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Discovering the factors impacting the evaluation of knowledge management in the organizational domain

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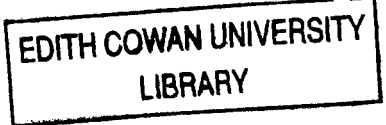
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DBA Thesis



Discovering the Factors Impacting the Evaluation of Knowledge Management in the Organizational Domain

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March 2004

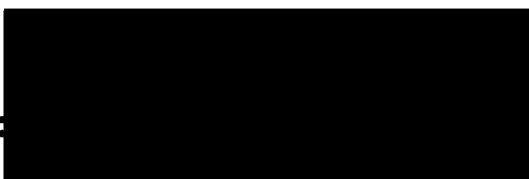
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Publications

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Abstract

The knowledge, skills and experience possessed by employees, customers, suppliers and other stakeholders are major components of an organization's Intellectual Capital, the effective management of which has been found to be critical for business success. In order to manage knowledge at an organizational level however, it is necessary to be able to define it in the context of the organization, measure its existence and, more importantly, assess how its creation, use, dissemination, evaluation and management impacts business performance and learning.

Whilst the term "Knowledge Management" has evolved since the early nineties into a generally recognisable management discipline in its own right, significant literature over the past eight years has focussed on the management of knowledge as a more generic organizational competence making Knowledge Management Initiatives difficult to identify and define and even more difficult to evaluate. Despite the challenges, the subjects of knowledge management and intellectual capital are gaining strategic management exposure particularly in relation to how investment in, and outputs from, these initiatives can or should be evaluated.

Knowledge management and intellectual capital are inextricably related, and whilst some previous research has gone into evaluating knowledge as an extension or derivative of information and into intellectual capital as a discrete item on the balance sheet, little has been done to analyse the development of models that attempt to evaluate the impact of knowledge management as an organizational process or capability.

A comprehensive meta-analysis by literature review of international articles dealing with knowledge management and intellectual capital evaluation from a broad range of business and scientific journals was undertaken to identify precisely what has been measured by public and private sector organizations within the Knowledge Management, Intellectual Capital and other closely related domains between the years 1996 to 2002.

By the end of 2002, human capital based measures were found to be the most frequently quoted in KM literature. Financial, human capital, internal infrastructure and composite measures such as the Balanced Scorecard have grown in varying degrees in frequency of use, whilst customer, process, intellectual property, innovation and quality related measures have gradually lost ground compared to other metrics between 1996 and 2002.

Significant differences occur in the evaluation and reporting of KM initiatives amongst the main geographic regions of North America, Europe, Scandinavia and Japan, but these differences seem to be more related to public policy differences and to management style than to a result of any definitive or deliberate differences in formal evaluation plans and methodologies.

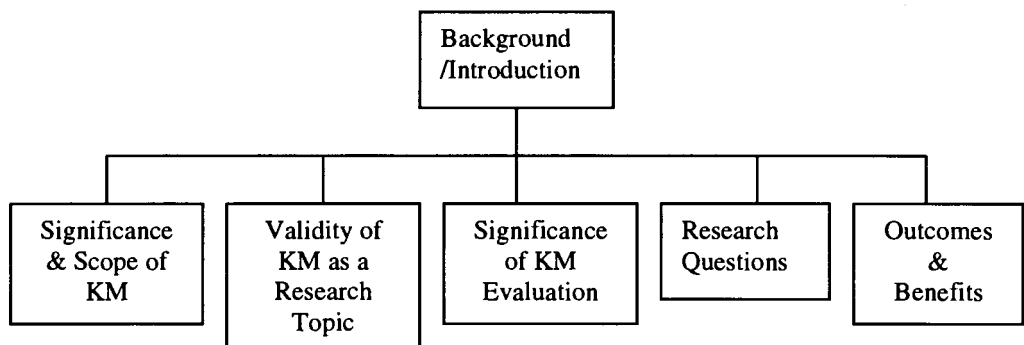
Generally, KM evaluation between 1996 and 2002 has focused on explicit (rather than tacit), internal (rather than external) and outcome (rather than process) oriented measurement processes.

Inadequate accounting systems, lack of measurement and reporting standards, lack of long-term vision and poor understanding of the contribution of knowledge to competitive advantage have been and remain major constraints to the future development of KM.

1. Background/Introduction

This chapter provides the background to, and examines the concept and significance of Knowledge Management, its viability as a research topic and the importance of, and the driving factors behind the need for its evaluation. The research focus is on the evaluation of Knowledge Management in conjunction with other disciplines that have been closely associated with it. The chapter concludes with the specific research questions that will be addressed in this study followed by the anticipated benefits and outcomes of this study.

The Chapter structure is depicted as follows:



1.1 Significance and Scope of Knowledge Management

Knowledge has been the subject of philosophical and epistemological debate since ancient Greek times and its management is far from a new concept. What is new is that organizational and managerial practices have become more knowledge focussed in recent times. This change in focus appears to have been driven by an ever-increasing demand for organizations to adapt more quickly to the rapidly changing market-place and global economy. In this context, knowledge has emerged within a relatively short time-span of the past ten years, as one of the major means of attaining sustainable competitive advantage and a primary source of wealth creation at the organizational and national levels (Drucker 1998; Davenport & Prusak 1998; Stewart 1998; Bassi 1999; Guthrie 2002).

Interest in the concept of knowledge management (KM) is growing (Blumentritt & Johnston 1999; Olson 1999; Swan, Scarborough, & Preston 1999; Guthrie 2002). A particularly significant surge of interest in KM occurred in 1998 with more references to it in management literature in the first six months of 1998 than appeared in the previous five years (Swan et al. 1999). As well as, or perhaps because of, its growing interest

and status, KM is also increasing in scope (Duffy 2002), to the extent that it appears to be merging with or even subsuming the management of other related concepts such as Organizational Learning (Swan et al. 1999) and the management of Intellectual Capital (Birkinshaw 2001). Organizational Learning (OL) and Intellectual Capital (IC) will feature strongly in the scope of this study as concepts that have had an impact on the growth of KM and have been associated with KM principles in one way or another¹. Whilst OL as a management issue appears to be losing momentum to some extent in favour of KM (Swan et al. 1999), IC is strongly implicated in recent economic, managerial, technological and sociological developments in a manner previously unknown and largely unforeseen (Guthrie 2002).

The management of knowledge as a major component of IC, has been found to be important and applicable for *all* organizations, regardless of size, type or location, not just those that have become known as “knowledge organizations” (Sullivan 1999). As Allee (1997: p7) explains,

“every industry is a knowledge industry, everyone is in the information business and almost everyone is now a knowledge worker”.

This adds weight to the position taken in this research project that the understanding of the management and evaluation of knowledge in particular, and IC in general, is crucial for the success of all organizations including governments, non-profit organizations and commercial businesses.

Commonly quoted examples of knowledge oriented (or “learning”) organizations that have become international KM benchmarks are shown in the following table:

Organization	Country	Source
British Petroleum	UK	Davenport & Prusak, 1998
Buckman Laboratories	USA	Davenport & Prusak, 1998
Canon	Japan	Nonaka & Takeuchi, 1995
Chaparral Steel	USA	Davenport & Prusak, 1998
Canadian Imperial Bank of Commerce (CIBC)	Canada	Edvinsson & Malone, 1997
CSIRO	Australia	Davenport & Prusak, 1998
Dow Chemical	USA	Davenport & Prusak, 1998
Electricite de France	France	Allee, 1997
Eli Lilly & Co	USA	Perez & Hynes, 1999
Ernst & Young	USA	Davenport & Prusak, 1998
Finnair	Finland	CIO Magazine, 1999

¹ The connections between Organizational Learning, Intellectual Capital and Knowledge Management are established in section 2.9.

Hewlett Packard	USA	Davenport & Prusak, 1998
Hoffman-LaRoche	Switzerland	Davenport & Prusak, 1998
Honda	Japan	Garvin 1998
IBM	USA	Davenport & Prusak, 1998
Matsushita	Japan	Nonaka & Takeuchi, 1995
McKinseys	USA	Davenport & Prusak, 1998
NEC	Japan	Davenport & Prusak, 1998
Oticon	Denmark	McKinsey, 1998
Royal Dutch Shell	Netherlands	Bahrami, 1995
Skandia	Sweden	Edvinsson & Malone, 1997
The World Bank	USA	Liebowitz & Wright, 1999
Xerox	USA	Davenport & Prusak, 1998

Table 1: Examples of Knowledge Organizations

The above-mentioned list of organizations is far from complete but indicates the range of organizations that have started to look at knowledge as a serious resource and also shows the range of countries that the individual organizations represent. The above “knowledge oriented” organizations range from banks, oil companies, consulting firms, manufacturing companies, research companies and service providers indicating that KM as a concept is not unique to any industry, organization type or country.

From a geographic perspective, the USA, Scandinavia and Japan are well represented in KM/IC literature with the UK and other European countries such as the Netherlands and France also receiving some mention. Australia is not well represented with the CSIRO being the only example encountered in a preliminary literature review.

It has been claimed that 90 percent of large private sector enterprises and 40 percent of federal public sector organizations in the US have at least one KM initiative in progress (Caldwell 2000). This does not necessarily mean that the US manages knowledge better than any other nation. Nonaka and Takeuchi (1995) go to some lengths to explain the differences between the Japanese and American approaches to KM with the management of knowledge purportedly being a lower profile in Japan largely because it has always been an obvious and normal part of conducting their business and far from a new management concept. Different approaches to KM by different nations are explored further in section 4.4.

Knowledge creation, as a critical component of KM has been discussed at both organizational and national levels. It is widely accepted that firms which consciously invest in the creation of new knowledge through research and development activities or through more informal learning processes, tend to do better than those that ride on the coat-tails of knowledge created by others (Boisot 1998). In the same vein, the effective

generation and application of knowledge at the national level is being seen as a crucial basis of economic competitiveness and an essential element of effective operation of a modern economy and society (Johnston 1998). Furthermore, national economic competitiveness, together with its ability to meet social and cultural objectives, rests on the strength of the national knowledge infrastructure and the strength of the connections between its various components (Johnston 1998). The generation and application of relevant knowledge therefore needs to be recognized as a central economic activity and not just an organizational improvement initiative.

Despite the growing acceptance of corporate knowledge as the most important factor of production for the 21st century, few organizations have mastered the principles of evaluating their KM initiatives and the relevant metrics involved. From a poll of eighty large organizations for example, Stewart (1998) established that whilst 80 percent of managers believed that managing organizational knowledge should be an important part of business, only 15 percent believed that they did it well, with one of their main admissions of weakness being their perceived lack of ability to measure the effectiveness of their knowledge based initiatives.

There are many related concepts that need to be understood and considered before any benefits can be realized from investments in knowledge related initiatives. These concepts are discussed in the Theoretical Context Overview in Chapter 2. Having established the relevance and importance of KM to organizational success, the next section looks at the viability of KM as a subject for a research thesis.

1.2 Viability of KM as a Research Topic

The management of knowledge at the organizational level has been regarded by some authors as a flawed concept (Draper, 1999; Kidman, 1999). Prusak, (1999) also acknowledges that “knowledge management” is a misnomer in the sense that we cannot really manage knowledge any more than we can manage the forces of nature, but he accepts the term as a de facto label for this nascent field of organizational endeavour.

Whilst the term is not immediately nor widely understood in management or information systems parlance, KM has become an acceptable and mature concept in its own right (Kidman 1999) and an important management discipline and business process (Caldwell and Harris 2002). The Gartner Group, furthermore, believes that KM will emerge from its “Trough of Disillusionment” in 2002 and be acknowledged as a required business process for most enterprises (Caldwell and Harris 2002).

Schultze (1999) adds that the management of knowledge is an important research topic in a number of academic disciplines, including management, strategy and information systems. Teece (1998) agrees that KM requires considerable scholarly enquiry and adds (p289) the warning that:

“there is a real danger that KM will become discredited if it proceeds in ignorance of extant literatures thereby creating unnecessary intellectual clutter and confusion”.

Teece further adds that the economics and evaluation systems for knowledge need to be better understood and that empirical evidence of the value of KM is urgently needed. The need for research into KM evaluation and measurement models is supported by Lalor & Okkerse, (1998: p6), who believe that:

“The results of KM must be measured and recorded. The results may be evaluated as things like improved client service and satisfaction or shorter time to market with new products and services. Evaluation will help monitor the value of, and justify the investment in, KM initiatives”.

Whilst acknowledging the challenges presented by the “fuzziness” of this topic, the above issues provide justification for empirical research into what organizations internationally have done in relation to assessing the viability of their knowledge oriented activities and KM initiatives.

It is now necessary to look more closely at why the evaluation and measurement of knowledge related initiatives is so important.

1.3 Significance of KM Evaluation

Being elusive and not easily defined, knowledge is very difficult to measure and indeed becomes increasingly more difficult to measure as we consider the transition of knowledge between the progressively more complex levels of the individual, team, department, organization, industry and nation. This leads to multiple dimensions of knowledge that demand different evaluation models² depending on the nature of the entity, the context of the knowledge being applied within it and with its external stakeholders and the level at which the evaluation is being conducted.

² Evaluation models are assumed to include relevant approaches, frameworks, methodologies, systems, procedures and practices involved in the evaluation process.

Dawson (2000) maintains that the value of knowledge is entirely dependent on the context in which it is made available. For knowledge to be valuable to an organization, the organization must be in a position to act on it, and the profitability of the resulting action will then provide an indication of its value (Dawson 2000). The process of KM evaluation therefore needs to encompass far more than just an attempt to measure knowledge as an asset, it also needs to measure the propensity and capacity to act on the knowledge acquired or generated and the ability of an organization or nation to develop a knowledge creating culture.

The growing importance of knowledge to business success has been accompanied by the need to place a value on the anticipated benefits to be derived from investment in KM related initiatives. Claims of significant business benefits resulting from such investments include:

- Andersen Consulting who claimed that their firm saved millions a year in FedEx bills alone by using Intranet and other knowledge sharing tools (Stewart 1995).
- Olson (1999), who reported that:
 - Texas Instruments avoided spending \$500M on a new silicon fabrication facility by leveraging internal knowledge of best practice in its existing plants;
 - Booz Allen & Hamilton claimed savings of \$21.3M over three years by using KM to better deploy its professional services staff;
 - Skandia Insurance was able to set up its office in Mexico in six months using previously acquired and documented knowledge whereas previously it had expected this task to take seven years.

These and other claimed success stories only provide possible indicators, as opposed to sound evidence, that implementation of a KM philosophy can result in significant benefits to the organization. No evidence was provided in these cases to show precisely how or to what extent the claimed successes in cost and time savings resulted directly from KM investments, rather than from some other business or environmental factors. Swanborg and Myers (1997) believe that whilst KM has become a major business trend, the efforts and claimed successes of early adopters have been both distorted and made so generic that the relationship between KM initiatives and the benefits purported to result from them are little more than assumptions. This adds weight to the need for this type of research to provide an understanding of the nature and extent of this relationship.

Developing this relationship requires an understanding of the knowledge creation process. Since the process of creating knowledge is dynamic in nature, it makes more sense to think in terms of developing capabilities in these areas rather than attempting to manage knowledge per se (Dawson 2000). Dawson also recognizes the need to consider the individual and organizational perspectives in developing knowledge creation and management capabilities. Attempting to value knowledge as an object or physical asset, which appears to have been the predominant evaluation approach to date, is a narrow view that does not embrace the full potential of the KM concept. Without considering the effects on the knowledge accumulated in the heads of employees, suppliers, customers and other organizational stakeholders, all other performance indicators remain incomplete and inadequate for judging the capabilities of an organization (Strassmann 1996).

Improvement in the amount and value of IC is seen as an identifiable benefit resulting from the KM process. Models for the evaluation of IC are emerging (Edvinsson & Malone 1997; Sveiby 1997; Stewart 1998; Liebowitz & Wright 1999), but do not appear to have been formalised in Accounting standards and appear to be a long way from becoming generally accepted business practice. Many of these models attempt to quantify the value of knowledge as an intellectual asset but generally do not identify the full range of organizational benefits that may result from the effective creation, use, dissemination, sharing and management of corporate knowledge. While the appraisal of knowledge assets is an important component of evaluating the effectiveness of KM initiatives, it is only part of the total KM evaluation process and many other issues need to be addressed to provide a comprehensive understanding of the evolving nature and characteristics of models that attempt to evaluate the success of these initiatives. (Nonaka 1991) p98 provided the following perspective on measurement of KM:

“In most companies the ultimate test for measuring the value of new knowledge is economic - increased efficiency, lower costs, improved ROI etc. But in the knowledge creating company, other more qualitative factors are equally important. Does the idea embody the company's vision? Is it an expression of top management's aspirations and strategic goals? Does it have the potential to build the company's organizational knowledge network?”

As some of the benefits of KM can only be measured in qualitative terms, this study will take a broad perspective in the investigation of both the quantitative and qualitative factors involved in the evaluation of KM.

Sullivan (1999) maintains that only 2-3 dozen firms in the world are systematically extracting value from their corporate knowledge. Despite the steady growth in interest

in the subject of KM, the lack of hard data to support its worth is believed to be restricting its further development (Hilderbrand 1999; Nasser 1996). Furthermore, the success rate for KM projects, on the basis of achieving their original objectives, appears over recent years, to be fairly poor, with only half of the companies with a KM initiative achieving their stated objectives (KPMG 1998). This is a poor indictment on the ability of organizations to effectively manage knowledge oriented initiatives. It is suggested that the lack of understanding of the organizational factors affecting the evaluation of KM initiatives may be contributing to the poor success rate of KM oriented projects.

Many organizations (even large organizations in developed nations) are still reluctant to embrace the concepts of KM and its evaluation in any form. Apart from the lack of legal mandate for organizations to report on intangible assets, the reasons appear to be a combination of it being too difficult (Wallman 1999), and too subjective (Gold et al. 2001). According to Abramson (1998), the young field of KM lacks the sophisticated tools to evaluate such an “esoteric endeavour” and the impossibility of evaluating KM has been suggested by some as being “conventional wisdom”. Another possible reason for the limited credibility of KM evaluation models is that many of these models attempt to measure the wrong things (Guptara 1999) and may therefore send the wrong message to internal and external stakeholders. KM demands a rigorous regime of measuring the right volume of the right things otherwise the evaluation system becomes unmanageable and the results meaningless or unintelligible by those who need to take action from them.

Despite the problems of execution and methodology, there seems to be general agreement that measuring the return on investment from knowledge initiatives is highly desirable as subjective measures used to-date have been described as inadequate (Abramson 1998). Hilderbrand (1999), uses Teltech Resource Network Corporation as an example of an organization that has developed a methodology that appears to defy the “conventional wisdom” that the impact of knowledge based initiatives on organizations cannot be measured. Other organizations such as Skandia, the World Bank (Blumentritt and Johnston 1999), Dow Chemical (IFAC 1998) and Eli Lilly (Perez and Hynes 1999) have also developed workable models which, at the very least, suggests that this exercise is not impossible. However, many models developed to date appear to be less than comprehensive and poorly focussed. Edvinsson & Malone (1997: p124) for example, quote the OECD in their claim that:

“for all the importance of the knowledge and skills of all workers as factors in performance, the means for measuring them are remarkably crude”.

And on a national perspective, Edvinsson & Malone warn (p8) that:

“an economy that cannot properly measure its value, cannot accurately distribute its resources nor reward its citizens”.

Managing and measuring the intellectual component of an entire economy is becoming increasingly critical in the public sector as government authorities are being subjected to increasing public scrutiny and pressure to achieve equitable resource distribution. Accepting the axiom that it is difficult to manage what cannot be measured, evaluation models are necessary to ensure that the knowledge infrastructure, both nationally and organizationally, can be and is, effectively managed.

Whilst KM has its roots in a number of information technology related disciplines such as Information Systems and Information Management (Swan et al. 1999), the Accounting profession is also an interested stakeholder in the concept by virtue of its concern with measuring and reporting IC. The International Federation of Accountants reports that top executives of Canadian Financial Post 300 firms and US Fortune 500 firms view knowledge resources as critical for their success (IFAC 1998). Much of this interest by the Accounting profession in non-financial measures stems from the inability of current accounting systems to cope with the variety and complexity of new key performance indicators needed for business survival in an increasingly competitive global market place (Fisher 1992) driven by information and knowledge rather than the more traditional factors of production of land, labour and money.

Because of the importance of corporate values and philosophy in the management processes of many successful companies, the emphasis on the tangible, explicit aspects of knowledge³ that characterize most knowledge management projects is unlikely to provide much value and may be at worst, a diversion from where and how companies should be focusing their attentions (Pfeffer and Sutton 1999). It is necessary to understand why knowledge is being collected and why it is of value, otherwise it soon becomes dormant and not likely to contribute to organizational wealth.

By understanding the factors for evaluating the impact of KM, organizations will be in a better position to make informed decisions about what to measure and how to conduct such evaluations. This process of evaluation facilitates a deeper understanding of the interaction between the technology and the underlying organizational processes within a particular organizational context and facilitates a dialectic process which will generate

³ See definitions Section 2.4.

motivation, commitment and knowledge (Serafeimidis and Smithson 1997). This provides the essence of this research study.

The next section defines the research questions that provide the focus for this thesis.

1.4 Research Questions

The main research questions to be dealt with by this study are:

- *What are organizations measuring when evaluating knowledge management and its related initiatives?*
- *What are the factors impacting what is being measured under the label of KM evaluation?*

These questions seek to develop an understanding of precisely what organizations are measuring within the context of KM evaluation and what impacts the KM measurement models used by organizations. By using sophisticated computer based qualitative data analysis tools to examine the contents of selected papers from quality business and scientific journals that deal (exclusively or otherwise) with KM and closely related concepts over the past decade, significant insights were also gained into the following questions:

- *What trends have emerged in the development of KM evaluation?*
- *To what extent are the practices of KM evaluation different between the major international regions of North America, Europe, UK, Scandinavia, Japan and Australia?*
- *What are the factors inhibiting the development and acceptance of KM evaluation?*
- *What are the lessons to be learnt from the adopters of KM evaluation between 1996 and 2002?*

The next section looks at the potential outcomes and benefits that will ensue from the analysis of the research questions outlined above.

1.5 Outcomes and Benefits

The specific outcomes expected from this research project include:

- The generation of an understanding of the KM and IC evaluation models and processes that has developed since the early nineties. In each organization covered in the literature, precisely what has been measured will be analysed and discussed.

- Categorisation of the main types of measures that have been used and an indication of relative frequencies of use of the various measurement models used by organizations over the history of KM between 1996 and 2002. This historical perspective will provide an indication of whether evaluation models are converging or diverging in terms of evaluation methods and will provide a springboard for further research projects.
- A comparison of evaluation methods used by organizations in different geographic regions identifying the different approaches used by different countries which in turn are expected to offer some explanations as to why different styles and approaches to KM measurement have evolved in different regions.
- On the basis of the results achieved from data analysis, shortcomings in previous KM evaluation models will be identified and strategies for moving forward will be offered.
- A high level framework for KM evaluation will be developed to provide a platform for the future development of KM evaluation.

As pointed out by Malone (1999), there are significant social, as well as organizational benefits to be gained from this type of study. If better information on intellectual assets can be presented, capital and resources will be better allocated in the economy, representing a significant social benefit. Better information to investors reduces risk and thus reduces the cost of capital which is another clear social benefit (Wallman 1999). At the organizational level, understanding the evaluation of KM and IC will make companies more efficient and competitive and ultimately more valuable (Malone 1999). Malone (1999:p42), recognizing the connection between KM and IC⁴, also claims that:

“IC is not confined to business, it is likely to be the first universal evaluation tool for all human institutions through which we will be able to construct a more valuable society and is our best hope for continued prosperity; learning how to evaluate it is the only path to getting there”.

This research project will provide a significant step in this learning process.

⁴ Discussed further in 2.6.

Results from this research will provide KM practitioners, consultants and academics insights into KM evaluation which in turn will lead to a better understanding of the context within which KM evaluation should be used to enhance organizational learning and performance. The generation of a means of classification of KM evaluation models as a by-product of this study will also help public and private organizations in deciding which models are applicable to their particular circumstances and their individual approaches to knowledge and KM. The results of this research could also be instrumental in improving the success rate of KM initiatives.

1.6 Summary

The management of organizational knowledge has developed since the early nineties into a critical organizational improvement activity. Proving the organizational value of KM has become one of the major issues and challenges for management in the implementation of a KM philosophy.

The KM concept has gained significant acceptance since the early nineties but its further development is being hampered by a poor understanding of KM as a management process and the evaluation models associated with it. Complicating the KM evaluation process are the relationships between KM and other activities such as the management of Intellectual Capital (IC) and the Organizational Learning (OL) process.

