099	.086	.043	.241**	.000
	Sig. (1-tailed)	.005	.	.000	.131	.165	.314	.003	.498
	N	130	130	130	130	130	130	130	126
LATO	Pearson Correla	-.023	.304**	1	.006	-.128	.064	-.359**	.143
	Sig. (1-tailed)	.397	.000	.	.474	.073	.236	.000	.055
	N	130	130	130	130	130	130	130	126
KBVAI(	Pearson Correla	.136	.099	.006	1	.312**	.037	.306**	.029
	Sig. (1-tailed)	.062	.131	.474	.	.000	.338	.000	.373
	N	130	130	130	130	130	130	130	126
LMCAF	Pearson Correla	.563**	.086	-.128	.312**	1	-.013	.104	-.082
	Sig. (1-tailed)	.000	.165	.073	.000	.	.442	.119	.182
	N	130	130	130	130	130	130	130	126
LDER	Pearson Correla	.240**	.043	.064	.037	-.013	1	.092	.088
	Sig. (1-tailed)	.003	.314	.236	.338	.442	.	.149	.164
	N	130	130	130	130	130	130	130	126
LVAIC	Pearson Correla	.167*	.241**	-.359**	.306**	.104	.092	1	-.094
	Sig. (1-tailed)	.029	.003	.000	.000	.119	.149	.	.148
	N	130	130	130	130	130	130	130	126
LFATA	Pearson Correla	-.090	.000	.143	.029	-.082	.088	-.094	1
	Sig. (1-tailed)	.158	.498	.055	.373	.182	.164	.148	.
	N	126	126	126	126	126	126	126	126

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

Table 65

Research results – Equation 23

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.583[a]	.340	.301	.73669

a. Predictors: (Constant), LFATA, LROA, LDER, KBVAIC, LMCAP, LVAIC, KBDV

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	32.963	7	4.709	8.677	.000[a]
	Residual	64.040	118	.543		
	Total	97.002	125			

a. Predictors: (Constant), LFATA, LROA, LDER, KBVAIC, LMCAP, LVAIC, KBDV

b. Dependent Variable: LATO

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.116	.671		-.173	.863
	KBDV	-2.86E-02	.208	-.014	-.138	.891
	KBVAIC	7.843E-02	.048	.167	1.621	.108
	LVAIC	-.300	.050	-.495	-5.963	.000
	LROA	.555	.104	.419	5.331	.000
	LMCAP	-6.69E-02	.035	-.153	-1.906	.059
	LDER	6.571E-02	.065	.077	1.014	.313
	LFATA	5.086E-02	.053	.075	.969	.335

a. Dependent Variable: LATO

Table 66

Multicollinearity analysis for Model G

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	KBDV	.538	1.857
	KBVAIC	.524	1.907
	LVAIC	.813	1.229
	LROA	.908	1.102
	LMCAP	.863	1.159
	LDER	.981	1.020
	LFATA	.931	1.074

a. Dependent Variable: LATO

Table 67

Research results – Equation 24

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.518[a]	.269	.225	.58440

a. Predictors: (Constant), LATO, KBVAIC, LDER, LFATA, LMCAP, LVAIC, KBDV

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14.802	7	2.115	6.191	.000[a]
	Residual	40.300	118	.342		
	Total	55.101	125			

a. Predictors: (Constant), LATO, KBVAIC, LDER, LFATA, LMCAP, LVAIC, KBDV

b. Dependent Variable: LROA

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.944	.502		3.875	.000
	KBDV	.295	.162	.192	1.816	.072
	KBVAIC	-6.54E-02	.038	-.185	-1.705	.091
	LVAIC	.201	.042	.440	4.835	.000
	LMCAP	3.077E-02	.028	.094	1.094	.276
	LDER	-1.05E-02	.052	-.016	-.204	.839
	LFATA	-2.20E-02	.042	-.043	-.526	.600
	LATO	.350	.066	.464	5.331	.000

a. Dependent Variable: LROA

Table 68

Multicollinearity analysis for Model H

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	KBDV	.553	1.807
	KBVAIC	.526	1.903
	LVAIC	.749	1.335
	LMCAP	.846	1.183
	LDER	.972	1.028
	LFATA	.926	1.080
	LATO	.819	1.221

a. Dependent Variable: LROA

Table 69

Research results – Equation 25

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.646[a]	.417	.378	.71109

a. Predictors: (Constant), LROA, LFATA, LDER, KBVAIC, LMCAP, LATO, LVAIC, KBDV

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	42.393	8	5.299	10.480	.000[a]
	Residual	59.160	117	.506		
	Total	101.554	125			

a. Predictors: (Constant), LROA, LFATA, LDER, KBVAIC, LMCAP, LATO, LVAIC, KBDV

b. Dependent Variable: LMB

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-4.928	.648		-7.603	.000
	KBDV	-2.03E-02	.200	-.010	-.101	.919
	KBVAIC	-4.04E-02	.047	-.084	-.855	.395
	LVAIC	5.088E-02	.055	.082	.919	.360
	LMCAP	.256	.034	.573	7.434	.000
	LDER	.210	.063	.240	3.349	.001
	LFATA	-3.95E-02	.051	-.057	-.777	.439
	LATO	3.098E-02	.089	.030	.349	.728
	LROA	.196	.112	.144	1.747	.083

a. Dependent Variable: LMB

Table 70

Multicollinearity analysis for Model I

Coefficients[a]