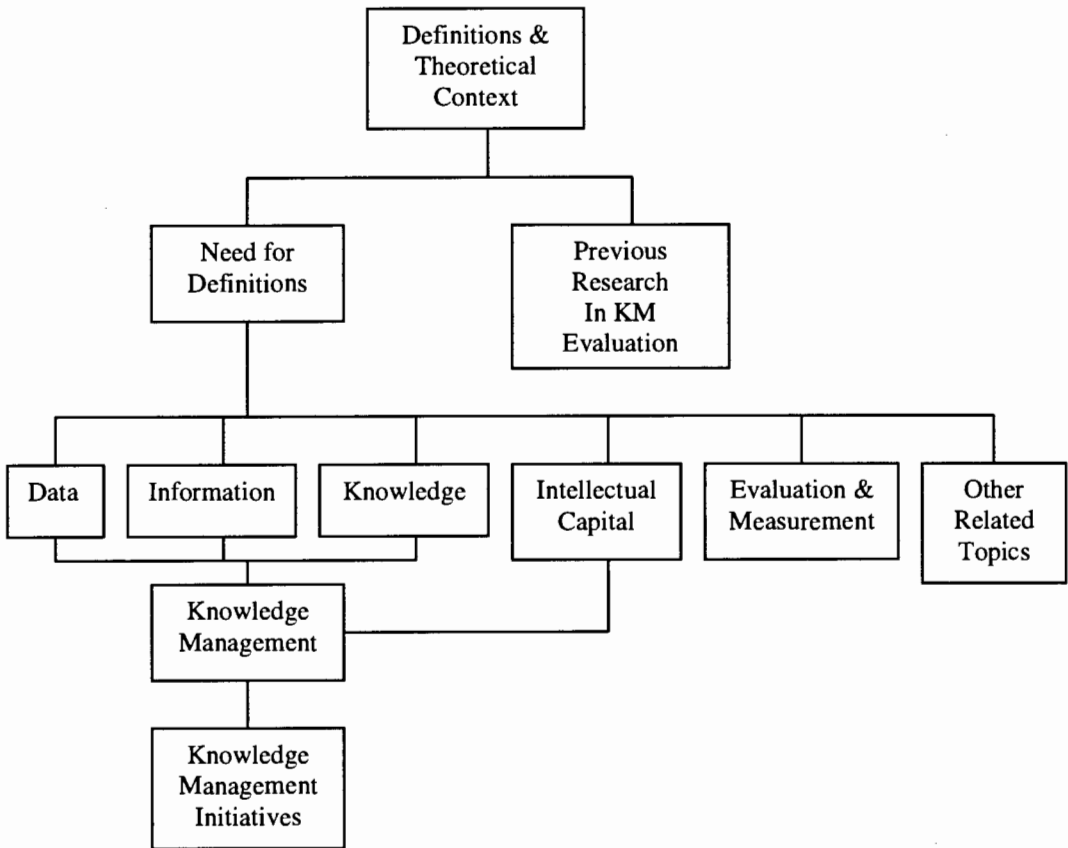
This study responds to the demand for more research into the evaluation of knowledge in the organizational context by examining the relevant literature on KM and associated organizational improvement activities over the entire history of KM. Research questions focus on the evaluation models and methods that organizations have used over the short history of KM to assess the value of knowledge itself and projects under a variety of titles that have purported to manage organizational knowledge in whatever form. Benefits will result from the study in regard to the development of such models and the distillation of meta-data into a generic framework for the development of KM evaluation models.

The following chapter defines the necessary terms that have been associated with KM and explains the meanings and relationships between the major concepts.

2. Definitions and Theoretical Context

This chapter clarifies the terms used throughout this thesis and explains the components and principles of KM, IC and other related disciplines. The need for definitions is discussed prior to developing the continuum from data through information and various perspectives of knowledge. The concepts of KM and IC are then explained and how they interrelate. Other topics connected in a variety of ways with KM and IC are then briefly introduced and their relationships to KM and IC explained.

The Chapter structure is as follows:



2.1 The Need for Definitions

Prior to the emergence of knowledge as something separate and distinct from data and information, it was commonly accepted that information was derived from data and that information is generally more valuable and useful than data in managerial decision making. It was not until interest started to be taken in knowledge as something conceptually different to data and information that the distinction between the three terms started to become confused, resulting in increasing demands for clarification. Allee (1997) suggests that the need to sort out what is useful and relevant has caused people to grapple with the definitions of information and knowledge and the

relationship between them. Davenport (1997: p9) whilst not making any distinction between the three terms himself, concedes that:

“defining these terms can show where a company has focused its IT energy, where the data it generates has a real use, whether the assumptions for structuring information make sense and if any of it has paid off”.

This is an indication that KM in its early stages of development was closely aligned with IT which in itself may have contributed to some of the confusion. Consulting firms and software vendors for example, have incorrectly used the terms data, information and knowledge to describe the nature of their products and to gain financial advantage from the emerging interest in the KM concept. Davenport (1997) asserts that misuse or non-use of information, wasted investment and poor use of information technology has resulted from a lack of understanding of the basics of data, information and knowledge. This was later backed up by Davenport and Prusak (1998: p1) with the claim that:

“we can understand knowledge best when we have a good understanding of data and information. Understanding what these things are and how to get from one to another is essential to doing knowledge work successfully”.

A clear understanding of these terms is therefore necessary in order for a meaningful analysis of KM evaluation to be conducted.

2.2 Data

Davenport (1997: p9) defines data as “observations of states of the world”. Examples could be the number of items of stock in a warehouse, temperatures, pressures and dollar values of transactions. Davenport and Prusak (1998: p2), define data a little more specifically as “a set of discrete, objective facts about events”.

Data is easy to capture, communicate and store, can be managed efficiently and effectively by technology, does not require analysis, exists in its own quantifiable form and generally does not require any interpretation to understand it. Brabb (1976: p6) makes the connection between data and information in his claim that:

“data are raw facts, that may or may not be information since they are the raw material from which information is created”.

Davenport (1997: p9) makes another important observation about data by stating that “People turn data into information”. This doesn't define data but connects people to data and information. The human element in data and information is particularly

important to the subject of knowledge as it suggests that the transition from data to information is initiated and managed by people not machines. Data is normally regarded as just words and numbers but it is important to appreciate that sounds (voice recordings) and images (videotapes, photographs) etc are also important forms of data. Allee (1997: p110) takes this even further with the view that; “we gather data with all our senses, nose, ears, eyes, taste and touch”. The processing of data, once it has been codified, is largely routine, repetitive and mechanical, requiring highly predictable courses of action depending on well established conditions. This makes data processing highly adaptable to computerisation, but the actual conversion of data into information requires human intervention.

Few organizations analyse or understand their data gathering processes. This raises the important question – if organizations cannot even manage their own data effectively, how can they expect to manage their knowledge? Whilst efficient and effective data management is important for all organizations, it is generally a back-office activity and has little to do with decision making, productivity or organizational growth. Thus, although an understanding of the nature of data in relation to information and knowledge is important, evaluation of data is not relevant for the purposes of this study.

2.3 Information

In the last 20 years or so, the definition of information has not changed significantly as evidenced by the following:

“information is communicated knowledge expressed in a form that makes it immediately useful for decision making” (Brabb 1976: p6).

“data that has been organized or prepared in a form that is suitable for decision making” (McFadden and Hoffer 1988: p4).

"information refers to a body of facts in a format suitable for decision making or in a context that defines relationships between pieces of data" (Zikmund 1997: p131).

All three definitions above make the connection between information and decision making and it is interesting to note that the definition from Brabb in 1976 included a reference to "knowledge" as a special type of information. The more common view of a transition or continuum from data to information then to knowledge is used for this study and is explained further in 2.4.1.

A commonly quoted definition of information by Drucker (1998:p5) is that “Information is data endowed with relevance and purpose”. Davenport and Prusak

(1998) liken information to a "message" which can be in the form of a document or some other form of visible or audible communication. In regard to information, it is generally implied that it is explicit and documented in a form that can be read or analysed by humans. Data and information are often interchanged and incorrectly used terms, and in many cases, the subjects of Information Management and Management Information Systems refer to data not information (see further discussion in 2.5).

Davenport (1997: p9), advises that: "unlike data, information requires some unit of analysis". As previously stated, only people not computers convert data into information because this requires an appreciation of the context of the data and information and why the conversion is necessary. When humans however have made the conversion, Information Technology can take over again to manage, communicate, store and disseminate this new information in the same way that it processes data. From a computer's perspective, data is no different to information. It is the human interpretation that makes words, numbers, images, sounds etc data or information.

The distinction between data and information is however not quite as clear as may have been suggested up to this point. McFadden and Hoffer (1988: p31), for example maintain that:

"the distinction between data and information is often difficult to maintain. Data becomes information when used in the context of making a specific decision or when applied to the solution of a particular problem".

McFadden and Hoffer (1988) thus believe that the definition depends on how the data (or information) is used rather than on their inherent properties. In other words, data can be data or information depending on how and where it is used. This may have led to the overuse of the interchangeability of the two terms to a large extent. Stewart (1998: p69) takes this one step further by suggesting that "one man's knowledge is another man's data". Context is thus important in the definitions of data, information and knowledge.

The distinction between data, information and knowledge becomes particularly important when it becomes necessary to assess the respective contributions of these "assets" to organizations and when it is necessary to design systems that deal with their relative differences in complexity. There is still much confusion about the distinction between high level information and explicit knowledge. This is explained more fully in 2.4.1.

It is generally accepted that information is more valuable than data and that it can be bought and sold like a commodity. Allee (1997: p7) makes an important observation in relation to the valuation of information by claiming that: “a remarkable phenomenon of the knowledge economy is that information has emerged as a product in its own right”. However, as with data, it is the valuation of knowledge not information that is of interest in this study.

2.4 Knowledge

According to Alavi and Leidner (2001:p109):

“a philosophical understanding of the term knowledge was never a determining factor in building the knowledge-based theory of a firm, nor in triggering researcher and practitioner interest in managing organizational knowledge”.

On the basis of this statement, it was determined that a philosophical discourse on knowledge was not necessary for this study. A pragmatic understanding of knowledge is however necessary in the organizational context in order to understand the processes involved in KM. Knowledge will firstly be examined in relation to data and information before looking at knowledge in the broader organizational perspective.

2.4.1 The Data, Information and Knowledge Transition Perspective

Toffler, (1990) and Allee (1997) state that knowledge embraces imagery as well as attitudes, values and other symbolic products of society and that it is embodied in experience, concepts, and beliefs that can be communicated and shared. Davenport and Prusak (1998: p1) maintain that: “knowledge is neither data nor information though it is related to both”, and (p5): “most people have an intuitive sense that knowledge is broader, deeper and richer than data or information”. Although this does not explain the relationship between data, information and knowledge, it establishes the important basis for this study that knowledge is not the same as data or information and therefore evaluation models need to be developed to account for the differences. This is discussed later.

The transitional model depicting a continuum from data to information to knowledge as shown in Figure 1 below, is supported by Davenport and Prusak (1998) who regard knowledge as the next logical stage after information. They concede however, that it may be difficult to note the exact points at which data becomes information and information becomes knowledge.

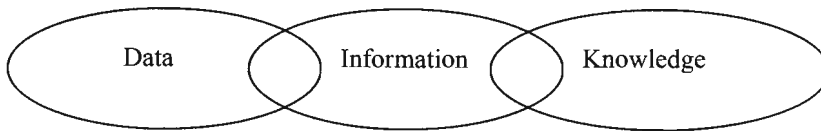


Figure 1: The Data, Information and Knowledge Continuum

Alavi and Leidner (2001) do not support this view and assert that examination of knowledge in a data, information and knowledge continuum rarely survives scrupulous evaluation as knowledge is possessed in the minds of individuals and is thus highly personalised. It is possible however, to adapt this continuum concept to address Alavi & Leidner’s assertion by introducing the distinction between explicit and tacit knowledge. The following diagram, based on the continuum model has been developed to explain the interrelationships.

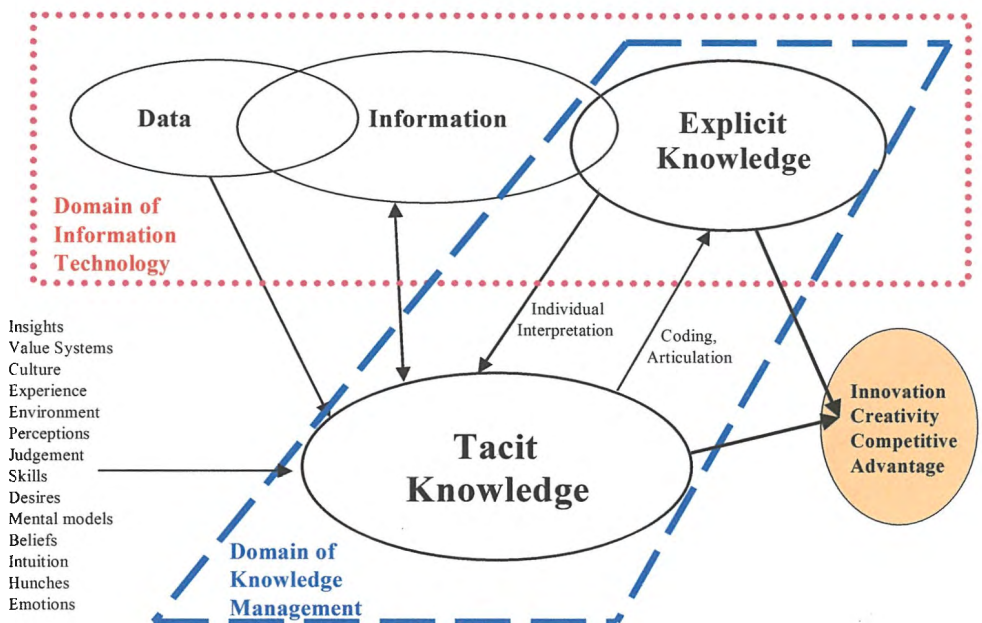


Figure 2: Relationship Between Data, Information and Knowledge

Figure 2 shows the relationship between data, information and knowledge and the intersection of the Information Technology and Knowledge Management domains. It shows that tacit knowledge is required in order to convert data into information and information into explicit knowledge. Some of the inputs to tacit knowledge such as insights, culture, skills and beliefs are shown which are clearly outside the domain of

IT. The diagram further shows that Information Technology alone cannot create knowledge and that the continuous cycle between tacit and explicit knowledge is required for organizational innovation, creativity and competitive advantage to occur. The cycle between explicit and tacit knowledge is further explained in 2.4.2.

Because computers make no distinction between data and information, information sharing may be automated and may even be done totally by machines. Knowledge is intellectually intensive whilst information is Information Technology intensive (Moody and Shanks 1999) meaning that knowledge sharing cannot be automated to the same extent as information (using the broadest meaning of knowledge). Tacit knowledge transfer is not complete until the recipient accepts and understands the new knowledge. The recipient may have a new way of looking at the knowledge acquired and thus, as knowledge is transferred, it evolves into richer contexts. The understanding of this cycle is germane to the principles of KM.

Knowledge has also been seen as the result of learning (McMaster 1996) and can be conveniently grouped into employee knowledge and skills, physical technical systems, managerial systems and values and norms (Leonard 1998). Although the focus of this study is on organizational knowledge, the distinction between personal and organizational knowledge is important in management and measurement contexts. Personal knowledge is the experiences, values, intuitions, perceptions, skills etc possessed by individuals and shown in Figure 2 as factors influencing tacit knowledge. Myers (1996: p2) distinguishes personal from organizational knowledge by explaining that:

“Organizational knowledge is the processed information embedded in routines and processes which enable action”.

Organizational knowledge is thus action oriented and this principle represents a significant contribution to the value of KM. Myers also believes that whilst information can be hoarded, knowledge cannot as it is constantly changing and evolving: if it doesn't evolve it will lose value very quickly and thus to retain its maximum value, knowledge must be shared not hoarded.

2.4.2 Epistemological and Ontological Views of Knowledge

As introduced in 2.4.1, knowledge is commonly referred to and discussed in terms of its explicit and tacit characteristics. Leonard and Sensiper (1990) explained that explicit knowledge is shared through a combination process and becomes tacit through a

process known as internalisation. The cycle continues by tacit knowledge being shared with others through a socialisation process and becomes explicit again through externalisation. They believed that even semi-conscious or unconscious knowledge, that we are not even aware of, is not entirely tacit. This is supported by Alavi and Leidner (2001), who state that tacit and explicit are not dichotomous states of knowledge but mutually dependent and reinforcing qualities of knowledge. Explicit knowledge cannot exist in an organizational context without the tacit knowledge of individuals and teams continuously enhancing it. Furthermore, Nonaka and Takeuchi (1995) maintain that explicit knowledge is only the tip of the knowledge iceberg and that it is tacit knowledge that presents the most important organizational benefits and management challenges.

The inter-relationships between the epistemological and ontological aspects of knowledge (as seen by Nonaka and Takeuchi, 1995) are shown in the following diagram:

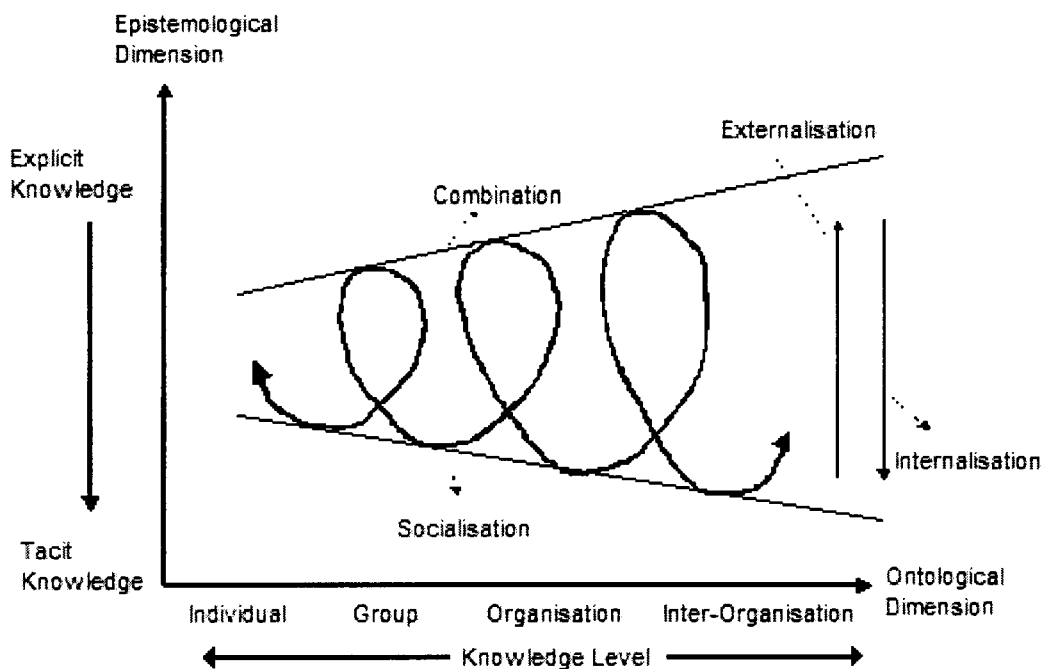


Figure 3: Epistemological vs Ontological Perspectives.

Figure 3 supports the belief of Alavi and Leidner (2001) that tacit and explicit are mutually dependent and reinforcing qualities of knowledge. The diagram shows that it is not only the constant interaction between explicit and tacit knowledge (the epistemological dimension) that leads to the generation of organizational knowledge, it

also requires the continuous interaction between individuals and teams both within and between organizations (the ontological dimension). This spiral does not occur naturally; it usually requires organizational direction and strategic action to ensure that the knowledge generated is the most appropriate knowledge at the right time and is made available to those who need it. These elements need to be measured somehow to ensure that the knowledge generation process is working effectively and in accordance with organizational objectives. Every organization needs to establish what type of knowledge it needs in order to survive and develop. Being able to measure this process and its outcomes will improve the likelihood of an organization achieving its objectives. Knowledge generation also implies the evaluation of the processes and outcomes of the continuous spiral from internalization, socialization, externalization and combination and the evaluation of the development of organizational learning within individual, group, organization and inter-organizational levels.

Previous KM research criticized some organizations for focusing too heavily on the explicit component of knowledge (Fahey & Prusak, 1998; Nonaka 1991). Whilst it is accepted that explicit knowledge is easier to grasp and is more quantifiable, a balance is necessary between how much tacit knowledge needs to be made explicit and what needs to be left in tacit form. This is discussed further in section 2.6.

The spiral described above in Figure 3 encapsulates what has become known as the phenomenon of KM. The next section defines this term more fully for the purposes of this thesis.

2.5 Knowledge Management

As there are a number of different approaches for organizations to view their knowledge, so there are numerous different perspectives as to how to manage that knowledge. KM has been seen by a variety of exponents as a state of mind (Scott 1998), a technique (Webber 1999), a framework or system (ICAA 1998), a process (Keyser 1997), a practice (Dale 1998) or indeed any other organizational endeavour that attempts to manage any form of Intellectual Capital⁵. KM can be seen to be related to the wider field of management in the context of overlapping and synergistic relationships in such activities as learning and innovation, benchmarking and best practice, strategy, culture and performance measurement (Martin 2000).

⁵ Defined in 2.6.

Nissen et al. (2000) and Swan et al. (1999) identified that KM has its roots in a number of information technology systems and principles including Artificial Intelligence, Business Process Reengineering (BPR), Information Systems, Information Management, Expert Systems, Decision Support Systems and Data Mining/Data Warehousing. The legacy of information systems and technology appears to have influenced many organizations to take a technological approach to KM which fails to consider the importance of tacit knowledge and its continuous cycle with explicit knowledge to create organizational value as explained in 2.4.1.

Garner (1999) believes that definitions of KM tend toward the abstract and are, at best, nebulous. Indeed, a standard definition for KM may never be agreed (Hunter 1999; Ives, Torrey et al. 1999) as each individual, team, group and organization will need to develop its own approach to learning, knowledge generation and management that suits its unique culture and nature of operation. The complexity of this task is a major contributing factor to the poor understanding of the KM concept.

One of the first issues that needed to be addressed in this study was to find an appropriate organizationally oriented definition of KM. Swan et al., (1999:p669) define KM as:

“any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organizations”.

This definition fits closely with Alavi and Leidner's (2001) view of knowledge as a process which is the position taken in this study. The expression “wherever it resides” is taken to include tacit as well as explicit knowledge in all its forms. A variety of KM approaches and systems need to be employed in organizations to effectively deal with the diversity of knowledge types and attributes (Alavi and Leidner 2001). This range of approaches and systems will require multiple evaluation methods to assess their contribution to the organization. Measurement as a KM activity must therefore be added to the definition and domain of KM. This point is germane to this thesis and it will be established that the evaluation of the effectiveness of KM initiatives must be built into the KM process in order for the KM initiative itself to achieve its desired benefits.

The objectives of enhancing organizational learning and performance are also important from the point of view of understanding the models that attempt to value these objectives. Sierhuis and Clancey (1997) add that an important aspect of KM is improving an organization's learning capability as well as its propensity. An

organization can only sustain itself if its people act, collaborate, learn and evolve as an entity in action. In accepting this proposition, it can thus be said that the LO and KM disciplines must become mutually self-supporting; one concept simply cannot operate without the other (Loermans 2002). As Allee (1997:p70) put it,

“In order to be a high-performing learning organization, work processes must incorporate conscious and deliberate attention to every aspect of knowledge”.

If the discipline of KM operates in such a way as to improve an organization’s learning capability, it thus improves the capacity of the organization to generate new knowledge and thus systematically expands the knowledge base of the organization. For this cycle to operate effectively and continuously, organizational learning and knowledge generation need to be fully integrated into every mission-critical business process.

It has been established above that information and knowledge are not the same thing and it can therefore also be logically concluded that knowledge management is not the same as Information Management. The inclusion of “knowledge creation” in Swan et al’s definition, is considered to be one of the important characteristics of KM that distinguishes it from the process of Information Management which does not create information. The distinction between IM and KM is explained in the following table adapted from De Long et al. (1997):

Knowledge Management Project	Information Management Project
Goals emphasize value-added for users	Goals emphasize delivery and accessibility of information
Supports operational improvement and innovation	Supports existing operations
Adds value to content by filtering, synthesizing, interpreting and pruning content	Delivers available content with little value added
Usually requires ongoing user contributions and feedback	Emphasis on one-way transfer of information
Balanced focus on technology and culture issues in creating impacts	Heavy technology focus
Variance in inputs to system precludes automating capture process	Assumes information capture can be automated

Table 2: KM vs IM Projects

From the above table, it becomes reasonable to conclude that IM systems cannot manage knowledge and that measures for IM projects will therefore not be appropriate for evaluating KM projects. Indeed, the different measures required for knowledge oriented projects may be alien to the traditional measures used by the developers of IM systems. The need for a combination of technical and human elements is something information management projects have in common with KM projects, but in KM projects, it has been found that the complexity of human factors to be managed is much

greater than for data or information management projects (Davenport et al. 1997). The human element in KM will become increasingly apparent in subsequent chapters.

It is believed that attempting to formalise or compartmentalise KM as a discrete management discipline will restrict the analysis and richness of what is a critical concept for organizational survival and growth. From this point on therefore, Swan et al's definition of KM will be used in its broadest possible generic context as the management of knowledge at any organizational level and not with any suggestion of the concept being a formal definitive discipline.

This study will demonstrate that the approach taken by organizations to knowledge and its management will directly impact the measurement models that are used to evaluate the organizational impact of their KM initiatives⁶. One of the most commonly quoted concepts associated with the evaluation of KM is Intellectual Capital.

2.6 Intellectual Capital

In 1993 Leif Edvinsson, in a supplement to Skandia's annual financial report, used for the first time the term "intellectual capital" instead of the more common accounting term "intangible assets" (Brennan and Connell 2000). Intellectual Capital is more encompassing than the traditional view of intangible assets and its definition is important in order to understand the scope and context of KM. Stewart (1998:p67) offers a view of IC as:

“intellectual material that has been formalised, captured and leveraged to produce a higher-valued asset”.

Stewart's definition includes the sum of an organization's patents, processes, employees' skills, experience, technologies and information about customers and suppliers and as such applies in different ways to different organizations. This definition of IC covers elements of explicit (patents etc) and tacit knowledge (skills, experience etc) which suggest an inextricable link between IC and KM. Duffy (2002) believes that the ultimate objective of managing knowledge is to capitalise on IC specifically to encourage knowledge transfer and support knowledge sharing and re-use. Another view of the synergy between KM and IC is that KM, as a business process, administers the IC of the company just as the discipline of managerial accounting tracks the financial investments (Geisler 1999).

⁶ Defined in 2.7.

Skandia has been conducting evaluations of its IC since about 1993; its IC report contains 91 different measures (Edvinsson and Malone 1997). Even pioneers in this field like Skandia however, do not suggest that this evaluation process is a simple exercise. According to Edvinsson and Malone (1997), Skandia takes the view that IC evaluation needs to deal with subjective and even irrational factors, some of which resist any attempt to translate them into empirical measures.

IC can be broken up into components in a number of different ways. The four components of IC as proposed by Brooking, (1998) are:

Intellectual Property

patents, copyrights, trade-marks, design rights etc

Internal Infrastructure

technologies, methodologies, processes, culture, structure, databases, information and communication systems, rules, policies, management philosophy etc.

External Market

brands, reputation, customer loyalty, repeat business, backlogged orders, distribution channels, contracts, agreements, licenses, franchises, business partnerships and alignments etc.

Human Assets

individual know-how, collective expertise, creative problem solving and decision making, capability, leadership, entrepreneurial and managerial skills, education, work related competencies, innovativeness etc.

Intellectual Property, Internal Infrastructure and External Market are comprised almost entirely of explicit intellectual material (that is documented or recorded in one form or another), although there may be some tacit elements in these components. Human Assets on the other hand are almost entirely tacit. It is also worth noting that whilst Intellectual Property, Internal Infrastructure and Market assets are owned or controlled by the organization, human assets are not, and can permanently walk out the door of an organization at any time.

A pervasive assumption made in many existing IC measurement models is that knowledge must be made explicit before it can be effectively valued. Supporters of this

codification approach, such as Andersen Consulting and Ernst & Young, believe that a formative goal in measuring IC is to identify tacit knowledge and to make it as explicit as possible (Kanter 1999). This codification model has been underpinned by the assumption that tacit knowledge cannot be measured and therefore must be converted into something that can be measured. This argument is not sustainable as it is simply not possible to convert all tacit knowledge into explicit knowledge (Sveiby 1994). This approach also suffers from the fact that as soon as tacit knowledge becomes explicit, it generally becomes more available (perhaps even into the public domain) which potentially reduces its value. Apart from losing value, Alavi and Leidner (2001) maintain that attempting to make all knowledge explicit may result in a rigidity and inflexibility which would impede rather than improve organizational performance.

An opposing view to the codification approach is used by Bain, Boston Consulting Group and McKinsey's who use a personalisation approach that focuses more on tacit dialogue than documentation (Hansen, Nohria et al. 1999). Whilst it may be tempting because of potential loss of value to leave all knowledge in the tacit domain from where it originated, the organization then runs the risk of losing it completely if the tacit knowledge owner leaves the organization. A balance is therefore necessary between what is made explicit and what can prudently be left in tacit form and this balance is likely to be unique for each and every organization.

Intangibles such as knowledge stocks and flows, knowledge distribution and the relationship between the creation of knowledge and economic growth are still largely unmapped (Amidon 1998) and as a result, IC models are struggling to provide a complete and reliable evaluation system of knowledge contribution to organizational performance and learning. Existing models and projects seem to focus too heavily on the *quantity* of knowledge rather than what the sharing of relevant knowledge can do for the organization (Pfeffer and Sutton 1999). Davenport added that trying to track the growing value of knowledge as it moves through the organization is not currently possible but the business results of knowledge can be measured. As Allee (1997:p10) puts it:

“more knowledge does not necessarily mean more value to the organization, it must be effectively shared in order for it to multiply – that is the economic reality of the knowledge society”.

A corporate strategy perspective of IC focuses on four corporate knowledge phases beginning with its acquisition, accumulation, transformation, and ending with its valuation (Carroll and Tansey 2000). IC is best conceived as the knowledge and creativity available to a firm to implement a business strategy that maximizes

stakeholder value. This broad definition includes any benefits that can accrue to a firm along the value chain from applying knowledge and creativity (Carroll and Tansey 2000).

The measurement of IC is most frequently discussed in an accounting domain and as such, will need some form of standards to be established if valuing intangible assets (including knowledge in whatever form) becomes compulsory for public reporting purposes. IC measures have been reported to be incompatible with current historical cost based accounting systems. From an accounting perspective, IC as an asset can be seen as either the result of a knowledge transformation process or the knowledge itself (IFAC 1998). KM or the management of knowledge on the other hand is a process or capability that will be unique for each and every organization (IFAC 1998) and will not lend itself to be subject to a high degree of standardisation. Advocates of wholesale changes to the current accounting system to cater for its treatment of knowledge assets include: Davenport and Prusak (1998); Amidon (1998); Edvinsson and Malone (1997); IFAC (1998); Teece (1998); and Miles et al. (1998).

Whilst it is unlikely that IC measurement will replace traditional accounting practices in the foreseeable future, it is reasonable to expect IC measures to be presented as a supplement to existing financial reports. As a supplement however, it is not likely to receive the level of credibility it deserves. There is also a pervasive tendency to measure what is easiest to measure rather than what is important (Serafeimidis and Smithson 1997) and this could adversely impact the reliability of and confidence in IC reports. Furthermore, whether as a supplement or a stand-alone report in its own right, the IC report needs industry and professional mandates before it is likely to become standard practice. Implementation of IC measures in financial reporting is thus likely to be slow and somewhat less than consistently applied.

The relationship between KM and IC and total organizational capital is shown in the following diagram which depicts the market value of a firm consisting of financial and intellectual capital. The components of IC are similar to the breakup proposed by Brooking (1998) earlier in this section and represent the domain of influence of KM.

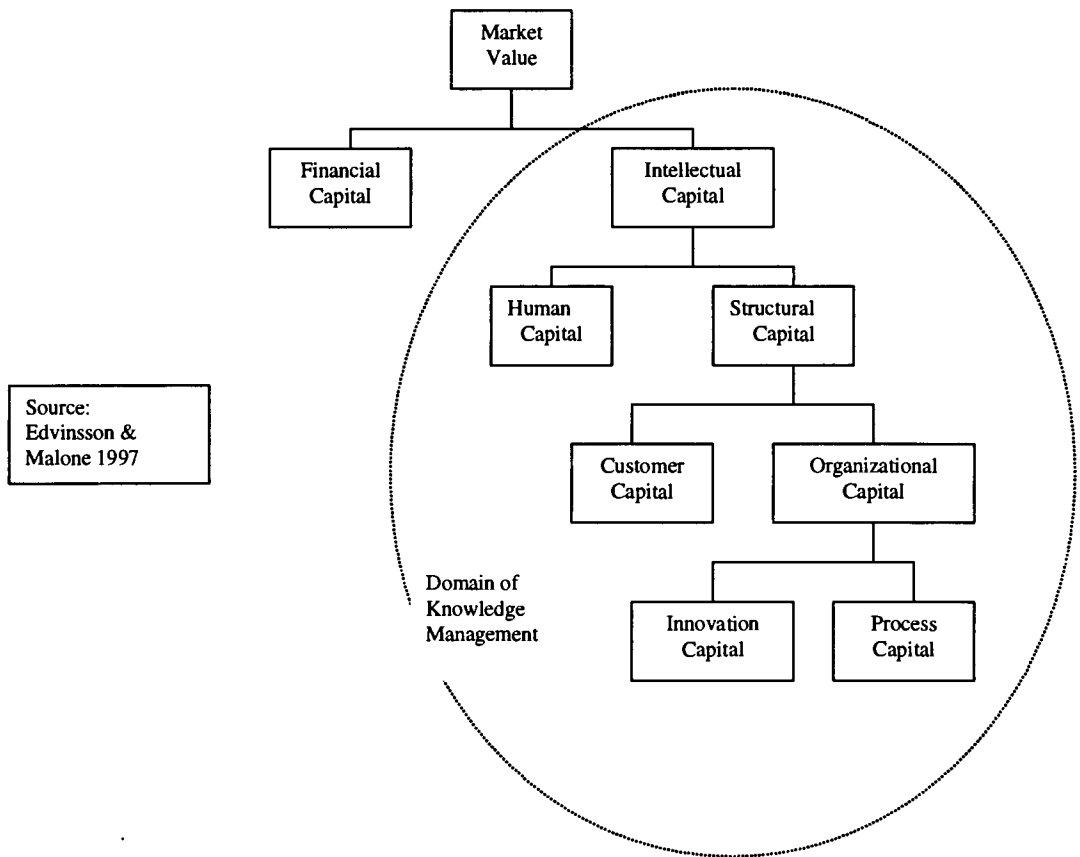


Figure 4: Components of IC and KM in relation to total Market Value

It is necessary to make a clear distinction between IC management (ICM) and KM. From Brooking's components, it can be seen that the management of IC is more than just the management of the traditional accounting perspective of intangible assets or Intellectual Property. ICM has been described as the leveraging of human, internal and external structural capital in combination (Edvinsson and Malone 1997). Another view is that ICM is the organizational process that manages the intangible assets and provides the mechanisms by which these assets can be measured and recorded in the books of the enterprise. This is the essence that distinguishes ICM from KM. From the point of view of this thesis then, KM is the more relevant focus for this study because it is a broader concept that deals with the processes of enhancing organizational performance and learning rather than just a leveraging and measurement mechanism, which is still important but not the only consideration. KM is therefore assumed to encompass the principles of ICM.

2.7 Knowledge Management Initiatives

Not all attempts to evaluate KM will involve a definitive project or program. Evaluation of knowledge whether at individual, team or organization level, may be an on-going activity and not necessarily related to a specific initiative. Most evaluation efforts

however are expected to involve the evaluation of a designated project of some kind. The term “Knowledge Management Initiative” (KMI) is taken to mean any system, project, program or any other formal organizational process that satisfies Swan et al’s definition of KM discussed in 2.5. Within Swan et al’s definition of KM, KMIs are taken here to include any organizational improvement activity designed to enhance business performance or learning that involves the leverage of corporate knowledge in one form or another. Examples include the evaluation of product innovation strategies, competence, continuous improvement and training programs connected with KM⁷. This includes initiatives designed specifically to increase the value of IC. The view taken in this study is that many organizational improvement initiatives may satisfy the definition of KM but may not have been specifically labelled as KM or knowledge oriented initiatives.

According to De Long, et al (1997), the majority of KMIs are undertaken at the Business Unit, functional or operational process level where they have the most immediate impact on performance and tend to focus on objectives such as reducing cycle times and costs, more efficiently using knowledge assets, enhancing functional effectiveness, increasing organizational adaptability, increasing value of existing products and services and creating new knowledge intensive products, processes and services. Hilderbrand (1999) categorises KMI objectives into: generating revenue (45%), containing costs (35%), enhancing customer service (10%), improving quality (6%) and refining internal processes (4%). In other words Hilderbrand believes that 80% of such projects focus only on improving financial returns. Indeed, existing knowledge oriented projects seem to focus heavily on the quantity of information and knowledge rather than on what the sharing of relevant knowledge can do for the organization. Neef & Davenport, (1997), found that many KMIs focused on the storage and distribution of large quantities of explicit knowledge but few projects tackled the essential tasks of developing user enthusiasm, giving users and providers more time to exchange knowledge and developing meta-knowledge that can help guide its effective management. Most KMIs have a strong technological focus, but De Long et al., (1997) and Alavi & Leidner (2001) found that more frequently, it is cultural and human factors that differentiate KMI successes from failures.

2.8 Evaluation and Measurement

The term “evaluation” is taken to include measurement, appraisal, assessment of value or amount of, or justification for, KM or IC improvement initiatives. The process of

⁷ see section 2.9 for more detailed coverage of these topics

evaluation may be purely subjective and thus may not involve the measurement of a specific KM element or factor. Unless a specific type of evaluation is intended to be expressed in the ensuing text, the use of the term “evaluation” will mean any or all of these elements.

The reason for the use of the terms “evaluate” as well as “measure” in the selection criteria for relevant articles (see section 3.5) is that measurement is an objective and functionalist view whilst evaluation is broader and more subjective, thus providing a pluralistic platform for analysis. The combination of the terms “evaluation” and “measurement” in the selection criteria resulted in the extraction of a broader and richer range of material than would have otherwise occurred.

2.9 Other Related Topics

Schultze and Leidner (2002) overcame a limitation in their research of ambiguous definition of KM by including “organizational learning” and “memory” into their selection criteria for KM related articles. This study goes one step further by extending the nomenclature into a number of other topics that have been connected one way or another with KM. The following table shows the topics related to KM in addition to those used by Schultze and Leidner.

Concept	Source
Innovation	Edvinsson and Freij 1999
Organizational learning	Senge 1990; Schultze & Leidner 2002
Competence & capability	Allee 1997
Information and knowledge creation, sharing and transfer	Schultze 1999
Quality	Huang, Lee et al. 1999
Organizational memory	Schultze 1999
Continuous improvement	Argyris 1998
Collaborative work	Schultze 1999
Communities of practice	Wenger and Snyder 2000

Table 3: KM Related Concepts

The relationship between each of these concepts and KM is briefly explained below.

2.9.1 Innovation

Edvinsson & Malone (1997) quote Drucker in claiming that every organization needs innovation as its one core competency and every organization needs IC management as a way to record or appraise its innovative performance. The most established and still

the most commonly used indicators of innovation are technology-based, including capital expenditure, expenditures on research and development (R&D) and patent activity (Tidd and Driver 2001). Many traditional accounting and finance indicators concentrate on short-term measures of profitability that tend to undervalue innovation. Measures based on value-added, market to book value and the price to earnings multiple have been found to be better indicators of innovation (Tidd and Driver 2001). Tidd and Driver established that there is a demand for measures to be developed of the efficiency and effectiveness of the innovation process; efficiency in the sense of how well companies translate technological and commercial inputs into new products, processes and services; and effectiveness in the sense of how successful such innovations are in the market and their contribution to financial performance (Tidd and Driver 2001). KM clearly has a major role in this innovation initiative which in turn improves the value of IC and enhances bottom-line results.

2.9.2 Organizational Learning Culture

Despite Swan et al's prediction of KM taking over the mantle of Organizational Learning (OL), the concept of the Learning Organization (LO) is still relevant to 21st century management because of the increasing complexity, uncertainty and rapidity of change of the organizational environment (Malhotra 1996). Cultures that value and provide opportunities for communicating tacit knowledge appear to be rare in contemporary organizations. Such cultures are most frequently pursued under the banner of Organizational Learning at firms like AT&T, Ford, Intel and EDS, all under the tutelage of Peter Senge's Systems Thinking and Organizational Learning Centre at MIT (Davenport 1997). The understanding of the OL process and its connection with the generation of organizational knowledge is far from clear (Macleod 1999; Gourlay 1999; Schein 1997). This problem was identified even earlier by Nonaka and Takeuchi (1995:p45) who stated that:

“organizational learning theories basically lack the view that knowledge development constitutes learning and most OL theories concentrate on individual learning and have not developed a comprehensive view of learning at an organizational level”.

According to Sandelands (1999) and Amidon (1996), companies that are not able to embrace shared learning and knowledge generation at organizational level simply disappear. Brown and Woodland (1999:p190) add further insight into the need for further study into organizational learning by claiming that:

“it is impossible for an organization to sustain competitive advantage without constantly learning and developing new knowledge”.

The definition of KM from Section 2.5 states that OL is one of its major objectives and thus it becomes necessary to consider the evaluation of the learning process in organizations despite the fact that the devotees of OL rarely relate their goals to the day-to-day management of information or knowledge (Davenport 1997). KM is inextricably linked to OL with the two concepts needing to always be discussed in concert (Loermans 2002). Birkinshaw (2001) believes that the concepts of OL and IC both overlap somewhat with KM.

2.9.3 Competence and Capability

Winter (1998) acknowledges the importance of knowledge and competence in business strategy and indeed in human society and recognizes that different approaches to the management of knowledge and competence assets prevail in different industries. McMaster (1996) connects competence with knowledge by stating that development of core competency strategy is an approach to creating and sharing knowledge and that this practice is becoming more popular. McMaster adds that strategic alignment of organizational and individual competencies is key to success.

Nonaka and Takeuchi (1995:p47) quote Prahalad and Hamel in their definition of core competence as:

“the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies”.

Nonaka and Takeuchi found little difference in the literature between organizational competence and capability and Sveiby (1997) saw competence as a synonym for both the process of knowing and knowledge as an asset and regarded competence as the most important component of intangible assets.

2.9.4 Information and Knowledge Sharing

According to Quinn, et al. (1998), information sharing is critical in the KM context because intellectual assets increase in value with use. This must occur within the organization amongst employees and with sources outside the organization for maximum benefits to be gained. Knowledge sharing is the same concept on a broader scale taking into consideration the tacit/explicit cycle explained in 2.4.2. Just exchanging or transferring information or knowledge is not enough as this alone does not necessarily lead to the information or knowledge being used more effectively. By

sharing however, which involves a feedback loop, amplification and modification, the benefits can become exponential (Quinn et al. 1998).

Cultural issues overlap information and knowledge sharing to a large extent.

Professionals are often reluctant to share the information or knowledge that they possess as it represents their unique competitiveness, power and status in the market place.

Changing this culture is difficult and likely to take considerable time but is necessary for information and knowledge sharing to become part of the normal way things are done in the organization.

2.9.5 Quality

A quality culture is critical in a learning organization because it breaks down the barriers to OL and because the quality of information and knowledge in addition to products and services directly impacts the long-term sustainability of quality of changes and innovation in an organization (Huang et al. 1999). Huang et al believe that information and knowledge quality can be assessed through the dimensions of accuracy, believability, reputation, relevancy, value-added, timeliness, completeness, volume, interpretability, ease of understanding, conciseness, accessibility, security and ease of manipulation. All of these attributes are measurable in varying degrees either as direct measures of quality or as surrogate measures for OL.

Davenport and Prusak (1998) noted that a popular approach to getting started with KM is to build on a company's quality or re-engineering efforts. Zhao and Bryar (2001) went a step further and established that TQM and KM principles can be implemented synchronously and that there is an inherent synergy between them.

2.9.6 Organizational Memory

Brown (1998) introduced organizational memory as a concept related to OL by citing an example of capturing stories from service representatives and constantly refining them through conversations amongst each other to create a powerful organizational memory which in turn improves their capacity to learn from previous failures and successes. McMaster (1996) added that it is necessary to understand the mechanisms, structures, systems and language patterns that form organizational memory in order to effectively break with the past and make intelligent decisions about the future.

Brooking (1998) believes that the IC knowledge base forms the basis for organization

memory which provides the potential to significantly boost utilization of the skills possessed by individuals.

2.9.7 Continuous Improvement

Argyris (1998) linked Continuous Improvement (CI) with OL by suggesting that companies need to make the ways managers and employees reason about their behaviour a key focus of OL and CI programs. McAdam, et al. (2000) connect CI with innovation and Quality Management, Bessant and Francis (1999) consider CI to be part of organizational dynamic capability and Barker (2001) sees human intellectual energy to be part of CI. Teaching people how to reason about their behaviour in new and more effective ways requires a CI culture that in turn breaks down the defences that block the organizational learning process. Kuhn (2001) provides a broad network of interrelated concepts and connected CI, KM, LOs and Communities of Practice as interrelated and mutually supporting concepts.

2.9.8 Collaboration and Communities of Practice

Although Chua (2002) noted that Communities of Practice (COP) were first introduced in about 1992, Wenger and Snyder (2000) described them as new organizational forms that promised to complement existing structures and radically galvanize knowledge sharing, learning and change. Skyrme (1997) also made the connection between COPs and KM by suggesting that COPs are being increasingly applied in the KM context. People in COPs share their experiences and knowledge in free flowing creative ways that foster new approaches to problems. COPs can drive strategy, generate new lines of business, solve problems, promote the spread of best practices, develop people's professional skills and help companies recruit and retain talent (Wenger and Snyder 2000). COPs are the heart and soul of the World Bank's KM strategy and are also strongly supported and nurtured by companies such as Royal Dutch Shell and Xerox (Wenger and Snyder 2000).

2.10 Previous Research in KM Measurement

Whilst snapshot reviews of KM projects have been conducted in the past, (eg DeLong et al 1997), little comprehensive chronological or geographic research on KM evaluation or measurement models has hitherto been conducted.

Previous research studies on KM evaluation models have been fairly narrow in focus but have indicated that few firms have begun to actively manage their knowledge assets

on a broad scale and that in many cases, KM has been addressed at either a philosophical or technological level with little pragmatic discussion on how knowledge can be managed and used more effectively (Davenport 1998). Some of the exceptions have been identified in Table 1. Indications are that an increasing number of knowledge-intensive firms are beginning to maintain records of the competencies of individual employees (Den Hertog and Huizenga 2000) and other records under initiatives that may not have been called “knowledge based” but nevertheless deal with organizational knowledge in one form or another. Examples of knowledge oriented initiatives that may not mention knowledge include case studies that have been conducted of initiatives in innovation, continuous improvement and collaborative work.

The geographic perspective has been touched on to some extent in previous research but generally only in the US versus Japanese approach to KM (Nonaka and Takeuchi 1995). Skyrme (1997:p2) observed that:

“the Japanese have been quietly practicing their own form of knowledge management for many years”.

This observation has led to the inclusion of a component of this research project to establish if any different approaches to KM evaluation can be determined between major geographic areas.

Previous research has shown that the gap between market and book value is gradually widening (Wallman 1999). This has resulted in the information currently being presented to investors becoming increasingly unreliable and even misleading (Wallman 1999; Fisher 1992). Furthermore, current accounting systems have been found in previous research to be inadequate and whilst strong recommendations have been made for new rules and measures to be established (Malone 1999; Petrash 1999), little direction is offered to organizations in how to structure an effective KM evaluation framework.

Some valuations have focused on one or two classes of intangibles for a limited number of firms. For example Hurwitz et al. (2002) found examples which calculated human and structural capital for 43 Swedish firms that have calculated brand capital for brand-intensive firms and others that have calculated the intangibles associated with technology investments in over 400 US firms. While these and other approaches all conclusively demonstrate that intangible assets exist at the firm level, no examples were

found of attempts to develop a comprehensive chronological and geographic study across all classes of intangible assets across a broad spectrum of firms.

Previous research in KM and IC has consistently advocated that a business case must be defined in order to justify necessary investment strategies in KM and that further research is needed in this area to clarify the evaluation framework for the new forms of intellectual capital. This thesis will help to clarify the KM/IC evaluation framework.

2.11 Summary

Whilst the management and evaluation of knowledge are critical for organizational success in the burgeoning knowledge economy, there appears to be few frameworks and guidelines in place to assist organizations in how to approach this somewhat fuzzy and esoteric endeavour.

An organization's approach to knowledge will impact the way it manages and measures knowledge and knowledge oriented projects. Knowledge management is the discipline that manages an organization's Intellectual Capital and has been associated with a number of other organizational improvement initiatives such as innovation enhancement, continuous improvement and organizational learning. This has complicated the subject of KM evaluation somewhat because it means having to determine what constitutes a KM initiative even when such initiatives may not have been deliberately connected with organizational knowledge. A definition of KM was established as a basis for extraction of relevant articles from the literature and in order to focus further analysis.