Model		Collinearity Statistics	
		Tolerance	VIF
1	KBDV	.538	1.858
	KBVAIC	.513	1.949
	LVAIC	.625	1.600
	LMCAP	.837	1.195
	LDER	.972	1.029
	LFATA	.924	1.083
	LATO	.660	1.515
	LROA	.731	1.367

a. Dependent Variable: LMB

Table 71

Summary of results

PERFORMANCE MEASUREMENT	DEPENDENT VARIABLE	KNOWLEDGE-BASE AND INTELLECTUAL CAPITAL PERFORMANCE INTERACTION	HO NULL HYPOTHESES
Productivity	Asset Turnover Ratio	Not significant	Not Rejected
Profitability	Return on Assets	Not significant	Not Rejected
Market Valuation	Price to Book Ratio	Not significant	Not Rejected

Table 72

Anova summary

MODEL	F STATISTIC	SIGNIFICANCE	EXPLAIN COMPANY PERFORMANCE
Model 1 – part B Productivity Low knowledge-base	16.244	$\rho < 0.05$	Yes
Model 1 – part B Profitability Low knowledge-base	20.438	$\rho < 0.05$	Yes
Model 1 – part B Market valuation Low knowledge-base	9.346	$\rho < 0.05$	No
Model 1 – part B Productivity High knowledge-base	6.415	$\rho < 0.05$	Yes
Model 1 – part B Profitability High knowledge-base	3.727	$\rho < 0.05$	Yes
Model 1 – part B Market valuation High knowledge-base	1.649	$\rho > 0.05$	No
Model A	10.7	$\rho < 0.05$	Yes
Model B	4.111	$\rho < 0.05$	Yes
Model C	9.950	$\rho < 0.05$	Yes
Model D	2.562	$\rho < 0.05$	Yes
Model E	8.754	$\rho < 0.05$	No
Model F	2.617	$\rho < 0.05$	No

Table 74

Summary of results for Model 1 – part B

PERFORMANCE MEASUREMENT MODEL NUMBER	DEPENDENT VARIABLE	GROUP	R^2 FOR MODEL	VACA BETA	VACA T	VAHC BETA	VAHC T	SCVA BETA	SCVA T	NULL HYPOTHESIS H_0
Productivity 1	Asset Turnover Ratio	Low	0.699	0.691	5.912	-0.503	-4.625	n/a	n/a	Not Rejected
Productivity 4	Asset Turnover Ratio	High	0.666	0.357	2.443	-0.555	-3.262	-0.146	-0.919	Not Rejected
Profitability 2	Return on Assets	Low	0.745	0.838	7.786	0.197	1.967	n/a	n/a	Not Rejected
Profitability 5	Return on Assets	High	0.536	0.571	2.443	-0.070	-0.348	0.082	0.441	Not Rejected
Market valuation 3	Market to Book Ratio	Low	0.572	0.065	0.464	0.178	1.378	n/a	n/a	Not Rejected
Market valuation 6	Market to Book Ratio	High	0.339	0.253	1.233	0.100	0.417	-0.301	-1.351	Not Rejected

Comment: I have just wondered now.. when you say "null" I assume you mean "nil"?

Table 75

Summary of results for Model 2

PERFORMANCE MEASUREMENT MODEL NUMBER	DEPENDENT VARIABLE	GROUP	R^2 FOR MODEL	VAIC BETA	VAIC T	NULL HYPOTHESIS H_0
Productivity A	Asset Turnover Ratio	Low	0.649	-0.310	-2.891	NOT REJECTED
Productivity B	Asset Turnover Ratio	High	0.433	-0.524	-4.227	NOT REJECTED
Profitability C	Return on Assets	Low	0.633	0.549	6.065	REJECTED
Profitability D	Return on Assets	High	0.326	0.415	2.899	REJECTED
Market Valuation E	Market to Book Ratio	Low	0.632	0.178	1.494	NOT REJECTED
Market Valuation F	Market to Book Ratio	High	0.166	-0.057	-0.142	NOT REJECTED

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¶

Table 76

Summary of results for Model 3

PERFORMANCE MEASUREMENT MODEL NUMBER	DEPENDENT VARIABLE	R^2 FOR MODEL	BETA FOR INTELLECTUAL CAPITAL PERFORMANCE	NULL HYPOTHESIS H_0
Productivity G	Total asset turnover	0.340	0.167	NOT REJECTED
Profitability H	Return on assets	0.269	-0.185	NOT REJECTED
Market valuation I	Price to book ratio	0.417	-0.084	NOT REJECTED