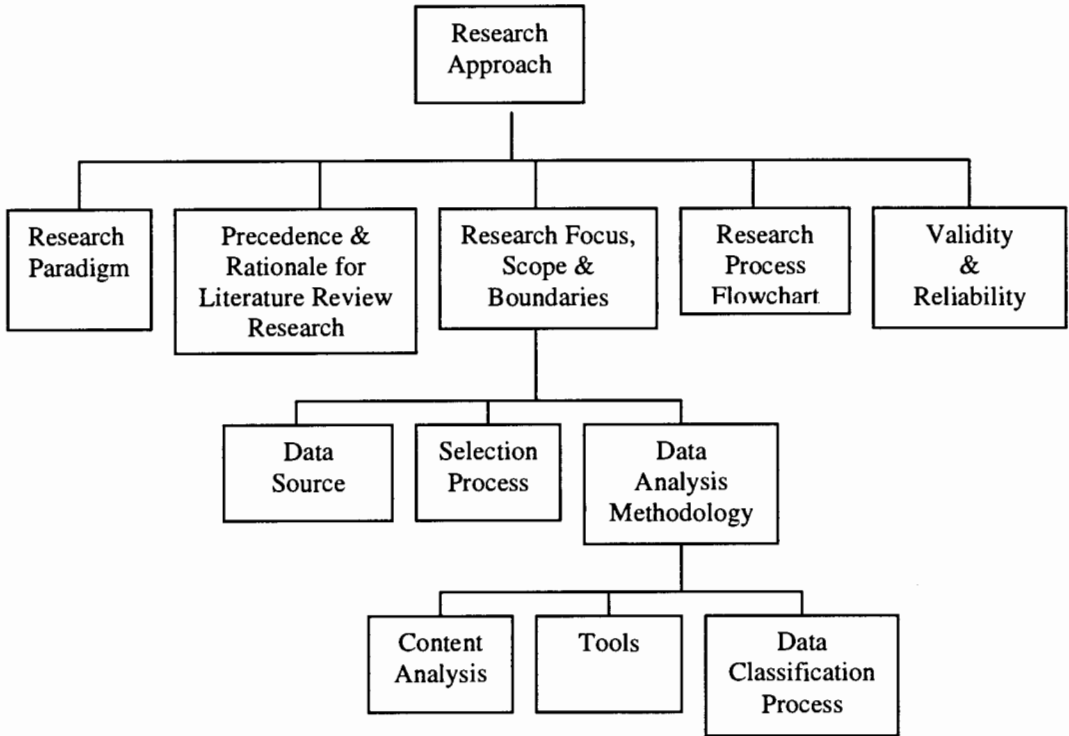
Previous research on KM evaluation has tended to be narrowly focussed and "snapshot" views rather than comprehensive functional or chronologically based studies.

The next stage defines the scope of the study and source data that will provide the information to answer the research questions posed in 1.4.

3. Research Approach

This chapter describes the research approach and the methodology used for data identification, extraction and analysis.

The Chapter structure is depicted in the following diagram:



3.1 Research Paradigm

It was considered important for the outcomes of this project that the research objectives should determine the most appropriate research paradigm rather than a selected paradigm driving the direction of the research on the basis of convenience or personal preference of the researcher. The objective of this research project is focused on providing understanding and clarity, not proving any particular hypotheses, and thus, a predominantly qualitative approach (with some quantitative support) was seen to be the most appropriate overall style.

According to Myers (1997), there are three underlying paradigms or philosophical perspectives in research: positivist, interpretive and critical. Whilst all three have their particular relevance in certain circumstances, interpretive research was seen to be the most relevant for this type of study because it focuses on the full complexity of sense making as the situation emerges (Myers 1997). Furthermore, an interpretive approach, as defined by Burrell and Morgan (1985) and Sveiby (1994), as opposed to a

functionalist or positivist approach, has been chosen for this thesis because evaluation, by its very nature, involves subjective elements and cannot be separated from human intellect, history, culture and social organization and because an interpretive approach was seen to be the more appropriate approach to achieve the objectives of this study. Whilst research in the field of Information Systems has been dominated by quantitative positivist research (Goles and Hirschheim 2000), qualitative research in Information Systems (IS) has gained significant acceptance in recent years and has been spurred by a general shift away from technological to managerial and organizational issues (Myers 1997).

Interpretive research can be based on different modes of analysis in the form of hermeneutics or phenomenology, with hermeneutics being primarily concerned with the meaning of a text or text-analogue (Myers 1997). This project deals primarily with providing clarity and understanding from textual sources and was thus seen as an example of hermeneutic analysis. Hermeneutics supports the object of the interpretive effort of attempting to make sense of the organization and the relationship between people, the organization and information technology (Myers 1997). This mode of analysis supports the objective of a chronological and geographic approach to KM evaluation and developing an understanding of evaluation processes in complex human and technological environments.

KM is neither purely a physical nor a social science and is not a pure IS discipline either. As discussed in 2.9, KM relates to many other fields apart from IS, but many still see the strong IS heritage in KM and thus the IS research paradigm (see 3.2) features strongly in previous KM research. No single research paradigm or approach fits perfectly with the principles of KM or the objectives of this study. A methodological pluralism as advocated by Garcia and Quek (1997) and Goles and Hirschheim (2000), was therefore adopted. Some quantitative components in terms of documenting the occurrences of evaluation models by year and by geographic region are covered, but only to clarify the meaning and to support or explain qualitative findings.

3.2 Precedence and Rationale for Using Literature Reviews for IS Research

Meta-analysis has been used successfully in a number of previous IS research studies using a combination of quantitative and qualitative methods. DeLone and McLean's 1992 research on Information Systems Success Factors provides a useful model and

research methodology for this study. DeLone and McLean conducted a comprehensive study using meta-analysis which resulted in a classification of evaluation methods and the development of a model for the evaluation of IS effectiveness. They cited 180 articles from seven leading publications between 1981 and 1987 in their analysis. A taxonomy was developed in their study comprising six major dimensions or categories of IS success covering over one hundred different measures.

Swan et al., (1999) used a similar literature search style using articles extracted from 1562 different journals in the on-line ProQuest and Social Science Citation Index databases to identify general themes within KM. They used quantitative techniques to analyse frequency of references to search terms such as KM and LO followed by qualitative analyses of conditions for the effective implementation of KM. As with this research study, their objective was to illustrate trends and, although comprehensive, did not claim a high degree of scientific precision.

Mahmood et al (2000) also used meta-analysis in their studies on evaluating information systems satisfaction. Forty five empirical studies from eight major journals dated between 1986 and 1998 were reviewed as part of their analysis. The Mahmood et al style of research is also relevant as supporting model and precedent for this project because, as with this study, its objective was to reduce confusion by studying a phenomenon over an extended period of time.

Another example of this type of research was provided by Schultze and Leidner (2002) who used six specific academic IS journals for their research and selected 78 articles from these journals via an on-line ABI Inform database (offered by ProQuest) and manual scans of abstracts. They found that an initial perusal of abstracts retrieved by the key word searches identified articles that were not directly related to the objective of their research and thus had to be excluded from the sample. This research project encountered similar issues as will be discussed later.

Tidd and Driver (2001), suggest that collecting data from on-line sources is a cost-effective method that avoids contacting companies directly and thus minimises resources and the burden on industry. The increasing availability of data in a variety of on-line sources makes this an increasingly rich and viable resource for research. Comparisons over time are also possible using literatures reviews which would not be possible with surveys or interviews. See further comments on data validity in section 3.8.

3.3 Research Focus, Scope and Boundaries

The following diagram depicts the research focus for this study which covers the dimensions of KM and IC and their major related disciplines as defined in section 2.9.

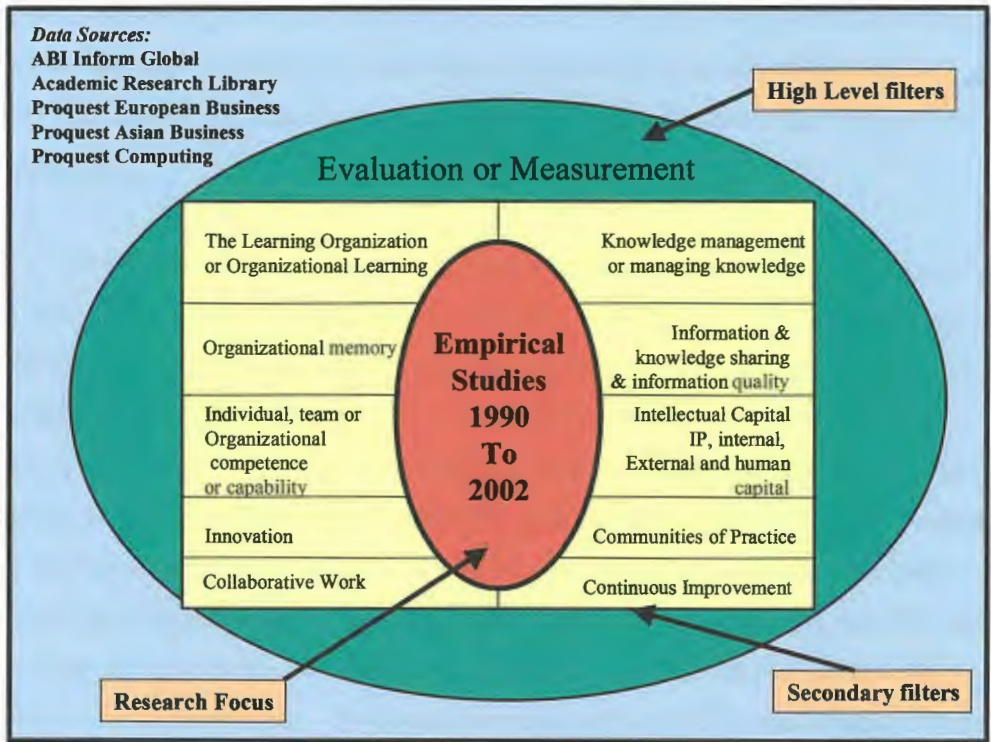


Figure 5: Research Focus

Figure 5 above shows the staged filtering process that was used to select the relevant articles for this study. The data sources are defined in 3.4 below. The high level filter was defined as any variation of the words “measure” or “evaluate”. This was further refined by a specifically selected variety of topics that were found to be associated with KM as previously defined in section 2.9. Although the initial search extended back to the early eighties, no occurrences of the required data were found prior to 1992.

The final filter was to select only empirical studies⁸ as opposed to purely theoretical papers. Theoretical studies did not provide the level of detail required for this study and were thus eliminated in either the selection or data analysis phases. This process is discussed further in section 3.5.

⁸ Empirical is taken to mean any articles dealing with first-hand research of KM measurement models in actual use in organizations or reports providing evidence of such models that have actually been implemented in organizations.

3.4 Data Source

It was necessary to decide on a collection of on-line resources that would provide a comprehensive body of data preferably in the one location and in a consistent format. A number of databases were selected from the total on-line ProQuest resources available through the Edith Cowan University library in Perth, Western Australia. These were selected on the basis of the journal listings provided with each database and selecting those databases that contained the most likely collection of journals, on the basis of journal title, that would cover topics connected with the evaluation of knowledge and/or IC initiatives.

ABI Inform Global was the main data source where full text articles have been available from more than 500 ABI journals since about 1971. This easily covers the full history of KM which did not become acceptable management parlance until the early nineties. In addition to ABI Inform Global, four other databases were included in the source library. The ProQuest Academic Research Library was selected with the intention of including many of the KM initiatives from non profit organizations such as the medical and government sources. The intention with the selection of the Proquest Computing database was to include the Information Systems oriented articles dealing with KM and IC that may not have been covered by the business and managerial periodicals in the ABI Inform Global collection. ProQuest European and Asian Business databases were included in an attempt to balance out the US dominance of the subject and to provide a wider geographic perspective to the study.

Unlike the approach used for the DeLone and McLean, Swan et al and Schultze and Leidner research reports mentioned in 3.2 where a small number of specific journal titles were selected as the data source, specific journals were not selected as sources of articles for this study. This minimised journal selection bias to a large extent.

A constraint with this on-line selection was that some journals do not offer their articles on-line to ProQuest and some journal articles are only available in full-text form on-line a year or more after publication in hard-copy journals. However, on the basis of World rankings of the top 50 IS journals by Mylonopoulos and Theoharakis (2001), it was found that sufficient internationally recognised journals were represented in the ProQuest on-line databases to provide a sufficiently rich range of material to draw from. It was expected that Management and IS journals would cover KM fairly comprehensively but perhaps not IC as this subject was seen to be more of an issue for accountants and economists. It was found for example that MISQ, HBR,

Communications of the ACM and IS Research (all represented in the top 50 ranking) covered KM and other related issues comprehensively and that these journals were available in the Proquest libraries mentioned above. The Journal of IC was the most prolific provider of articles on IC and one of the few journals available on-line that covered this topic in any depth but predictably is not represented in the top 50 IS journals.

3.5 Selection Process

The following selection criteria, derived predominantly from the preliminary literature review described in chapter 2, were used to extract potentially suitable articles from the target databases.

All derivatives of the word *evaluate* or *measure* in addition to any occurrences in the article title or abstract of:

Knowledge and all derivatives of the word *manage*
*Organi*ational learning (where * = s or z)*
*learning organi*ation*
information sharing
knowledge creation
knowledge generation
knowledge transfer
intellectual capital
innovation
competence or competency
*organi*ational capability*
human capability
internal structure
external structure
customer capital
structural capital
market assets
human assets
infrastructure assets
intellectual property assets
collaborative work
*organi*ational memory*
communities of Practice
human capital

The reason for separating the terms “knowledge” and “management” was to pick up articles that dealt with the evaluation of managing knowledge and management of knowledge in addition to “knowledge management” per se.

A total of 1539 articles from the database collections potentially satisfied the above selection parameters as per the first and second filters shown in figure 5 in section 3.3.

A manual review of all abstracts was then conducted to assess the relevance of the potential articles to the objectives of the research. This was done by ensuring that the context of the abstract was clearly targeted towards the measurement or evaluation of KM, IC or the other related topics identified in the literature review in chapter 2. Figure 6 (see later) provides a diagrammatic view of the research method.

The combination of the software guided selection process and the manual review of relevance resulted in only 223 articles out of the original 1539 (14.5%) being copied to the research database for further analysis. The breakdown of articles within each selection category is shown in the following table.

Selection Keywords: "measur?" or "evaluat?" AND:	Total Potential Docs	Selected Docs	% of Total Selected
knowledge + manag?	234	73	32.7%
organi*ational learning	58	19	8.5%
learning organi*ation	16	0	0.0%
information sharing	18	0	0.0%
knowledge + creat?	98	4	1.8%
knowledge + generat?	17	0	0.0%
knowledge transfer	4	0	0.0%
Intellectual capital	9	5	2.2%
innovation	382	39	17.5%
competenc?	469	63	28.3%
organi*ational capability	7	0	0.0%
human capability	1	0	0.0%
internal structure	30	0	0.0%
external structure	0	0	0.0%
customer capital	0	0	0.0%
structural capital	0	0	0.0%
market assets	1	0	0.0%
human assets	6	1	0.4%
infrastructure assets	1	0	0.0%
intellectual property assets	3	0	0.0%
collaborative work	0	0	0.0%
organi*ational memory	1	1	0.4%
Communities of Practice	15	0	0.0%
human capital	169	18	8.1%
	1539	223	100.00%

Table 4: Selected Documents

The selected 223 articles were sourced from 126 different journals thus significantly extending the scope and comprehensiveness of previous reviews conducted by DeLone and McLean (1992), Mahmood et al. (2000), Schultze and Leidner (2002) and Swan et al. (1999). The full list of authors and titles of articles comprising the research database for this thesis is shown in Appendix A and the full list of journals and the number of articles selected from each journal and journal category is shown in Appendix B.

The reasons for rejecting such a high percentage (85.5%) of articles included:

- The words “measure” or “evaluate” or their derivatives may not have related to the measurement or evaluation of KM or related concepts as identified earlier;
- Some articles particularly from medical journals referred to measurement or evaluation of specific systems, processes or technology rather than elements of KM or IC;
- Different meanings of concepts of key terms such as “human capital” - in some cases these referred only to the actual number of people not their value to the organization in the KM context;
- Terms such as “creation” or “generation” often referred to the creation or generation of other things apart from knowledge or IC.

The numbers of articles selected by year of publication between 1992 and 2002 were recorded and are tabled below:

Year of Publication	No. of Articles Extracted	% of Total
1992	1	0.4
1993	0	0
1994	0	0
1995	2	0.9
1996	23	10.3
1997	9	4.0
1998	14	6.3
1999	36	16.1
2000	58	26.0
2001	49	22.0
2002	31	14.0
Total	223	100

Table 5: Articles by Year of Publication

Data for 1992 and 1995 were rejected as insufficient occurrences of empirical measurement were found during this period for meaningful analysis and were thus excluded from further analysis, thus leaving 220 articles for further analysis. Apart from the relatively low number of relevant articles in 1997 and 1998, numbers for other years are reasonably well spread between 1996 and 2002.

3.6 Data Analysis Methodology

3.6.1 Content Analysis

The principles of Content Analysis were used to analyse the data for the appropriate keywords. Content Analysis, according to Hussey and Hussey (1997), represents a formal approach to qualitative data analysis and is particularly useful when attempting to make sense of large volumes of open-ended material as was the case with this study. By using software tools (see 3.6.2 below) it was feasible to identify keywords associated with each KM evaluation model that would determine the most appropriate category that the model should fit into. Using this technique, it was the data that determined the categories into which the models would be classified. Any coding unit (sentence in this case) that referred to an empirical example of the measurement or evaluation of KM or IC or its associated topics from table 4 in section 3.5 was stored for further analysis.

3.6.2 Tools

NUD*IST ® (QSR N6 Student version 6) was used to identify the major themes in KM/IC evaluation and measurement models. NUD*IST has particular strengths in managing, exploring and searching textual material, managing and exploring ideas about data, linking ideas and constructing theories about data, testing theories and generating reports including statistical summaries (University of Hong Kong, 1995).

The unit of text analysis used within the NUD*IST system to extract relevant material was the sentence. The other text coding options of line or paragraph were not considered appropriate as individual lines would not provide the necessary context for the reference and an entire paragraph was seen to be excessive, potentially diluting the focus of the selected sentence. If further context was required for the sentence selected, NUD*IST provided the options of selecting additional sentences either side of the selected text unit as required.

Microsoft Excel® spreadsheets were used in conjunction with the NUD*IST database to facilitate analysis and sorting of node elements by important parameters such as date, geographic orientation, actual measures used etc.

3.6.3 Data Classification Process

All sentences that covered some aspect of evaluation or measurement of KM or related concepts were firstly coded to a number of “free nodes” within the NUD*IST database. These free nodes were not initially linked to each other in any way and were constructed according to identifiable keywords within the sentence that described the nature of what was being measured such as “quality”, “competence” or “customer”. A total of 40 nodes or individual measurement themes were created in this way as shown in the following table.

	"node" description, measurement theme
1	Financial, accounting, economic
2	Technology, information systems
3	Customer, markets
4	Human capital
5	Knowledge as an asset or Intellectual property
6	KM as a process
7	Information or knowledge sharing, transfer or dissemination
8	Operational processes and procedures
9	Efficiency, effectiveness or productivity
10	Innovation, creativity
11	Quality
12	Composite measures
13	Relationships and Alliances
14	Learning ability, propensity, opportunity
15	New product development
16	Competition
17	Knowledge creation and use
18	Logistics and delivery
19	Organizational culture
20	Capability, competency
21	Decision making
22	Communications
23	Structural capital
24	Outcomes
25	Teamwork, participation, Communities of Practice
26	Social capital
27	Change
28	Leadership
29	Project success
30	Performance
31	Strategic issues
32	Risks
33	Losses
34	Commitment, action orientation
35	Image, reputation
36	Conflict, turbulence, instability
37	Training
38	Control
39	Project Management maturity
40	Organizational maturity, sophistication

Table 6: Measurement themes

On completion of the coding exercise it was apparent that many of the free nodes could be consolidated as they were measuring or evaluating similar things but perhaps using slightly different terminologies. For example, measures dealing with skills, competence, capability, ability to learn and leadership were distinctly human attributes and could thus be consolidated under a human capital category. The 40 free nodes were consolidated into 12 major measurement categories. These categories are further discussed in 4.2.1.

The actual descriptions of the metrics were then extracted from the coded units (sentences) in the NUD*IST database and loaded into an Excel spreadsheet to facilitate sorting of parameters such as dates and measurement mechanisms. This resulted in 838 spreadsheet entries (see Appendix E), each corresponding to a single example of a KM metric used by an organization at some stage between 1996 and 2002. Each metric was then allocated to one of the 12 identified KM measurement categories.

3.7 Research Process Flowchart

The process for the conduct of the research is depicted in the following flowchart.

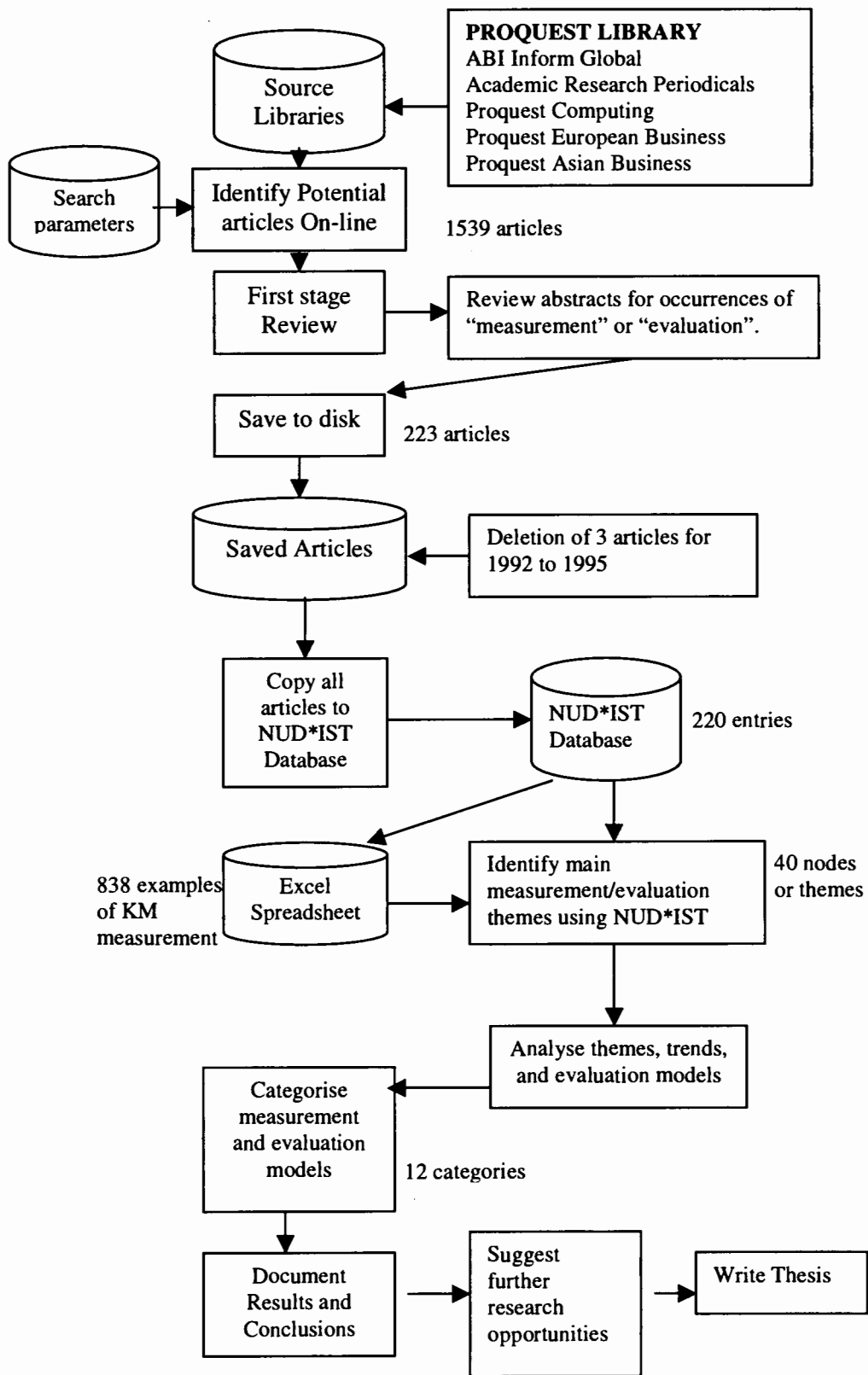


Figure 6: Research Methodology Flowchart

In summary, 223 articles from 124 different journals were selected from 1539 potentially useful articles identified by automated search tools. Three articles dated 1992 to 1995 were deleted. From the remaining 220 articles, 838 examples of KM measurement were identified which were then placed into 40 “free nodes” within the NUD*IST system. These 40 nodes were then refined and consolidated into 12 major measurement categories that provided the basis for more detailed analysis.

3.8 Validity and Reliability

3.8.1 Data Source

As advocated by Webster and Watson (2002), a deliberately broad base for source data was selected for potential articles for this study covering a number of topics associated with the key area of KM, a broad set of journals across a number of disciplines and wide geographic coverage. This significantly enhances the relevance and validity of the study.

The main source of data was the ProQuest ABI/Inform database which has been a reliable and comprehensive source of articles for academia, industry and government for more than thirty years (Innodata 2003; Convera 2003). ABI Inform Global contains over 550,000 articles from over 1,000 international business and management periodicals. Full text articles are available from more than 500 of these journals. More than 350 of the database’s sources are English-language articles published outside the US (ProQuest 2003), thus enhancing the international focus of this study. According to ProQuest, their approach to indexing and abstracting using about twenty indexing elements provides precision in researching and makes it easy to determine which articles meet the researcher’s needs.

The ProQuest Research Library covers more than 2,600 journal titles from a wide range of subject areas including business, education, literature, political science and psychology (ProQuest 2003). ProQuest also claim that their editorial and technical processes ensure that many complete articles are made available on-line within 48 hours of receiving the hard copies. This added re-assurance that the ProQuest material would be up-to-date.

ProQuest European Business covers more than 110 leading titles including The Economist, Fortune and European Business Journal (ProQuest 2003) thus ensuring an adequate representation of European material. ProQuest Asian Business comprises

articles from more than 75 key publications including Asiaweek and Far Eastern Economic Review (ProQuest 2003). ProQuest Computing articles are sourced from over 260 Information Science and Technology journals including Computerworld, InfoWorld, PC World (ProQuest 2003) thus ensuring access to relevant KM articles from the IS school.

Only feature articles (as opposed to commentaries, book reviews, editorials etc) from periodicals (as opposed to newspapers etc) were included in the acceptable articles types in an attempt to maximise validity and relevance of empirical material. Only feature articles were found to contain the necessary depth of analysis and detail of empirical studies.

3.8.2 Research Software

The use of specialist software tools was particularly critical to add rigour and validity to this study. The NUD*IST software product is one of the most widely recognised qualitative research software products available (currently used in over 80 countries according to the vendor, QSR) and has been used successfully in a number of IS related research projects in recent years (Cannon 1998; Collins & Caputi 1998; Rotter 1999; Lau et al 2001). As with this study, the Cannon study involved “making sense” of a large amount of empirical unstructured textual data.

Efficient and effective use of the right software tools can benefit and enrich any research project. According to Barry (1998), NUD*IST is particularly strong in providing structure, project management functions and searching capability. The use of keyword searches under software control to identify the 1539 potentially useful articles in the selected databases provided a high degree of rigour to the selection process by eliminating the possibility of missing potential articles by manually reading the text and also eliminating initial selection bias.

3.8.3 Validity vs Reliability

Validity is the extent to which the research findings accurately represent what is really happening in the real world (Hussey and Hussey 1997). This study claims a high level of validity on the basis of the number of empirical studies used for source data, the rigorous research procedures used, and the adoption of a hermeneutic paradigm. In this study, the aim is to gain knowledge and meaning from empirical studies of the phenomenon of KM and IC evaluation and as such, a high degree of validity is claimed

to be maintained. The appropriateness and validity of this interpretive approach is supported by Schultze and Leidner (2002), who established that research that is part of the interpretive discourse aims to create a coherent, consensual and unified representation of what the organizational reality is “actually” like, despite its complexities and contradictions.

Reliability relates to the degree to which the research findings can be repeated (Hussey & Hussey 1997) and whilst the selection process used in this study is certainly repeatable, the source data bases change continuously and the manual review of abstracts will provide different results depending on who conducts the review. Even if the study was to be repeated by the author, a different mind-set is likely to have developed in terms of relevance of articles. High levels of reliability are therefore very difficult to achieve in qualitative research of this nature. It can be argued however that low reliability is entirely consistent with high validity if the subject matter is volatile or subject to differing perspectives or levels (Ratcliff 1995) as is the case with this topic.

3.8.4 Judgement

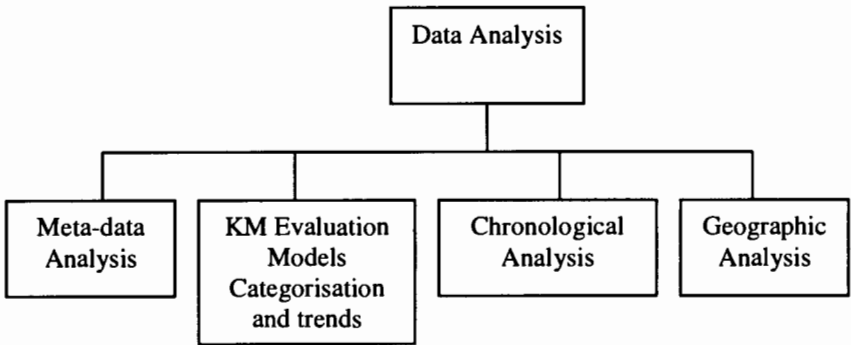
The first stage review of appropriateness of articles on the basis of relevance to the research topic required some subjective judgement by manually reading all 1539 abstracts. There was no other convenient way to automate or improve on the reliability of this process because of the nuances of meaning and context and the range of disciplines associated with KM as identified in Chapter 2. Furthermore, as no previous research could be found using this research methodology for this topic, no co-researchers could be approached to verify the rigorousness of the coding.

See Section 5.2 for further discussion on this issue.

4. Data Analysis

This chapter identifies and discusses the results from the data analysis phase and covers findings in relation to data sources, evaluation categories and individual measurement types and their trends over time and within major geographic regions.

The Chapter structure is depicted as follows:



4.1 Meta-data Analysis

The wide range of journals from which the 220 articles were extracted shows the pervasiveness and relevance of KM and IC to a variety of disciplines in business, academia, education, medicine and science in both the private and public sectors. Appendix B shows the full list of journals from which relevant articles were selected. Journals were categorised in order to identify the main focus areas from which articles were selected. Journal categories were established on the basis of keywords in the journal title rather than on any extensive analysis of the journal contents. For example, keywords such as “health”, “medicine” and “nursing” were categorised as Medical whilst “computing”, “IT” and “database” related journals were categorised as Information Systems.

The number of articles selected from each journal type in descending order of occurrences is shown in the table below.

Journal Category	Number of articles selected	% of Total
Management	81	38
Intellectual Capital	23	10
Financial, Accounting, Economics	20	9
Medical	16	7
Information Systems/Information Technology	12	5
Knowledge Management	11	4
Education	8	4
Learning Organization/Organizational Learning	8	4
Human Resource Management	8	4
Research	6	3
Government	6	3
Sociology	5	3
Psychology	4	2
Library Management	3	1
Engineering	3	1
Manufacturing	3	1
Scientific (other than medical)	3	1
TOTAL	220	100

Table 7: Articles within Journal Category⁹

From the above table, whilst it can be deduced that the evaluation of KM is predominantly a management issue with 38% of the total number of articles being sourced from management oriented journals, the number of articles in the other disciplines indicates that KM evaluation is far from exclusive to any one, or a narrow range of disciplines. It is accepted that Management is a very broad category and includes titles such as management development, small business management, hotel management, marketing management, project management, business strategy, quality management, change management and so on, but the point is made that evaluation of knowledge and knowledge related initiatives have become important considerations in all aspects of management. Knowledge management, human resource management and library management have been separated out as discrete journal categories simply to highlight these as separate specific examples. Different conclusions can obviously be made by combining or splitting these categories and representing them in different ways. If IC was to be included in the Financial, Accounting and Economics category for example, this category would become much more significant at 19% of the total number of articles.

Journal categories from the above table also indicate a maturing of the KM concept outside the earlier boundaries and heritages of Information Management. Indications

⁹ Note that the number of relevant articles was reduced from 223 to 220 as explained in section 3.5.

from the above table are that KM evaluation is not a significant Information Systems or Information Technology (IS/IT) issue with only 5% of articles coming from IS/IT related sources. It was noted that the medical field is showing a more significant interest in KM evaluation than the IS/IT profession.

4.2 KM Evaluation Models

4.2.1 Categorisation

As described in section 3.6.3, the 43 “free nodes” of evaluation themes constructed in NUD*IST were consolidated into 12 measurement categories which are described in the following table.

Measurement Category	Code	Description
Customer Capital	C	customer satisfaction; brand value from customer perspective; customer (including potential customer) perceptions of organizational image and reputation
Financial	F	any financially oriented measure using dollars as the metric
Human Capital	H	includes individual skills; competence, capability or ability to learn; years of education; hours of training; entrepreneurial spirit; tacit knowledge; leadership; social capital, empowerment, ability to cope with stress, conflict, change and turbulence.
Internal Infrastructure	I	Organizational culture; explicit knowledge and information bases, knowledge and information transfer infrastructures and systems; structural capital; information and knowledge sharing culture.
Intellectual Property	IP	patents; copyright; trade secrets; trademarks; registered brands; intellectual property rights.
Market Intelligence	M	any measures associated with competition and the overall market position (as opposed to individual customer measures).
Innovation & Creativity	N	new product development; continuous improvement initiatives; innovative ability, capacity and propensity to innovate or create
Process	P	includes decision making practices; effectiveness of operations; knowledge creation processes; productivity improvements; efficiency and effectiveness measures; cycle times; speed of service delivery; measurements of process outcome.
Quality	Q	"fitness for purpose" of the product or service; defect rates; measures of compliance with specifications.
Supplier related	S	measures dealing with alliances and partnerships with suppliers.
Technology	T	sophistication of the technology in use; use of or take-up of new technology; level of technological maturity.
Composite Measures	X	Combination of any of the other categories into a formal framework of integrated measures

Table 8: KM Evaluation Categories

Each of the 838 individual KM related metrics extracted from the 220 articles were then allocated to one of these categories. These categories provided the structure for further analysis.

4.2.2 Ranking of Measurement Categories

The number of metrics within each category were charted to arrive at a ranked list of the relative frequency of use of these categories as used by organizations between 1996 and 2002. This resulted in the following pie chart (Figure 7). The legend relates to the codes allocated to each of the categories as identified in Table 8 above.

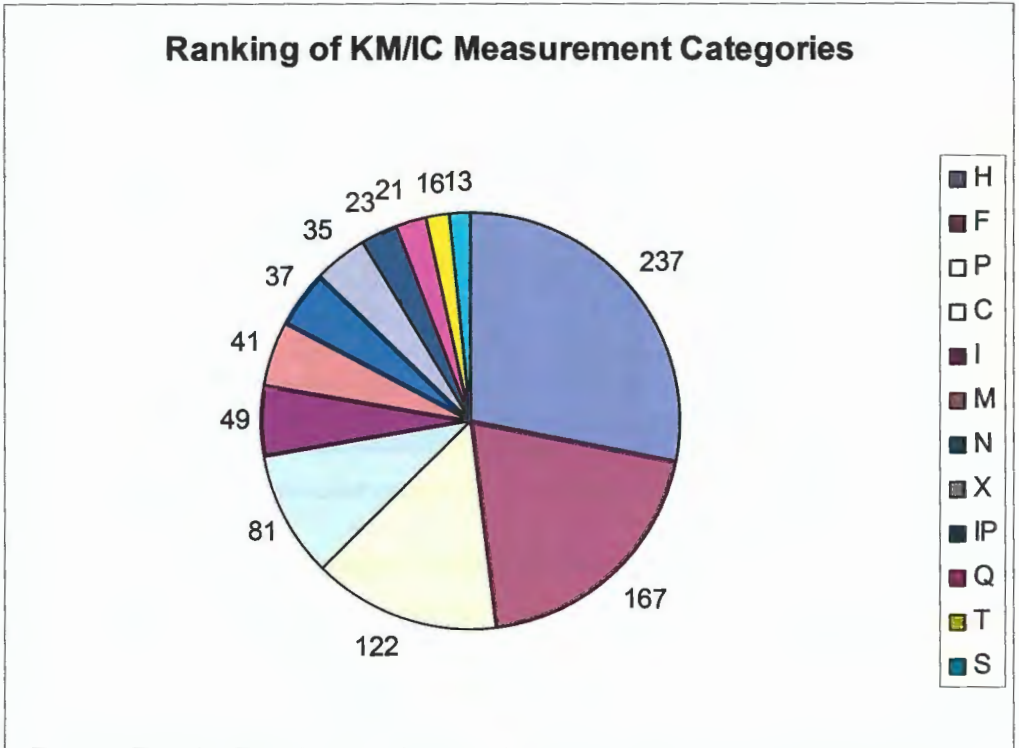


Figure 7: Ranking of KM/IC Measurement Categories From Table 8.

This table shows that, over the period 1996 to 2002, Human Capital was the most commonly used category of measurement for KM followed in descending order of frequency by Financial, Process, Customer, Internal Infrastructure, Market Intelligence, Innovation, Composite Measures, Intellectual Property, Quality, Technology and Supplier Related measures.

The analysis of specific measures within each of these categories is further explored in the following sub-sections.

4.2.3 Trends in Measurement Categories

By charting the number of measures within each category against each year from 1996 to 2002, some identifiable trends were highlighted. The following Table 9 shows the

results. It was determined that the actual numbers of cases have limited meaning as they are directly dependent on the number of on-line articles available in the selected databases which may or may not be representative of the number of real-life cases. The percentages of each category to the total number of cases for each year were seen to be more meaningful than the actual numbers of cases and are highlighted in the following table.

Category	1996		1997		1998		1999		2000		2001		2002		Totals
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
C	6	7.23		0	17	21.5	18	13.5	24	8.45	11	7.64	5	6.1	81
F	14	16.9	7	21.2	12	15.2	15	11.3	53	18.7	39	27.1	27	32.9	167
H	25	30.1	5	15.2	20	25.3	33	24.8	86	30.3	38	26.4	28	34.1	235
I	1	1.2	1	3.03	2	2.53	7	5.26	18	6.34	11	7.64	9	11	49
IP		0	6	18.2	3	3.8	3	2.26	10	3.52	1	0.69		0	23
M	4	4.82	1	3.03	8	10.1	10	7.52	13	4.58	2	1.39	2	2.44	40
N	1	1.2	2	6.06	3	3.8	10	7.52	15	5.28	6	4.17		0	37
P	20	24.1	10	30.3	7	8.86	25	18.8	34	12	23	16	3	3.66	122
Q	5	6.02	1	3.03	1	1.27	4	3.01	9	3.17	1	0.69		0	21
S	3	3.61		0		0	5	3.76	2	0.7	3	2.08		0	13
T		0		0	1	1.27	3	2.26	5	1.76	5	3.47	2	2.44	16
X	4	4.82		0	5	6.33		0	15	5.28	4	2.78	6	7.32	34
Totals	83	100	33	100	79	100	133	100	284	100	144	100	82	100	838

Table 9: Trends in measurement categories identified in Table 8.

Table 9 above shows the changing emphasis between the measures over the period 1996 to 2002. Charting the percentages for the 6 most significant categories from this table, over the period from 1996 to 2002, resulted in the following chart:

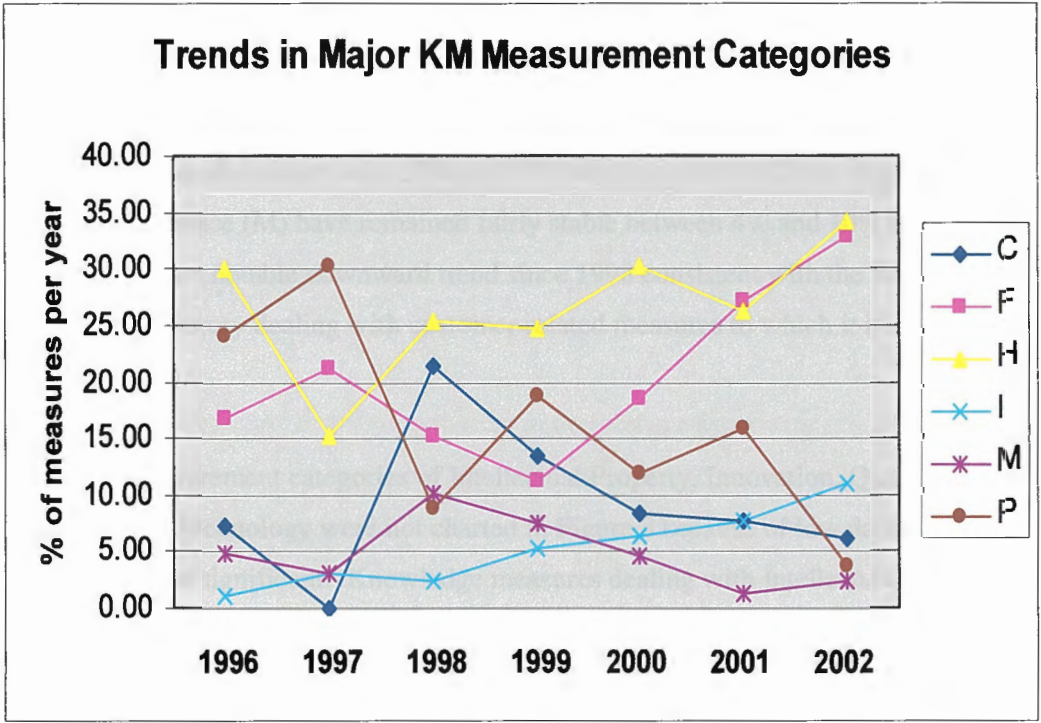


Figure 8: Trends in Major Measurement Categories

Table 8, and the graphical representation of data in Figure 8 above, highlight some significant changes in the use of KM evaluation models between 1996 and 2002. Customer capital related measures (code C) show a steady decline in relative use from 21.5% in 1998 to 6.1% in 2002. There was no data for this category in 1997, which appears to be an anomaly, and no explanation for this could be deduced from the literature. The decline since 1998 was unexpected given the literature focus in the late nineties on the importance of customer orientation and its strong relationship to business performance (Kennedy 1998; Li and Cavusgil 1999; Stivers and Joyce 2000; Moore et al. 2001; Lenskold 2002). The decline in customer related measures seem to have been offset to some extent by increases in the frequency of use of Human Capital (H) and Financial (F) measures in particular since 1998.

Human Capital measures (H) have gained in overall use from 15% in 1997 to 34% in 2002. No explanation can be offered for the fall from 30% in 1996 to 15% in 1997. Once again 1997 seems to be an aberration in the data.

Financial measures (F) were fairly high at 17% in 1996 but then fell for some reason between 1997 and 1999 before growing strongly again in use to achieve an even more significant 34% in 2002. This was unexpected given the criticism that financial measures have received in connection with KM and IC since the mid nineties (Ahmed 1999; Kaye and Anderson 1999; Wurzburg 1998).

Internal infrastructure measures (I) have grown steadily from 1% in 1996 to 11% in 2002. This may be due to the increasing focus on explicit information and knowledge bases as assets. The other category that appears to be losing significant favour is the Process (P) related category with 30% in 1997 falling to 3.6% in 2002. Measures of Market Intelligence (M) have remained fairly stable between 4% and 10% over the period but with a notable downward trend since 1998 consistent with the downward trend in the category dealing with customer related measures to which it is closely related.

The other measurement categories of Intellectual Property, Innovation, Quality, Suppliers and Technology were not charted in Figure 8 because of low data numbers but are nevertheless significant. Knowledge measures dealing with Intellectual Property (IP) seem to have lost ground significantly from 18% in 1996 to nil in 2002. This may suggest a re-focussing away from the more tangible forms of patent oriented measures to the more human capital type measures. Innovation and creativity measures (N) were low but relatively stable over the period with 6% in 1996 falling only slightly to 4% in 2001 but then falling inexplicably to zero in 2002. This was unexpected as the literature over this period claimed that models for these types of measures were emerging (Bobic et al. 1999; Bain et al. 2001; Kleysen and Street 2001; Frigo 2002; Stivers and Joyce 2000).

Quality (Q) related measures fell from 6% in 1996 to zero in 2002. This may have resulted from increasing pressures on organizations to implement more comprehensive measurement systems than ones just based on quality alone. Consolidated measures (X) were on the increase, but only slightly, rising from 4.8% in 1996 to 7.3% in 2002. There were very few occurrences on which to make any conclusive judgements about the composite measurement category but a tentative suggestion that this type of model is gaining in acceptance and use, would seem to be justified.

Cases of Supplier (S) and Technology (T) related measures were insignificant overall. No particular trends could be identified from the available data and these were eliminated from further analysis; thus leaving ten major categories from the original twelve shown in Table 8.

4.2.4 Metrics Within KM Evaluation Categories

Within each measurement category there was considerable variability in precisely what was being measured. In some cases, identifying precisely what was being measured

was not clear until more detailed analysis was conducted into how the measurement was being conducted. In some cases the category had to be changed when what was being measured was more clearly understood. For example, although an article may have stated that it was the knowledge oriented culture of the organization that was being measured (initially placing the case in the “I” or Internal Infrastructure category) it was not until it was explained that it was tacit knowledge sharing that was actually being measured that the category needed to be changed to “H” for Human Capital.

Appendix E shows the full list of measures in category and date order showing, wherever applicable, a column describing how the measures were conducted. Appendix E shows for example, customer related measures including customer satisfaction, customer retention, customer perceptions and orientations and so on, as examples of specific metrics related to customers.

4.3 Chronological Analysis

This section shows the chronological development of the ten previously identified categories of KM evaluation methods from 1996 to 2002 and the factors impacting KM measurement methods under these categories. In order to avoid tedious repetition, it may be assumed that discussions in the following sub-sections refer directly or indirectly to the evaluation of knowledge oriented organizational learning or performance improvement initiatives as per the definition of KM in 2.6.

4.3.1 1996

The main elements of KM evaluation models that prevailed in 1996 were an increasing awareness of the importance of customer related (external) measures in conjunction with internal financial, internal infrastructure and process oriented measures. A wide variety of financial measures were being used despite the failure of traditional accounting principles for intangible assets being well recognized. Very basic measures of human capital were in place and whilst organizational culture was seen as being conducive to organizational learning, few methods existed to evaluate it. Interest was also being shown in innovation as an indicator of effective use of knowledge but again, apart from counting patents, no effective methods were available to evaluate it. Process measures tended to focus on quantitative elements and the Balanced Scorecard was the main form of composite measurement method in use.

Customer (C)

Examples of customer related measures used in knowledge related initiatives in 1996 included studies by Davis (1996) who established that customer satisfaction was the top priority for large organizations such as General Electric (GE). Customer service levels at GE were monitored on a daily basis which showed a particularly high level of reliance on this type of measure for large internationally focussed companies like GE at the time.

Chenhall (1996) quoted a case of a large furniture manufacturer who stressed the importance of measures that were supportive of efforts to develop a heightened awareness (tacit knowledge) within the organization of customer needs and rapid response times. Managers from seven high performing manufacturing divisions noted that their flexibility was enhanced by learning about the changing needs of customers and how these needs impacted manufacturing operations (Chenhall 1996). This was an example of using a de facto or surrogate measure (customer satisfaction) to provide indicators of success or otherwise in another parameter (level of knowledge regarding manufacturing effectiveness).

The National Call Management Centre (NCCMC) at IBM UK used an external independent organization to measure customer satisfaction (Mortlock 1996). This indicated the high profile that customer satisfaction measurement had at the time to provide evidence of organizational learning and performance as well as the importance of the perceived credibility of the measurement methodology by virtue of using an external consultant to conduct the measure rather than conducting it internally.

Financial (F)

A wide variety of financial measures were encountered in 1996 in connection with KMIs with no particular preferences being evident. The evaluation of organizational and management performance involved the use of budgetary controls and the development of financial indicators such as return on investment, sales growth, cost reductions and the like.

Accounting systems were regarded as a legacy of the industrial age and that they had developed to support a system which hitherto had been labour and capital intensive. Despite quite high reliance on financial measures, the recognition of the failure of these traditional accounting systems in the knowledge society was widely recognised even at this early stage of KM evaluation development. It appeared that conventional aggregate financial indicators were becoming inappropriate in modern manufacturing settings

which seemed to be relying more and more heavily on knowledge and innovation as major inputs to production. Whilst many organizations appeared to believe that the traditional accounting systems did not provide the required tools for measurement in the knowledge domain¹⁰, few had any idea of what was needed to improve the measurement and reporting process.

Human Capital (H)

Although it was obvious at the time that employees acquire useful skills and knowledge that the organization could and should capitalize on, it was not obvious that these skills and knowledge were a form of capital that had grown in Western societies at a much faster rate than conventional (nonhuman) capital (Sweetland 1996).

Having accepted the principles of Organization Learning (OL) as a KMI in section 2.9, it was identified from the data that building an environment where learning and education happen as a matter of course had the potential to directly affect the bottom line. A study by the University of Michigan and Hay Management Consultants was quoted which found that organizations providing a week or more of educational opportunities for their employees each year had significantly higher profits than those companies which chose not to do so (Francis and Mazany 1996). Better educated workers were found to set more challenging goals for themselves and those with longer periods of employment with the same employer would be less inclined to leave, thus enhancing human capital for the organization (Weisberg 1996). These were examples of quantitative measures of learning (days of training and years of education) that were seen to lead to identifiable organizational benefits.

Qualitative measures of training effectiveness were also used in 1996. It was generally accepted that training as an element of OL (and thus KM) was concerned with equipping managers with the requisite knowledge, skills and also attitudes, as determined by job and role requirements, for effective job performance (Loan-Clarke 1996). This generated pressure to develop effective evaluation models to determine the effectiveness of training programs. Although such model had been around for a number of years prior to 1996, they appeared to be gaining considerable interest around this time as a result of this growing pressure. Kirkpatrick's model (1967) for example (as cited in Loan-Clarke 1996) advocated the need to measure the effectiveness of training at four different levels, reactions, learning, job behaviour and organizational change. Major surveys of evaluation activity indicated that Kirkpatrick's model was only being applied to any great extent at the first level, that of the individual trainee perceptions

¹⁰ such as the examples offered in Table 1

and reactions. In the UK, the "Training in Britain" survey conducted in 1989, found that 90 per cent of organizations used this reaction level of evaluation, but only 19 per cent attempted to evaluate training in terms of benefits to the organization (Loan-Clarke 1996).

Some researchers examined the relationship between training and productivity, and discovered that measures of training effectiveness were largely subjective up to this time. Black and Lynch (1996) for example, recognized that although the main problem with subjective measures of productivity was that they were not comparable across firms or even within firms over time, they concluded that employer provided training raised the subjective productivity measure by almost sixteen percent. This type of research seemed to have the effect of increasing the acceptability of subjective measures in general, which were only beginning to be accepted at this time.

Measurement of the ability to learn and change was also seen as a way of tracking how well an organization was able to maintain its competitive advantage (Robinson and Kleiner 1996). At United Airlines "management by walking around" was used to foster informal information exchange, which led to more productive use of existing human capital (Robinson and Kleiner 1996).

An example of the application of human capital in "excellent" companies was the concept of the champion who was seen to persevere and fight for new ideas or innovations and drive development of new products (Robinson and Kleiner 1996). It was recognized however, that just generating new ideas was not enough for the knowledge driven organization - champions were also needed to drive and support the process to implement the new ideas and to be instrumental in the critically important process of evaluation of the initiative.

The 360-degree feedback process was gaining interest in 1996 and offered an effective tool for performance measurement facilitation. This model created a mirror that measured colleagues' perceptions of performance. Edwards (1996) found that nothing motivated human behaviour more than the esteem of colleagues and this information was given high credibility. The 360-degree feedback process supports continuous learning (a KMI) because it not only targeted developmental areas but also sustained interest and motivation to improve in those areas. Some organizations like Florida Power and Light, Federal Express, The Royal Bank of Canada, and IBM used variations of this model for creating very effective succession planning processes (Edwards 1996). These factors were recognized as important elements in retaining human capital. It was

discovered that the 360 degree feedback model made better performance possible because it enhanced information and knowledge quality, provided specific performance feedback, targeted developmental areas, provided strong motivation, facilitated performance improvement, allowed measurement of training effectiveness, enhanced self knowledge, supported continuous learning and improved the reliability and validity of performance information (Edwards 1996).

One of the more unusual aspects of human capital measurement that was quoted in 1996 was that of assessing the ability of employees to cope with stress and pressure. Zea et al. (1996) quoted the Behavioural Attributes of Psychosocial Competence scale to measure competent coping. This showed some diversity of thinking in human capital evaluation models that were being considered at the time.

Internal Infrastructure (I)

Robinson and Kleiner (1996) stressed the value of IC to human resource development in that once meaningful measures had been developed for IC (and thus KM), it was found to be possible to measure the effectiveness of programmes designed to increase the amount of IC. The focus on the amount of knowledge and IC that existed in the organization as opposed to its effective use was prevalent at the time.

The IDEO company deliberately created a culture dedicated to innovation by hiring the right people, banning bureaucracy, using mentors and small teams and adopting environments conducive to idea cross-fertilization (Robinson and Kleiner 1996). This was an example of creating the right environment within which knowledge creation could be nurtured rather than trying to value knowledge itself. Another example was provided by Kaplan and Aronoff (1996) who found that no measurement system had been devised prior to 1996 to calculate the productivity benefits of a high-quality office environment, despite the fact that many organizations were sufficiently convinced of the importance of the work setting and had invested heavily in it. Steelcase Corporation, Chrysler Corporation, and Digital Equipment were used as examples of organizations that had all built multi-million dollar facilities designed around the concept of providing work settings tailored to the tasks of the occupants in the form of being conducive to learning and collaboration (Kaplan and Aronoff 1996). Although there were no studies that could reliably predict the returns on such facility investments, there was sufficient compelling (albeit subjective and anecdotal) evidence to support the notion that a better work environment promoted better organizational performance.

Intellectual Property (IP)

No data.

Market Intelligence (M)

Chenhall (1996) quoted a case study of an electronics firm which found that being evaluated on factors such as how often they were first to market with new products and the time it took to design new products helped them develop a culture of fast response. This was an example of using Market Intelligence metrics to improve the organizational learning and innovative culture.

A report by the Institute of Management stressed the need for organizations to make the link between investment in management development (learning) and long-term competitiveness (Davis 1996). Although this association between competitiveness and learning was accepted, the Institute of Management did not specify how or to what extent investment in learning improved market position.

It was found that firms that had higher skill levels were more highly valued in the marketplace provided they could use this capital to create value (Robinson and Kleiner 1996). Merger and acquisition specialists in 1996 regularly put a market value on this know-how to the extent that it provided a competitive advantage (Robinson and Kleiner 1996), but once again, whilst a connection was established between an element of IC (skill level in this case) and market value, no guidelines were available for organizations to calculate the strength of this connection.

Another useful measure was found to be the ability of organizations and their members to learn and adapt to a changing market environment (Robinson and Kleiner 1996).

Innovation (N)

Whilst there was a growing interest in innovation in 1996 that was being increasingly highly regarded as an intellectual asset, measures tended to focus on the impact of innovation on the organization rather than the value of innovation itself. A case in point was GE who had an interesting term for innovation, which they called "Vitality" which was a measure of the number of new products that had been introduced within the previous five years (Davis 1996). Increasing emphasis was being given to innovation as a significant component of "Balanced" corporate measurement systems which integrated customer satisfaction, process quality, innovation and financial

performance¹¹ (Davis 1996). Justman and Mehrez (1996) found that many firms accumulated knowledge over time by investing resources into projects designed explicitly to improve innovation and innovative capacity.

According to Robinson and Kleiner (1996) some firms were better at value creation than others because of their IC in the form of process development, know-how, problem-solving skills or ability to innovate. The measure of innovative activity in these cases was specified as the level of value that the innovative initiative generated for the firm, but no examples or guidelines were offered in the literature to explain how this cause and effect relationship should be approached or evaluated. IDEO, a contract R&D firm mentioned previously under Internal Infrastructure, was an exemplar of a firm that considered innovation to be its greatest strength and created a culture dedicated to innovation (Robinson and Kleiner 1996) but again this example did not explain how to measure these attributes of innovation.

No models appeared to be available at the time to measure the level of investment required in innovative capacity, the effectiveness of the process to generate the innovative capacity or in the effectiveness of outcomes derived from innovative initiatives.

Process (P)

The BPR of the early nineties had the effect of moving organizations from hierarchical to process driven modes of operation (Mortlock 1996). This had a significant impact on the evaluation models in use at the time and was instrumental in the development of process based KM measurement models. An example used by GE was a type of root cause analysis which, on the surface, appeared to be a knowledge acquisition endeavour, but proved to be a process that focussed on the effective utilization of labour resources. The primary scorecard measures that were targeted were equipment downtime, daily production rates, and overtime usage (Davis 1996) and process cycle and setup times (Chenhall 1996). These were clearly quantitative measures with little learning component. The only knowledge component in these initiatives was that the causes of these problems were identified and tracked and this “knowledge” was recorded in a variety of information and knowledge bases. This indicated that measurement models were more focussed on the outcomes of processes rather than on the efficiency and effectiveness of the process itself.

¹¹ See Composite Measures in 1996 for further discussions.

Kruzner and Trollinger (1996) established that, as companies concentrated on core competencies (a KMI as identified in 2.9), performance of key operational processes became paramount. Performance measurement was the means for making informed knowledge-based decisions about important business issues such as minimizing operational costs, manufacturing the right mix of products, identifying the most profitable distribution channels and optimising the utilization of assets (Kruzner and Trollinger 1996). Measuring performance was also a means of identifying and addressing areas where a company needed to make the kinds of organizational and process improvements that could develop, sustain, and amplify competitive advantage over the long haul such as using new knowledge-harvesting capabilities to systematically determine what products to produce, what assets to deploy, and what processes to change for long-term competitive advantage (Kruzner and Trollinger 1996). The generation of actionable organizational knowledge was found to result from leveraging this process performance oriented data.

Measuring the effectiveness of teamwork processes was popular in 1996. Four measurement techniques which sought to capture in different ways the effectiveness of workshops and thus contribute to the organization knowledge base were described as: meeting defined workshop objectives, measuring change in team functioning, participant evaluation, and job performance (Francis and Mazany 1996). It was recognized that valuable knowledge about the organization could be held at a number of different levels within and external to the organization by individuals, teams, groups, external consultants and even governments. Evaluation of external knowledge generation processes however was not conducted.

Feedback was seen to be advantageous to developing an understanding of decision making processes, identifying problems and opportunities for improvements and integrating both market and cost-based strategic priorities (Chenhall 1996). Feedback from explicit measures of the manufacturing process were found to assist in clarifying goals and expectations and when they formed part of the performance evaluation of managers, they would assist in motivating managers to achieve objectives.

Quality (Q)

IBM in the UK used the Baldrige self-assessment quality management and evaluation model to create an image and culture of being a quality organization (Mortlock 1996). Self-assessment was an important component of this quality management system and was gaining in popularity at the time as a means for an organization to learn about itself. Measuring quality was also being recognised as an opportunity to learn about internal

processes and customers' needs as well as an opportunity to improve production processes.

Parallels between commercial and medical organizations were identified by Miller and Adam (1996) who found that measuring quality and productivity was a major issue in the healthcare industry since traditional accounting practice did not reflect the complexity of the actual organizational constructs.

Composite Measures (X)

GE was an early and keen user of the Balanced Scorecard (BSC) as a means of providing a holistic picture of its performance (Davis 1996). GE's approach to the use of the BSC integrated customer satisfaction, process quality, innovation and financial performance and it was seen to be essential that the scorecard be "decomposed" into measures that were meaningful to lower level employees at the shopfloor level (Davis 1996). This led to the development of a set of measures that were tailored specifically to different employee groups to maximise understanding and action by those who were accountable for the performance of the function being measured. Generally, financial objectives at GE took precedence at the top, while production volume, quality and service objectives had the highest priority at the frontline employee level. This action highlighted the importance of communication of relevant understandable performance results to the most appropriate levels within the organization.

OXY USA and other organizations (such as McDonnell-Douglas, Intel, and American Airlines) used multi-source assessment as a type of composite measurement system that provided examples of targeted employee development designed to enhance major performance areas with the highest profile needs (Edwards 1996). Other examples such as the US Department of Energy and Motorola began using composite type measurement models to assess the effectiveness of leadership development and performance management initiatives (Edwards 1996). Users at AlliedSignal, Meridian Oil and DuPont noted for example that the 360-degree feedback model provided better information than the existing performance appraisal processes that prevailed at the time (Edwards 1996).

4.3.2 1997

Number of patents, sales, profits and expenditure on R&D were the main financially based measures for organizational innovation. Management performance, leadership development, employee attitudes, collaboration and teamwork effectiveness were

beginning to be measured in connection with KMIs and direct relationships between quality improvement and financial improvement were being established.

Customer (C)

No data.

Financial (F)

Financial expenditures on research and development (R&D) as a percentage of GDP were used as measures of competitiveness and as indicators to the creation of technology that contributed to innovation and the development of successful products in the global marketplace (Leal and Powers 1997). Investment in IT, which was fairly easy to quantify, was used as a convenient surrogate measure for innovative capability (Leal and Powers 1997). However, the strength of the correlation between IT investment and innovative capability was not established.

Financial measures of KMIs in 1997 tended to relate to measuring the effectiveness of quality improvement programs and included mostly surrogate metrics such as net profit as a percentage of sales, return-on-assets for the past year and for the average of the past three years, as well as sales growth as an average of the past three years (Adam, Corbett et al. 1997).

Human Capital (H)

Jubb and Robotham (1997) examined the performance of managers in the workplace prior to 1997 and concluded that there was no single measure that was capable, by itself, of assessing their performance. Abdul-Gader (1997) found that knowledge workers' computer experience, typing skills, number of communication partners, and perceived voluntariness affected their level of satisfaction, productivity, and use of systems, thereby highlighting the importance of human perceptions and attitudes regarding the efficient and effective use of organizational tools. Measuring these employee perceptions and attitudes was being recognized as a challenge but a necessary and worthwhile KMI evaluation activity.

The University of San Diego School of Nursing conducted a continuous 4-year evaluation cycle which was regarded as a major component of its learning objective (Clark 1997). The curriculum committee and the School of Nursing Faculty identified the evaluative questions to be addressed, delineated the standards to be used, and specified the sources and modes of data collection to answer the questions posed (Clark 1997). Data regarding program performance were then compared to the established

standards, discrepancies were identified, and recommendations for eliminating discrepancies jointly developed by the evaluator and the client (Clark 1997).

Internal Infrastructure (I)

Organizations were introducing computer mediated communication systems (CMCS) to their employees as means of improving office productivity and communications (Abdul-Gader 1997) and therefore learning. Such systems included messaging and “teamware” and formed the means by which employees could collaborate and work together.

Measuring degrees of collaboration between employees presented another challenge but was considered to be necessary in order to measure the effectiveness of CMC systems that were becoming to be regarded as “knowledge enabling tools”.

Intellectual Property (IP)

Patents were seen to be proxy measures of the output of R&D activities in the form of inventions and, as well as other measures of innovative activity, were found by Leal and Powers (1997) to be referenced in the literature as popular surrogates for innovation in society.

Market Intelligence (M)

No data.

Innovation (N)

No data.

Process (P)

Insufficient detail was provided in the cases found for meaningful analysis.

Quality (Q)

Studies suggested a relationship between quality improvement and financial improvement (Adam et al. 1997). The major factors that were found to influence quality were the organization's knowledge of quality management and management's involvement with a comprehensive approach to improve quality which was characterized by customer focus (Category C), a continuous improvement philosophy (Category N) and teamwork (Category H).

The popular statistical analysis and problem solving approach to quality management prior to 1997 was starting to give way to the use of management processes, including a spiral of continuous improvement and quality project teams (Adam et al. 1997). In

addition, behavioural approaches and management attitudes were beginning to be recognized as crucial to quality improvement and thus needed to be evaluated somehow.

Adam et al. (1997) established that the literature at the time suggested that many productivity improvement techniques and measurement systems were used in tandem with quality improvement approaches to achieve improved operating performance. Items such as traditional industrial engineering process analyses and work measurement, inventory reduction, employee selection, decentralizing decision making, and providing objective feedback on performance were gaining in popularity with performance quality being influenced by obtaining knowledge about quality improvement, focusing on customers, and management involvement (Adam et al. 1997).

Composite Measures (X)

No data.

4.3.3 1998

Human Capital based measures emerged as the most dominant metrics for KM/IC evaluation during 1998, marginally ahead of customer related measures whilst financial and process related measures seemed to be losing favour. It was recognized that new measurement models were necessary for intangible assets to supplement rather than replace existing measurement systems. Work experience, training and employee satisfaction and attitudes were popular focal points for human capital measures. Employee empowerment was recognized as a form of IC and skills and competencies were being recognized. Image and reputation were valued as well as the degree of company uniqueness in the market place. The value of brands was appearing on balance sheets and organizational learning was being directly connected to financial results. A mixture of quantitative and qualitative approaches to KM measurement was emerging.

Customer (C)

Organizations in 1998 were found to be just as likely to have stated and measured KM objectives covering customer relations and people-related issues as they were to report on profit and profitability improvements (Thompson 1998). This is supported by the graph in Figure 8 in section 4.2.3. Thompson recognized the apparent trade-off between customer and financial orientation in relation to measuring KMIs. Appelbaum and Reichart (1998) also recognised that managers needed a balanced presentation of both financial and operational measures with operational measures focusing on customer

satisfaction, internal processes, and the organization's innovation and improvement activities.

Frequency of repeat orders was seen as an appropriate objective measure or indicator of customer satisfaction and whilst Kennedy (1998) believed that it was difficult to prove causal impacts on company performance, he also maintained that customer attitudes could be successfully measured with polls, questionnaires and surveys over time. Attempts were also being made at the time to judge the extent to which customer satisfaction was growing over time (Kennedy 1998).

A well-recognised and positive public image and reputation was found to improve the admiration rankings; and, correspondingly, linkage with a major corporate mistake or mishandled crisis had a negative effect, especially if social and ethical responsibilities were involved (Thompson 1998). It was noted for example, that Microsoft, General Electric and Coca-Cola, had highly respected strategic leaders and this in itself was seen to enhance the IC of these organizations (Thompson 1998). There were no models however to evaluate this component of IC, just a binary perception of whether the organization was seen to be respected or not by their respective existing and potential customer bases. It was found that corporate reputations were significant components of IC that created economic value, and that image, because it embodied the company's uniqueness, was a key competitive tool (Thompson 1998).

Figure 8 shows that 1998 was the peak year for customer related measures of KM while human capital measures were beginning their significant relative growth path, apparently in preference to financial measures at the time. Although Kennedy (1998) found strong associations between strategies and tactics associated with better KM and a variety of measures of company performance such as customer satisfaction, he found the signs of progress with respect to more systematic management of knowledge less than encouraging.

Financial (F)

Following on from the pressures encountered in 1996, the IC school continued to exert pressure on existing accounting and measurement practices. The gradual shift in labour categories for example, called into question the effectiveness of historical cost-based measures in an information-intensive environment (Kennedy 1998).

A plethora of financial performance measures were used to help evaluate the relative success and progress of a business. These measures included, for example, ratios such

as return on capital employed (ROCE) and return on shareholders' funds (ROSHF), earnings per share (EPS), the share price itself and the price to earnings (PE) ratio (Thompson 1998). There was no suggestion that financial measures should become less important, but it was generally accepted that new models were necessary in order to evaluate intellectual assets with a view to supplementing and augmenting rather than replacing existing financial measures. Although still largely financially based, Economic Value Add (EVA), which compares a company's after-tax operating profits with its cost of capital, was emerging as a valid measure for the new economy. Furthermore, companies were increasingly including their brands as balance sheet assets and were, often for the first time, attempting to place a value on them (Thompson 1998).

A major barrier to the development of new models at the time was that, although most practitioners argued that the point of metrics was to provide a framework to measure the success or failure of a KM initiative, for senior executives, the reality was that measurement systems needed to offer the means to justify the expenditure of resources in the first instance (Skyrme 1998). It was becoming obvious that different stakeholders needed different measures.

Human Capital (H)

Most human capital studies measured work experience in terms of tenure, defined as years in a job, years in an organization, or years in a position or the number of times an individual had completed a certain task or operation (Tesluk and Jacobs 1998). New measurement models however were emerging to assess skills and competencies of workers; technology-assisted communication links were being developed that aimed to improve feedback and communication across operating divisions and across hierarchical boundaries (Wurzberg 1998). Technology assisted communication tools were seen to enhance the collaborative work environment and thus contribute to teamwork and innovation (Bal, Wilding et al. 1999).

Between 1995 and 1998, all specialty chemical division employees at Honeywell received 40 hours of annual training in the use of a Six Sigma continuous improvement process (Harrold 2000). The result was that productivity improved 4.7% annually and added \$2 billion in measured savings to Honeywell's bottom line (Harrold 2000). With respect to the more qualitative components, studies on managerial development found that certain types of experiences, such as assignments that required change implementation or involved a high level of responsibility were related to learning the skills and acquiring the knowledge and insights that were critical for effective executive performance (Tesluk and Jacobs 1998). Human capital and its impact on organizational

performance was tending towards a mixture of quantitative and qualitative measures that were seen to be more visible than in the case of financial measures alone.

A highly qualitative KM evaluation example from the medical profession recognized that three behaviours were required on the part of clinicians in order to enhance individual empowerment and the provision of effective healthcare: ability to evaluate one's own knowledge and skills for practice, an awareness of resources available for development of new competencies for practice, and a willingness to engage in this self-assessment (Oermann 1998). This approach closely matched Senge's (1990) disciplines of personal mastery and mental models in connection with learning organizations.

Adding weight to the qualitative argument for KM evaluation, Thompson (1998), established that satisfied employees were productive, and productive employees were essential for financial success. He also suggested, on the basis of empirical research, that employee satisfaction depended on compensation schemes and rewards, the culture of the organization, the prevailing style of management and job design and responsibility. Organizational culture and management style were common themes in the literature that were seen to impact the organization's approach to knowledge itself, its management and its measurement.

Internal Infrastructure (I)

A 1998 conference on creating and leveraging IC reported that most corporate initiatives to manage IC were focused on specific projects, the most common of which deployed technology to share and leverage knowledge and best practices (Pfeffer and Sutton 1999). Much of this knowledge and IC was in the form of facts, statistics, canned presentations, stock of knowledge, the number of patents, the compilation of skills inventories, and knowledge captured on overheads or reports and made available over some form of groupware (Pfeffer and Sutton 1999). This explicit knowledge is owned by the organization and thus forms part of its internal infrastructure.

Whilst there was increasing recognition that organizations needed to learn how to learn, Appelbaum and Reichart (1998) found that it was difficult to find examples of true learning organizations. Skip LeFauve was president of the Saturn project for much of its history and was in charge of the General Motors University, the intention of which was to take the lessons from the Saturn project and the best practices and knowledge from throughout the company and diffuse them throughout the organization (Pfeffer and Sutton 1999). Dissemination of best practice was becoming a common objective for

KM projects but as with other examples, the evaluation of the effectiveness of such projects created a major measurement challenge.

Intellectual Property (IP)

Wurzburg (1998) suggested that there was substantial anecdotal evidence of companies adopting strategies and tactics that included more systematic management and measurement of intellectual property such as patents and copyrights. However, this seemed to contradict the results in Table 9 in section 4.2.3 which shows IP at only 3.8% of KM measurement at the time and on a downward trend.

Market Intelligence (M)

Appiah-Adu and Singh (1998) established a positive correlation between market orientation and innovation¹² by explaining that the relevance of innovative activity by an organization is a reflection of the transformation of modern market environments in which new product development and differentiation have become important aspects of the business development of many firms. Regardless of whether market related metrics were used to value innovative activity as an element of IC or to evaluate an innovation generation activity as a KMI, they included measures of organizational competitive intensity and market dynamism (Appiah-Adu and Singh 1998), as well as market share and share price (Thompson 1998).

Understanding the competitive environment was becoming an important KM initiative by virtue of the ever increasing market pressures imposed by a global economy and its organizational learning perspective. Appiah-Adu and Singh (1998) found market related metrics that enhanced the organizational knowledge base by evaluating the threats posed by a business environment, as well as the behaviour and the ability of competitors to be distinctive. An evaluation method for market awareness was implemented by examining business performance over a three-year period relative to the main competition, using new product success rate, sales growth and Return on Investment (ROI) (Appiah-Adu and Singh 1998).

Innovation (N)

Innovation as a component of an organization's IC was the most important factor for organizational growth (Thompson 1998). Innovation, supported by learning, was seen to underpin customer care and service, and while it was found to be difficult to measure objectively, it was also recognised that attempts could be made to judge the level of

¹² Note the connection between innovation and KM in section 2.9.

innovative activity within the organization and the extent to which it was growing over a period of time (Thompson 1998).

Appiah-Adu and Singh (1998) found that a high degree of emphasis on innovativeness tended to be linked with a higher level of customer orientation because the commitment to innovation forced a firm to become externally focused and thus, more customer-oriented. This customer orientation was supported in this study by a high level of customer oriented measurement models that were in use in 1998 but was not supported by a correspondingly high level of innovation based metrics. The correlation between customer orientation and innovativeness claimed by Appiah-Adu and Singh (1998) was thus not supported by the findings in this study.

Process (P)

Process measurements were being established for all the important processes in the company. According to Eskildsen (1998), when process changes were suggested, all the relevant people were involved, knowledge and experience on “best practice” was shared with all colleagues in the company and the company motivated employees to be innovative in their work. Eskildsen however, also believed that goal setting and performance evaluation were weaknesses as there were insufficient process measurements available at the time. This is supported by Table 9 which shows a significant reduction in the use of process oriented measures in 1998 compared to the previous two years, perhaps in recognition of the fact that process based measures had not moved with changes in the knowledge based economy.

Quality (Q)

No data.

Composite Measures (X)

It was well understood in many large organizations at the time that no single measure could provide a clear performance target or could focus attention on all the critical areas of business (Appelbaum and Reichart 1998). The trend towards using a "balanced scorecard" approach recognizing the emerging importance of non-financial measures of KMIs such as organizational learning programs, was gaining momentum. Organizations that were able to create and use a set of measures that tied financial results to their learning management activities seemed to be coming out ahead of others according to Appelbaum and Reichart (1998). It was recognized that operational measures provided the drivers of future financial performance and that they should focus on a combination

of customer satisfaction, internal processes, and the organization's innovation and improvement activities (Appelbaum and Reichart 1998).

4.3.4 1999

Evidence was emerging of organizations jumping on the Organizational Learning and KM “bandwagons” without a clear understanding of what was involved or how to measure the effectiveness of new knowledge oriented initiatives. More effective learning about customers however, was becoming an important element of customer satisfaction surveys. Sales, profits and Return on Investment (ROI) were the main financial measures for KM whilst employee retention, knowledge and leadership skills and effectiveness of mentoring programs were being implemented under human capital evaluation. Generative rather than adaptive learning was being valued and measures of organizational culture were being developed. Knowledge about patents rather than just the number or value of patents was becoming valuable and the effectiveness of knowledge transfer mechanisms was studied. Measures to assess the degree of market orientation of the firm resulting from KM initiatives were emerging.

Customer (C)

Li and Cavusgil (1999) established that most measures of market orientation prior to 1999 were more reflective of cultural norms or customer satisfaction using examples such as, customer commitment, creating customer value, measuring customer satisfaction, and after-sales service. Learning about customers in 1999 generated knowledge that allowed firms to explore innovation opportunities arising from emerging market demand and reduced potential risks of misfitting customer needs (Li and Cavusgil 1999). Measures prior to 1999 tended to examine only one aspect of customer learning, that of information acquisition, which whilst necessary, only focussed on a narrow perspective of KM. Other aspects, such as the value of information processing, were not evaluated (Li and Cavusgil 1999). Learning from competitors and assessing the contributions of this initiative to the organization was recognized as being just as important as learning from customers.

Financial (F)

The Department of Trade and Industry (DTI) in Victoria Australia, attempted to prove the relationship between profitability and use of business expertise as part of their Continuous Improvement initiatives but found this to be an extremely complex and difficult exercise (Bryson, Daniels et al. 1999). Other organizations were also experimenting with intangible measurement models but few seemed to

be able to convert these experimental efforts into sustainable workable models (Mohanty and Deshmukh 1999; Pfeffer and Sutton 1999). This failure and disillusionment may have contributed to financial measurement models for intellectual assets regaining some of the ground that was lost in the years prior to 1999¹³.

Bryson, et al. (1999) conducted a study to measure the effectiveness of external consultants which was seen to be a popular means of “buying” external knowledge in order to enhance IC. The measurable organizational impacts of this study took three years to develop. This highlighted another major barrier to KM evaluation in the form of long lead times between investment in relevant initiatives and the ability to identify and measure their results. Bryson, et al. (1999) identified that the most important change to occur in the company being studied was the one which they felt could not be measured; it was now open and receptive to new ideas and outside influences and thus enhanced the environment within which knowledge could be generated, disseminated and used. As part of their implied KMI, the company was actively looking for ways to improve, as well as trying to develop new products by listening to its customers as well as trying to learn from its competitors.

Human Capital (H)

A series of studies prior to 1999 had theoretically proposed, but not empirically demonstrated, that a firm's learning orientation was likely to indirectly affect organizational performance by improving the quality of its market-oriented behaviours and directly influencing organizational performance by facilitating the type of generative learning that led to innovations in products, procedures, and systems (Baker and Sinkula 1999). Increasing interest was being shown in how an organization learns through its employees.

Freeman (1999) found that formal performance measures for staff were tied to the level and quality of participation and that the lack of formal performance metrics was largely due to the perceived difficulty in quantifying the ongoing effectiveness of the collaboration process. Whilst on the one hand attempts were being made to adapt existing quantitative measures, others were experimenting with new qualitative measures.

Shaw et al. (1999) examined levels 2, 3, and 4 of Kirkpatrick's training evaluation framework mentioned in 4.3.1, where the aims of training evaluation included assessing

¹³ See Table 9 section 4.2.3.

whether a change in learning or behaviour had occurred; whether the change could be attributed to the training rather than to other causes; and whether the magnitude of the change was worth the effort and expenditure of providing the training. Shaw et al found that determining whether a change had occurred normally required both a pretest and a posttest, and that examples of effective implementation of these had been extremely rare in assessing the impact of organizational behaviour teaching methods up to that time. As also established by Loan-Clarke in 1996, the most common assessment of training took the form of the simpler approach of assessing self-reported proficiency (learning criteria) at the start and end of the course (Shaw et al. 1999). Little appeared to have changed in measuring the effectiveness of training since 1996.

Gabris et al. (1999) conducted an empirical study on Leadership Credibility (LC), the enhancement of which can be argued to be a KMI within the context of section 2.9. Items measured were communication of vision, communication of the rationale behind the vision, sharing the vision, delegation of authority and power, practicing what was preached, following through on promises and recognition of good performance and rewarding it. These measurement parameters focussed on organizational culture which was becoming a critical factor in the development of KM and its evaluation, but again, measuring the impact of these parameters proved problematical.

While Gibb (1999) found that formal mentoring programs were very popular, there was little critical analysis of their relative successes and failures, and little theoretical exploration of the whole area at the time. An evaluation of a pilot mentoring scheme showed that most mentors and trainees had valued their participation in the process but had no means of measuring any specific benefits (Gibb 1999).

Despite the general low level of externally oriented measures being conducted at the time, Bryson et al. (1999) established that the use of externally acquired expertise was strongly related to the education and personality of the CEO. Personality however, was found to be a factor that was difficult to measure without using sophisticated psychological tests and it was precisely these types of tests which had not yet entered the sphere of KM evaluation. One indication of the importance of senior management personality was displayed by a company that did not use external advisers because the owner considered such expertise to be of limited value. An analysis of the education qualification of the CEO in relation to the use of external advisers revealed that managers with higher qualifications (MBA or other Professional Qualification) were more likely to consult external experts (ie to buy external knowledge) than managers with only secondary level school education (Bryson et al. 1999). Acquiring external

knowledge is one way of building the corporate knowledge base and increasing the value of IC.

Internal Infrastructure (I)

A study by Gardiner (1999) aimed to measure the extent to which a learning orientation had been achieved in two organizations who regarded themselves as “learning organizations”. A learning orientation is closely related to, and dependent on, the culture of the organization. Research findings from questionnaires and interviews showed that neither company could claim to be learning orientated at that time on the basis of LO principles available from the literature. Both organizations had moved towards a degree of learning orientation in terms of empowerment of employees and implementation of flexible organizational structures, but neither had developed wider involvement of employees in policy making or the establishment of environmental links. It was discovered that it was difficult to implement notions of shared learning if the mechanisms for passing on, sharing and measuring information and information flows were not in place.

Fifteen different online communities (OLC's) were studied by Cothrel and Williams (1999) to measure their performance and levels of success. OLCs are related to collaborative work groups and Communities of Practice identified in 2.9. Those who possessed superior knowledge and expertise were respected and acknowledged by other members, and they played an important role in how the community evolved. These experts served as informal leaders and were essential in creating the boundaries of discussions. It was identified that effective OLCs drew new members into the committee readily as knowledge-seekers were found to go where the answers could be provided. The measurement emphasis in this case was very much on subjective rather than quantitative models.

In 1999 the Victorian Department of Infrastructure in Australia implemented a networked information infrastructure that connected all staff in its urban and regional sites (de Gooijer 2000). An explicit KM strategy was defined, and a steering committee was put in place charged with planning, implementation and overall coordination of the initiative. The problem remained of developing a performance management framework for measuring the impact of these initiatives. Thus the question: what benefit could be demonstrated by KM for the Department of Infrastructure's business, was expected to be resolved by designing a performance management framework that measured KM outcomes. These outcomes included increased collaboration within the Department and with its stakeholders and project partners, improved information sharing amongst staff

and with stakeholders, faster response to the changes in the Department's external environment, and better coordination of development projects under the agency's responsibility. An extensive review of organizational practices in measuring KM initiatives had failed to surface a model that could be directly applied to the Department. Three approaches offered pragmatic ideas that provided a basis for evaluation: a KM map, based on the structure of an information ecology framework that considered the whole of an organization's culture, structure and processes; tacit and explicit knowledge transfer processes; and the notion of sense-making as a key element in electronic work and computer-mediated communication (de Gooijer 2000).

One of the more unusual examples of a measure in use at the time was reported by Mark Graham Brown, a performance-measurement consultant based in Los Angeles who reported working with a telecommunications company whose culture expected its managers to review 100 to 200 pages of data a week (Pfeffer and Sutton 1999). What was considered to be appropriate "data" was not defined in this example. If the intention was to enhance organizational learning then the measure of the number of pages read would hardly have been appropriate. Assessing the quality and relevance of the input would have been far more appropriate than quantity.

Intellectual Property (IP)

The prevailing view of knowledge taken by many consultants, organizations, and management writers at the time was of something to be acquired and distributed and something reasonably tangible that could be measured by way of (for example) number of patents (Pfeffer and Sutton 1999). Measurement of knowledge as intellectual property or assets was advocated as an important component of management control systems for future organizations (Armistead 1999). Armistead added that, in order to adequately protect intellectual property it was necessary to conduct a detailed knowledge analysis to place a value on it.

Although Wurzburg (1998) claimed that there was substantial anecdotal evidence of companies adopting strategies and tactics that included more systematic management of intellectual property in the form of patents and copyrights, Table 9 shows minimal interest by organizations in this type of measure for KM initiatives.

Market Intelligence (M)

Although Prahalad and Hamel identified that market and functional integration were core competencies in 1990 (Li and Cavusgil 1999), measures for the market attributes in

particular were still evolving in 1999. Market Intelligence measures in use in 1999 focused on behavioural processes of market learning instead of focussing more on organizational culture norms and value systems which were customer related measures identified by Li and Cavusgil (1999) as being more appropriate. Effectiveness of performance, the success of a business' products and programs in relation to those of its competitors in the market was measured by such items as sales growth in comparison with that of competitors or changes in market share (Baker and Sinkula 1999).

Although learning activities in relation to market and competition had received some attention up to this time, measures were restricted. For example, only one item was retained for competitor intelligence and it did not assess competitor learning directly (Li and Cavusgil 1999). The interpretation mode was measured by questions dealing with the degree of systematic analysis of competitor information. Learning about competitors enabled a firm to understand weaknesses and strengths of rivals, and to create benchmarks for new product development (Li and Cavusgil 1999). In an examination of market information processing, market knowledge competence was found to be an organizational core competence but figure 8 in this study does not support this as the focus at the time seemed to be more on specific customer knowledge than on general market knowledge.

Innovation (N)

Freeman (1999) identified that the transition to a knowledge-based economy was creating unique organizational challenges - specifically how to organize and manage people and resources in order to optimise their knowledge generation and innovative capacity. What Freeman was looking for was synergies of the algorithm for applying best practices to organizations, and the metrics for measuring progress and diagnosing problems on the way to becoming truly innovative, although he found that there were limited formal measurement systems to assess the effectiveness of individuals in their propensity and effectiveness in innovative behaviour.

The Kirton Adaptation-Innovation Inventory (KAI) model, originally published in 1976 was designed to measure propensity to innovate versus propensity to adapt - a personality dimension which was claimed to be significant for understanding and building organizational effectiveness (Bobic et al. 1999). Bobic, et al. established that the KAI model was still a valid measure of innovativeness in 1999, and that it could be an important human resource management tool for composing the makeup of work forces. Innovativeness was measured by the degree to which standard practice had not been relied upon (Bobic, Davis et al. 1999). In another case, the quantity of innovation

was defined as the number of new ideas generated with the quality of innovation being related to the idea's usefulness (Cady and Valentine 1999). Cady's research suggested that as the quantity of ideas generated within an organization increases, the quality decreases.

Process (P)

Ahmed (1999) identified different stages of measurement where the first was almost entirely financially based and the second stage characterised by non-financial measures. These stages applied to KM as well as to other organizational performance evaluation. Characteristically these measures were related to manufacturing strategy and to operational processes that facilitated decision making for managers and workers and fostered improvement rather than just monitoring performance and change within the dynamics of the market place (Ahmed 1999). Ahmed also established that investment in KMIs such as process improvement lead to pay-backs and impacts on future financial performance and that the drivers which underpinned the knowledge performance measures such as teamwork, learning, communication, knowledge processes, tools and techniques etc. required non-financial performance measures to ensure that adequate progress was being made.

Armistead (1999) maintained that all activities within an organization could be described in terms of processes and the inputs and outputs of processes could be described and, to varying degrees, measured. The origins of the process-based view of the organization (business process management) are predominantly operational and predominantly concerned with managing flows of material, people or information. Measuring the flow of information is a KMI within the definition described in 2.7. When General Motors became more serious about implementing lean and flexible manufacturing principles, attention switched to enhancing measures of intermediate outcomes and in-process indicators (Pfeffer and Sutton 1999) which enhanced the learning opportunity from the measurement process.

Buckmaster (1999) found that traditional process measurement systems of non-profit organizations had been characteristically low in complexity prior to 1999, focusing mostly on such constructs as inputs and outputs, with a view to evaluating efficiency and effectiveness. This highlighted that very little consideration had been given to KM evaluation in non-profit organizations prior to this time.

Quality (Q)

Process improvement focused on attempts to change practices to be more responsive to customers and to improve performance in quality, time, speed and reliability, while reducing production costs (Armistead 1999). Approaches emerging in quality management and lean manufacture, tested across a range of manufacturing and service sectors, demonstrated that changing practices to manage process and activity flow could bring about radical improvement in specific performance dimensions (Armistead 1999). Measurement of the effectiveness and efficiency of the flow was an integral component of these changing practices which enhanced the organizational knowledge in relation to internal processes.

Kathuria et al. (1999) developed a framework that took into account the importance of aligning systems for manufacturing, planning, and control, as well as for quality management with the manufacturing strategy of the company. Their framework suggested that an IT application for example, should be aligned with both the competitive priorities (cost, quality, flexibility, delivery, etc) and the process structure of an organization in a manufacturing environment. This enhanced the Armistead study of management and measurement of process flow into the strategic domain. A strategic focus is consistent with the objectives of quality and knowledge oriented organizations.

Composite Measures (X)

No data

4.3.5 2000

Increased relative use of human capital oriented metrics indicated that Human Capital measures were consolidating their position as the most important form of KM/IC evaluation. Improvements in customer retention were seen as indicators of effectiveness of organizational improvement initiatives. Whilst financial measures for intangibles still lacked a cohesive model, the degree to which the organization had achieved its vision was being recognized as a useful indicator of effectiveness of the vision in driving the organizational culture. Competencies in communication, measures of ability to learn and uniqueness of an organization's knowledge capital were gaining momentum. It was recognized that the KM/IC measurement systems needed to be consistent with the business strategy. Whilst IP rights and trade secrets were being recognized for accounting purposes, benchmarking was becoming an important means of gaining knowledge about the competition the positioning of the organization in the market place. Measures for innovation were still crude whilst more qualitative

measures of quality were emerging. More composite models of KM evaluation were being developed to challenge the Balanced Scorecard.

Customer (C)

Most companies were still using generic measures such as customer retention, customer acquisition, customer satisfaction, and customer profitability as indicators of effective learning (Stivers and Joyce 2000). Top executives perceived customer service factors as most important, followed by measures of market performance and goal achievement (Stivers and Joyce 2000).

Financial (F)

Financial measures were still the most familiar form of measurement of IC for both external and internal decision-makers (Brennan and Connell 2000). Although financial measures allowed for a high degree of comparability between firms, their main drawbacks were that they were based on historical data and were also dependent on the continuity of existing markets for their products (Brennan and Connell 2000). Pressures were continuing to be applied on financial measures from business, government, academic and professional institutions with strongly argued cases being presented along the lines that financial measures distorted reality, and represented lagging instead of leading business success indicators (Carroll and Tansey 2000).

Common financial measures of organizational performance included profitability, return on capital, economic value-add, revenue growth, cost reduction, and cash flow (Stivers and Joyce 2000). These metrics were also heavily used to evaluate knowledge oriented initiatives as well as organizational performance.

The ICM Group Inc conducted a study on measuring IC and found that collectively, companies were still measuring under the "tangible" assets scenario (Liebowitz and Suen 2000). Second, many of the cited metrics lacked "creativity" in terms of determining the size and growth of the organization's knowledge base. Most of the metrics used were fairly straightforward and did not necessarily address the types of knowledge that produced the most value-added benefits for the organization (Liebowitz and Suen 2000). For example, metrics to determine "return on vision" were only just being developed by such companies as Andersen Consulting and was seen to be a totally different mindset than producing metrics to assess returns on investment.

EVA (Economic Value Add) and the Balanced Scorecard were two tools many companies used to improve employee performance (Zwell and Ressler 2000). While

different in methodology, it was recognized that both were still predominantly financially based and attempted to determine, measure and value the factors controlling economic performance regardless of the improvement initiatives that contributed to that performance.

Human Capital (H)

Grossman (2000) established that although senior management lived or died by numbers, they were becoming increasingly aware that if human resource management really wanted to be a business partner, it must be judged by the same standards as everyone else in the organization. In the employee area it was found that many companies captured evaluations such as employee satisfaction, employee retention, and employee productivity (Stivers and Joyce 2000) as components of IC. The Danish Trade and Industry Development Council discovered that companies that managed their own IC (of which human capital was regarded as the most valuable form) outperformed other companies (Bornemann and Leitner 2002).

Choice used its competency database for annual readiness assessments, which were used in determining current leaders' capabilities and formed the basis for selection, promotion, and succession planning (Enz and Siguaw 2000). Competence was measured by the person's confidence in his/her ability to do the job, self-assurance about personal capabilities to perform work activities, and sense of mastery regarding necessary job skills (Siegall and Gardner 2000).

Simpson House Inn, a bed and breakfast located in Santa Barbara, California, devised the "Simpson House University" as part of its training curriculum (Enz and Siguaw 2000). Whilst not defined as such by Simpson House, corporate Universities can be seen as OL or KM initiatives. The general manager developed training modules using a variety of innovative activities that promoted understanding, improved staff communication and self-understanding, and enhanced self-esteem (Enz and Siguaw 2000). The hospitality industry in general was seen to be strong on the concept of satisfied employees leading to satisfied customers (Enz and Siguaw 2000).

Consulting heavyweight Watson Wyatt completed a research project that found a correlation between human capital and shareholder value (Grossman 2000). Wyatt's evaluation system for HR included recruiting excellence, collegial flexible workplace, communications integrity, clear rewards and accountability and prudent use of resources.

Craig (2000) established that by helping healthcare employees sharpen their skills and hone their knowledge, healthcare providers kept them on board thus retaining their tacit knowledge and ensuring that patients and clients consistently received high-quality care.

Joia (2000) found that, despite being a mature capital intensive industry, the mineral processing sector depended heavily on innovation and, by consequence, on human capital, as new processes needed to be developed through the heavy use of technology. Despite not being a classic knowledge-intensive industry such as those involved in information technology and telecommunications, such companies continued to strive to develop new knowledge from that already deployed - the main characteristic of the knowledge economy.

In the competitive environment of the time, high-performing organizations had learned how to deploy human resource practices to enhance competitive advantage (Enz and Sigauw 2000). The most successful firms created a bundle of employee practices that were customer focused, were aligned with each other, and reinforced the organization's strategic position (Enz and Sigauw 2000). The five categories of HR best practices were found to be leader development, training and knowledge building, employee empowerment, employee recognition, and HR cost management (Enz and Sigauw 2000).

Empowerment was found to be a valid component of IC by a US Government body in 1998 (Hepworth 1998) but was not evaluated as such until 2000. The four psychological dimensions of employee empowerment were impact, competence, meaningfulness, and choice (Siegall and Gardner 2000). Using the same measures in a study of middle managers in a large company, it was found that low role ambiguity, strong socio-political support, access to information, and a participative climate were also associated with perceptions of empowerment (Siegall and Gardner 2000). Measures for feelings of empowerment were developed from previously devised metrics in conjunction with new measures of communication with supervisors and general relations with the company, measures of general communication/teamwork and concern for performance (understanding the larger vision) (Siegall and Gardner 2000).

Development of evaluation systems for communication effectiveness in the US was exemplified by the Conversational Skills Rating Scale (CSRS) which measured the dimensions of alter-centrism (eg., attention to partner), composure (eg., confidence), expressiveness (eg., nonverbal animation) and interaction management (eg., turn taking) (Waldron and Lavitt 2000).

Internal Infrastructure (I)

Several key organizational infrastructure intangibles such as corporate culture and environmental orientation were recognized at the time as key drivers of superior performance (Bharadwaj 2000). In general, firm-specific intangibles tended to be tacit, idiosyncratic, and deeply embedded in the organization's social fabric and history embedded in the skills and experience of its employees, as well as in its processes, policies, and information repositories (Bharadwaj 2000). A firm's knowledge capital was widely recognized as a unique, inimitable, and valuable resource (Bharadwaj 2000).

The University of Maryland Baltimore County (UMBC) reused about 30 percent of its knowledge on research projects and started a laboratory for KM to use expert systems and KM systems for capturing online expertise (Liebowitz and Suen 2000). Developing metrics and studies for measuring IC were found to help to consolidate the KM field and give the discipline further credibility (Liebowitz and Suen 2000).

Whilst successful companies were found to manage IC better than less successful firms, managers of all companies surveyed by Brennan and Connell (2000) felt that structural indicators (such as Internal Infrastructure) were the least useful of all the measures considered. This supports the graph in Figure 8 in section 4.2.3 up to 2000 at least when Internal Infrastructure seemed to gain increasing focus.

Intellectual Property (IP)

The level of organizational innovation was still being measured predominantly on the basis of the number of patents owned (Balkin et al. 2000). Whilst patent counts were shown to be related to changes in firm value, profitability, and sales growth (Balkin et al. 2000), establishing the value of each patent to the organization presented significant challenges.

IP rights at Intel were recognized for accounting purposes because an objective value of these could be attached to their costs based on actual market transactions (Carroll and Tansey 2000). However, no relationship could be found between tangible assets and present value of future benefits of IP rights (Carroll and Tansey 2000). The limitations to the use of patents in innovation research were well known at the time. These weaknesses included that industries varied widely in their propensity to publish, that much patenting was defensive and not necessarily advancing the body of knowledge, and that many companies were beginning to rely more on trade secrets than patents to protect their innovations (McMillan and Hamilton 2000). Yet, even with these

constraints, patenting activity (and publishing to a somewhat lesser extent) were found to be good indicators of knowledge creation in terms of being documented information (explicit) that had been verified by a meticulous and, in the case of patents, legalistic research process (McMillan and Hamilton 2000). Thus, even though much of the research at the time sought to move beyond explicit knowledge into the tacit area, a substantial amount of evaluation work was still being conducted in the explicit realm.

Market Intelligence (M)

Six marketing capabilities were suggested by the literature and were confirmed via managerial interviews conducted by Vorhies and Harker (2000). These capabilities or competencies consisted of six areas: marketing research, product development, pricing, distribution, promotion, and marketing management. The results of the Vorhies and Harker study demonstrated that the 43 market driven firms outperformed the 44 less market-driven firms across adaptability, customer satisfaction, growth, and profitability dimensions (Vorhies and Harker 2000). This finding supported the theoretical work in marketing regarding the competencies of market-driven firms and extended the empirical findings of the market orientation researchers beyond simple measures of performance. The Vorhies & Harker study provided insights into the importance of developing a focused market-driven strategy and provided opportunities for learning about internal processes including evaluation models which contributed to achieving a business orientation. These insights however had not yet been translated into measurement practice.

Innovation (N)

Despite the well recognized importance of innovation, its evaluation was still trapped in traditional financially based thinking. Innovation was regarded by Balkin et al. (2000) as a composite measure computed by adding standardized values of R&D spending and number of patents. As with knowledge, an organization's definition of, and approach to, innovation significantly impacted how it approached its evaluation.

Process (P)

A dichotomy appeared to be emerging between process and outcome measures of process effectiveness particularly in the provision of healthcare. Process measures of quality were being increasingly used in healthcare (Peabody et al. 2000). Linkages between the provision of care and better health status had been firmly established and there were substantiated benefits to measuring process over measuring outcomes as processes could be measured more frequently than outcomes (eg, a death or complication), did not require a lengthy interval to become manifest, and were generally

less expensive to monitor. The most common methods for measuring process included assessments of the competence of the clinician and what the clinician actually did, chart abstraction, what services were being provided, whether they were provided efficiently, and whether they led to better health (Peabody et al. 2000).

Noble and Klein (2000) on the other hand established that outcomes measurement satisfied numerous objectives including the demonstration of treatment effectiveness; identifying which treatments at what level of intensity and duration were effective for which types of patients; and permitting tailoring of treatment based on data. The Quality Model for Quality Assurance in Managed Care environments comprised four components: access, clinical care, finance and client satisfaction. These four components were measured through direct care measures of patient care and client satisfaction measures, which were statistically assessed to the cost of care and to patient outcomes (Noble and Klein 2000).

The value-creating process was becoming clearer in 2000 by virtue of understanding how knowledge was created, integrated, converted, and used (Carroll and Tansey 2000). The KM process itself was being valued in terms of results such as: acquiring a patent or trademark, enhancing organizational efficiency resulting in identifiable cost savings and subsequent higher return of investment, or improved innovative capacity measured by performance indicators (Carroll and Tansey 2000).

A project management maturity analysis methodology was developed by Ibbs and Kwak (2000) and was applied by benchmarking 38 different companies and government agencies in 4 different industries. This assessment methodology provided solid and comparative studies on project management processes across companies and industries. It also provided a set of tools for organizations to use in identifying key areas of opportunity for improvement in project management. This study was one of the few, if not the first attempt, to truly integrate project management knowledge areas and project management processes against actual project performance data (Ibbs and Kwak 2000). In doing so, this study was an important step toward a factual and quantitative way to measure the effectiveness and efficiency of project management processes and performance.

Quality (Q)

Nine measures of organizational assessment for quality (OAQ) were identified by Gilbert and Parhizgari (2000): importance of the mission, supportive policies toward the work force, appropriateness of the organizational design, working conditions, pay and

benefits, positive supervisory practices, work force loyalty and pride, operational efficacy and customer oriented behaviour. Gilbert and Parhizgari (2000) believed that such measures would aid organizational leaders in their efforts to track progress within their organizations and pinpoint specific performance measures where the greatest opportunity for internal improvement may exist. OAQ could thus be seen as a Continuous Improvement initiative as defined in 2.9. The principles of OAQ embraced an increased emphasis on qualitative measures compared to the measures employed by previous quality management regimes such as TQM.

Composite Measures (X)

The A\$72 million difference between the net book value and market value of Morgan and Banks Australia was identified as the invisible intangible part of the company balance sheet (Martin 2000). It comprised such items as employee competence in the form of expertise, education, experience, values and social skills; internal structure such as patents, concepts, models and computer and administrative systems; external structure such as relationships with customers and suppliers, brand names, trademarks and reputation and image (Martin 2000).

Sveiby's Intangible Asset Monitor (initially introduced in 1997) was used in 2000 to classify results of a major international business study into 24 selected IC indicators. From replication of Sveiby's work in Ireland, Brennan and Connell (2000) found that IC was rarely reported in annual reports and, when reported at all, lacked a consistent framework. The top four indicators (all internal) were found to be leadership skills, employee satisfaction, employee motivation, and years of experience (Brennan and Connell 2000). Other internal factors included strategy implementation, innovativeness and the company's ability to attract and retain high calibre employees were also found to be crucial for organizational success. The Irish study also found externally oriented measures such as customers and business collaborations and market share to rank highly (Brennan and Connell 2000).

Carroll and Tansey (2000) found that the well known and often quoted Skandia model may have been an overkill, warning that it was unclear which measures were reliable predictors of a firm's long-run profitability, that some measures may be irrelevant, and that too many critical measures made the system uncontrollably complex. Demands for more relevant, more focussed and simpler measures for IC were gaining momentum.

Using findings from an Internet survey as well as industry literature and conversations with business and academic researchers, a research team developed a list of the nine

most critical categories of non-financial performance that determined corporate value creation: innovation; quality; customer relations; management capabilities; alliances; technology; brand value; employee relations; environmental and community issues (Low 2000). Taken together, these value drivers were combined to form a single measure of non-financial performance - a value creation index (VCI) - that represented the sum total of a company's performance across the most critical intangible categories (Low 2000). The VCI model demonstrated that fully 50 percent of a traditional company's value was based on these nine factors whilst for e-commerce companies, it was found that a very significant 90 percent of their value was based on these factors (Low 2000).

4.3.6 2001

Relational capital¹⁴, brand loyalty, customer orientation, indicators of corporate image and trust by customers were seen as important elements of IC. In the absence of appropriate frameworks and models, some organizations were starting to measure too much of the wrong things in relation to IC. Despite a number of models that had been in existence for a number of years prior to 2001, the need for all organizations to develop their own models that suited their particular business characteristics was recognised. The effectiveness of skills transfer and team performance were being measured in conjunction with the assessment of the knowledge generation environment and culture within the organization. Knowledge maps, knowledge bases and other mechanisms for identifying and ascertaining the existence and extent of knowledge within the organization were emerging. Competitive Intelligence was emerging as a marketing discipline to manage competitive knowledge. The ability of intellectual assets to generate value for the organization was becoming more important than the intrinsic value of the asset itself.

Customer (C)

Within Continuous Improvement initiatives, critical measures of customer orientation such as perfect order achievement, inventory dwell time (the ratio of days inventory sits idle in the supply chain relative to the days it is productively being used) and total days supply chain inventory, enabled firms to better monitor, manage and control their customer logistics offerings (Stank et al. 2001). Measurement integration employed analysis methods such as total landed costing (including capital components), segmental costing, and activity-based management that enabled firms to learn about their

¹⁴ Relational capital represents the knowledge embedded in the organizational value chain and is impacted by human capital (Bontis 1998).

customers and focus resources on customers of choice (Stank et al. 2001). Relational capital also emerged as a new form of customer capital that included brand loyalty, customer referrals and recommendations and customer complaints (Roslender and Fincham 2001).

Financial (F)

One of the key financial measures of corporate success in 2001 was return on assets (ROA). Corporate strategies and financial investors used ROA to compare management's use of the firm's total assets to industry averages as well as to the firm's direct competitors. While ROA was still a valuable measure, depending on it became problematic in an era when the traditional definition of assets was becoming outmoded (Oliver 2001).

Like much of the management accounting philosophies and practices developed in the 1970s, human resource accounting continued to be conducted under financial accounting and reporting principles and practices (Roslender and Fincham 2001). The information it provided, the models that underpinned it and the time frames involved were all consistent with the prevailing mindset of historical short-term financial reporting (Roslender and Fincham 2001).

Arguments that traditional accounting, as a mechanism for knowledge creation regarding the future was fundamentally flawed, was gaining momentum (Cooper et al. 2001). Traditional accounting was found to fail significantly to recognise the informational poverty of historically based accounting systems and the inability to use analysis of past behaviour as a predictive model for the future (Cooper et al. 2001). An example of measurement obsession at the time was a financial services company that was tracking 500 different measures and required individuals to report on them on a weekly basis (Kuczarski 2001).

While IC focused on value creation and growing shareholder wealth, it broke fundamentally with the financial database that economic value added (EVA) shared with other financial management approaches. Rather than measuring performance or calculating corporate financial attainment, it was observed that IC statements were concerned to underscore and visualize knowledge creation directing attention to priorities (Roslender and Fincham 2001).

Human Capital (H)

Government agencies began to realise that they could not achieve their mission without human brainpower, and yet, there was no generally accepted standard for measuring and reporting this asset on financial statements (Berkowitz 2001). In government as in industry, real value was found to be highly dependent on the ideas, insights and information in the minds of employees (tacit) and in the data banks (explicit) that these employees maintained.

Schooling and work experience were still standard measures of human capital (Hao and Kawano 2001). Medical educators took this one step further by seeking to improve measures to assess the clinical competency of residents as they completed their graduate medical education (Blumenthal et al. 2001).

A study by Miller (2001) measured the relationship between team levels of Knowledge, Skills and Ability (KSA) and team effectiveness. The results of this investigation of the Teamwork Test generally found that high team-level KSA scores did not produce better group performance. It was therefore suggested that the Teamwork Test may be measuring some individual capabilities but that these characteristics were better predictors of individual rather than team-level performance (Miller 2001). This highlighted the need for different measures depending on the knowledge context and organizational level that was being assessed.

The growth rate of the consulting profession at the time was averaging a rate twice that of the world economy (Simon and Kumar 2001). This led to the need to more effectively evaluate this form of human capital. The top five performance indicators for hiring consultants were: achieving objectives agreed upon, customer/client satisfaction, timeliness of service delivery, recommendations actually implemented and achieving measurable results (Simon and Kumar 2001). The top five strategic capabilities which clients identified as important to success, in order, were: ability to listen to and comprehend the client, quality of service, client-consultant communication, integrity and honesty and technical knowledge (Simon and Kumar 2001). Typically, Simon & Kumar did not suggest how these capabilities were or should be measured.

Internal Infrastructure (I)

Knowledge sharing was being used by the US military in the form of "after action reviews" and even the Police force (particularly in the UK) was recognising the value of IC when it was argued that value lies in the flows, the utilization of IC in the pursuit of

prevention and detection of crime, and to the maintenance of public order, road safety and the public confidence (Collier 2001).

Knowledge maps were emerging and were found to be a convenient way of identifying where key knowledge existed within an organization (Fahey et al. 2001). Such knowledge maps went beyond the functional roles typically identified in process flow diagrams. For example, they could include descriptions of the nature and quality of the relationships between internal units involved in executing adjacent tasks, for example, between order takers, order processors, and service deliverers within customer relationship management processes. They may also describe the history (know-what), nature (know-how), and rationales (know-why) for the interactions between firm subunits and customers and other entities in the value net (Fahey et al. 2001). It was recognised that knowledge produced by individuals reached its full potential to create economic value when it became embedded in organizational routines (Clarke and Rollo 2001).

Intellectual Property (IP)

No data.

Market Intelligence (M)

Mostly large organizations of all types possessed some method for gathering information on competitors and the external business environment, even if it was an informal process. Many of these organizations however lacked a formal process for collecting, assimilating, and converting competitive information into knowledge and intelligence that was seen to be useful for strategy formulation. Diverse types and sources of information on competitors were readily available via the Internet and other sources and utilizing competitive intelligence was becoming simpler and less tedious than in years past. Research found that most small to medium organizations did not realize the benefits that could be obtained from market or competitive intelligence (Groom and David 2001).

The effectiveness of on-line performance was normally measured by developers and evaluated by its proposers. Since there was still no universal standard to measure on-line effectiveness, differing methods were used, measuring on-line effectiveness according to their own objectives and expectations. Research in Market Intelligence and information system measurement at the time advocated the use of integrated evaluation methods and established that single measures of online effectiveness were no longer appropriate in order to understand the performance of marketing initiatives such

as the company Web site (Ranchhod et al. 2001). Effectiveness was measured by matching online results with management expectations. For more meaningful online marketing effectiveness measurement, it was necessary to adopt a multiple approach to understand what was being achieved. In particular, it explored the role of the Internet developer, the importance of the management of knowledge and learning, the impact of on-line technological capabilities and proper measurement (Ranchhod et al. 2001).

Innovation (N)

Researchers in Information Systems had begun to rely on the theories of innovation diffusion to study implementation problems (Al-Gahtani 2001). Climates conducive to innovation had been investigated at the organizational level, however, in team-based organizations, the climate for innovation at the team level took on increasing importance (Bain et al. 2001). A sample of 193 scientists and technologists in 20 research teams and 18 development teams were measured on their team's climate for innovation and team performance (Bain et al. 2001).

Lucent created the Value Creation Model (VCM) as a productivity measure for research-driven innovation projects, thereby providing managers with the ability to measure meaningfully a portfolio of projects (Kirchhoff et al. 2001).

Process (P)

Whilst libraries were commonly regarded as repositories of knowledge and learning, they themselves were being forced to become learning organizations to satisfy increasing consumer demands and make more effective use of publicly provided funds. Poll (2001) identified that libraries were developing indirect measures of evaluation, such as studying the use of their collections and services; the speed of delivering information and services; the accuracy of delivery; the costs of the library's products and services; the adequacy of processes; and the satisfaction rate of the population served.

Moore et al. (2001) found in some industries that corporate intellectual assets (the employees' collective knowledge and strengths) were well established as the firm's primary competitive advantage. Such firms were searching for ways to measure and guide the process of sustaining that advantage and, as a result, found that opportunities to create value were relying more heavily on the success of strategies designed to effectively manage intangible assets such as customer relationships, product innovations, operating processes, and employee knowledge and contributions (Moore et al. 2001).

Quality (Q)

No data.

Composite Measures (X)

A portfolio approach for measuring and managing the technology commercialisation process developed by the Advanced Technology Division of Lucent Bell Laboratories described a system for managing high technology R&D which consisted of a set of four quantitative financial factors condensed into two metrics, plus six qualitative attributes taken from four categories: strategic initiatives, market categories, intellectual property classes, and business unit designations (Kirchhoff et al. 2001). This showed an increasing emphasis on the use of an integrated collection of measures that worked together to provide a comprehensive holistic picture of an entire process.

In terms of library-specific measurement frameworks, Winkworth (2001) found the most complete was "The Effective Academic Library" developed by the Joint Funding Councils Ad-hoc Group on Performance Indicators for Libraries in 1995. There were a number of Library Management Statistics in common use at the time based on number of employees, total library expenditure per full-time-equivalent (FTE) employee, user expenditure on information provision per FTE, user expenditure on staffing per FTE, and user output measures such as seats offered per week per FTE user and loans per FTE user. Although leaning towards composite models in an attempt to provide holistic performance indicators for the entire organization, the measures were still largely quantitative.

4.3.7 2002

KM measurement frameworks were emerging, a more pro-active perspective was gaining recognition and enterprise wide knowledge was being recognised. A survey of 25 financial services organizations described 15 latent constructs of contemporary management issues as: employee satisfaction; employee motivation; human capital; management leadership; knowledge sharing; employee commitment; value alignment; structural capital; process execution; knowledge integration; training, retention of key people; relational capital; knowledge generation; and business performance (Bontis and Fitz-enz 2002). The recognition of the importance of these issues to the organizational culture set the scene for the development of KM evaluation in 2002.

Customer (C)

Customer lifetime value (CLV) captured the impact of marketing on purchasing behaviour and was a valuable measurement for targeting marketing activities (Lenskold 2002). Marketing campaigns intended to increase the profit per customer or improve customer retention rates and depended on the measurement of the CLV to demonstrate results. Measuring CLV allowed marketers to plan marketing efforts and extend offers to customers and prospects that were expected to return a higher value to the company (Lenskold 2002).

Financial (F)

Most reported methods for valuing a firm's IC provided a basic framework to put the development of IC in line with strategic goals, but did not provide a complete and manageable set of relevant IC measurements (Rodov and Leliaert 2002). Professor Baruch Lev of New York University developed such a framework to measure intangibles performance for any company, or division of a company, that used traditional financial reporting and that had publicly traded equity (Hurwitz, Lines et al. 2002). Professor Lev also established how the performance of intangibles was possibly linked to stock returns. Lev's Knowledge Capital Calculation Model attempted to estimate the value of the knowledge assets of a firm calculating employed "normalized earnings" which were a combination of the average actual earnings for the past three years plus stock analyst's forecasts of earnings for three years into the future (deTore et al. 2002). This represented an example of future oriented financial measures of KM.

Other examples of future orientation were provided by Bukh et al. (2002) who established that EVA, balanced scorecards and intellectual capital statements shared a "commitment to crafting a technology of managing" which pointed out relevant assets to be managed that were all concerned with connecting the future prospects of firms directly to the competence of management.

Human Capital (H)

Despite having established that businesses improve their market valuation (as well as many other measures of financial performance) when they invest more in training, Bassi et al. (2002) found that most businesses still did not know whether, or how much, value was being created by their training efforts. Furthermore, it was becoming increasingly apparent that organizations were suffering from human capital depletion primarily through turnover, as IC in the form of tacit knowledge in the heads of key individuals literally walked out of the door (Bontis and Fitz-enz 2002).

Internal Infrastructure (I)

Bukh et al. (2002) used a software engineering firm to demonstrate that, first and foremost, the organization relied on the knowledge and competency of its employees (human capital), but also on the knowledge and experience of its customers, processes and technologies (structural capital). The purpose of the firm's IC statement was to make its knowledge resources visible and to shed light on management's efforts to develop these resources. Here, the firm offered a way to read the statement that was said to be concerned with management's efforts to influence the structure of the firm's knowledge resources. It was not about the value in monetary terms of the firm's IC, but more about its management's efforts to develop knowledge resources (Bukh et al. 2002).

Three general strategies were used to create more value from the knowledge assets of a life insurance firm (deTore et al. 2002). Firstly knowledge product strategies enhanced the firm's offerings by increasing the knowledge content of the products or services that were being delivered to their customers. Secondly intellectual property strategy explicitly managed the intellectual property (patents, copyrights, trademarks) of the firm. Thirdly knowledge work strategy implemented specific infrastructures and management practices designed to improve how knowledge was created, shared and used. Earnings that could not be traced to physical and financial assets were traced from knowledge assets (deTore et al. 2002).

Intellectual Property (IP)

No data.

Market Intelligence (M)

According to Accenture's Insight Driven Marketing report, a 2001 survey of 175 marketing executives in the United States and United Kingdom revealed that 68% reported having difficulty measuring the ROI of their marketing campaigns. In an increasingly knowledge oriented economy, Lenskold (2002) believed that ROI was still the most appropriate marketing measurement tool, and that the adoption of ROI marketing measurements was becoming more of an organizational issue than one of measurability because the difficulties being experienced by many organizations resulted from their lack of understanding of the impact of measurement of marketing campaigns on strategic performance.

Innovation (N)

In a survey by Frigo (2002), over 60% of respondents indicated that innovation was a key feature in their company's mission statement, yet more than half rated their

performance measurement system for innovation as poor or less than adequate. Only 8% considered their performance measurement system very good or excellent in supporting innovation. Effective measurement of innovation continued to be a rare occurrence.

Process (P)

Globerson and Zwikael (2002) found that, in order to evaluate the quality of a project, products of each single process within the project (including explicit and tacit knowledge) needed to be evaluated. A field study was conducted to evaluate the extent of a project manager's involvement in the planning processes and to evaluate the quality of this involvement. A major problem in designing this study was to establish a way to evaluate the extent to which planning processes were used in projects and their quality level. Overall project success was measured as the ability to complete the project according to desired specifications and within the specified budget and the promised time schedule, while keeping customers and stakeholders happy (Globerson and Zwikael 2002).

Quality (Q)

No data.

Composite Measures (X)

Different approaches to consolidating a variety of IC metrics into a cohesive framework were becoming accepted benchmarks but Collardin and Vogele (2002) found that only a small number of firms, practitioners and consultants were experienced with the use of these models. Among the best-known (and most frequently quoted) methods for IC measurement were Skandia's Navigator, Sveiby's Intangible Assets Monitor, Brooking's Technology Broker, Bueno's Competence-Based Strategic Management Model (de Pablos 2002) and Kaplan & Norton's Balanced Scorecard (Frigo 2002).

deTore et al. (2002) developed a KM valuation model which required the construction of a hybrid knowledge/financial model called a "knowledge value driver tree". In order to link the operational impact of a proposed project to drivers of discounted cash flows for a firm, the knowledge value driver tree provided a set of metrics for management decision making as well as guidance for the KM project implementers.

In the software engineering firm mentioned earlier in the section under Internal Infrastructure, their balanced scorecard approach emphasised that financial, customer and learning and growth measurements provided appendices to the internal process

perspective and the IC statement was recognised as an active part of KM, because it created new networks and caught the interest of valued resources such as prospective employees and customers (Bukh et al. 2002).

The true measure of a company's value was being seen to rest in its people and ideas rather than in its equipment and real estate (Collardin and Vogeles 2002). Collardin and Vogeles (2002) also believed that KM/IC measurement approaches were tending, to a greater or lesser extent, towards synthesizing the financial and non-financial value generating aspects of the company into one external report, but added that it was still too early to predict whether or not a model or system for measuring knowledge capital would be integrated successfully into existing management and financial reporting systems.

4.3.8 Chronological Summary by Measurement Category

The table on the following 2 pages shows the main measures identified from the 838 individual measurement cases sorted into year and measurement category.

Category	1996	1997	1998	1999	2000	2001	2002
Customer (C)	Customer needs and satisfaction were the dominant measures.	No data	Customer relationships measured.	Customer satisfaction still popular but interest emerged in learning about customers and quality of supplied services and success of service/client relationships.	Customer satisfaction and increase interest in the impacts of customer relations on corporate value creation. Customer retention and acquisition.	Relational capital, brand loyalty and customer orientation.	Customer perceptions via web based surveys and measurement of customer lifetime value
Financial (F)	Mixed bag of costs, cost reduction, income, investment, sales growth, ROI measures and budgetary controls. Value Chain margin mgt. Failure of GAAPs for KM/IC recognized.	Focus on sales and profits and R&D expenditure as measures of innovation.	Earnings and ROCE, ROSHF, EPS and share price. Emergence of Economic Value Add (EVA). Need for new models in addition to the old.	Sales and profit focus and ROI. Measuring knowledge bought in by organizations. Measuring effectiveness of external consultants.	Mixed bag of costs, EVA, profitability, revenue, ROA, ROI and sales. Return on vision recognized.	ROA still popular. Some organizations going overboard with number of measures. IC focussed on value creation.	Future market returns, recognition of "investment" in training. Lev's Knowledge Capital Calculation Model. Frameworks there but not what to measure.
Human Capital (H)	Years of education, training in terms of hours per FTE and participants reaction to training courses. Individual and team performance measures. Building learning environments. Education linked to profits. Very basic metrics. Kirkpatrick's model used superficially. 360 deg feedback model emerging.	Interest in measuring management performance but no metrics available. Measuring employee perspectives and attitudes. Effectiveness of leadership development.	Work experience, training, employee satisfaction and attitudes. Empowerment emerged as a HC measure. Need to learn how to learn. Skills & competency recognized. Six Sigma model emerged. Mix of qualitative and quantitative metrics.	Employee retention measures, knowledge and leadership skills recognized as important attributes to measure. Organizational culture measurement under review. Social skills emerging as important HC measure. Generative learning and collaborative processes valued. Measuring synergies between measurement categories. Leadership credibility. Mentoring models.	Competencies emerging as a viable measure especially in relation to communications. Effectiveness of HR and learning abilities being measured. Correlation established between human capital and shareholder value. Models to assess learning emerging.	Medical Competence in Health industry. Movement in HC. Skills transfer emerging. Governments recognizing human capital. Individual vs team performance tests. Evaluation of Consulting firms.	HC and knowledge retention measurement. Retention of key people.
Internal Infrastructure (I)	Culture of innovation via design of work settings conducive to learning. Increase in amount of IC measured.	Office productivity via computer mediated communication systems. Collaboration and teamwork.	Organizational culture and logic. Image and reputation recognized. Corporate Universities.	Knowledge transfer and information integration and data collection frameworks. Degree of learning orientation. On-line communities studied.	Measurement of empowerment gets serious consideration. Uniqueness of organizational knowledge capital recognized. Importance of measurement systems supporting organizational strategy.	Knowledge environment recognized, knowledge sharing and its impact on decision making. Information and knowledge bases and knowledge maps. Measure of organizational cultures and climates that support innovation.	Enterprise knowledge recognized. Impact of corporate knowledge on assets and performance. Knowledge flows and transfer. Measurement of management efforts to develop knowledge resources.

Intellectual Property (IP)	No data	Patents as surrogate measures for innovation.	Patents and copyrights.	Knowledge about patents rather than value of patent per se.	Knowledge development in patenting. IP rights recognized for accounting purposes. Trade secrets recognized as knowledge assets.	No data	No data
Market Intelligence (M)	Market share and competitiveness as surrogate measures of IC. Benchmarking as means of evaluation.	No data	Market dynamism and competitive industry. Company uniqueness recognized as valuable. Brands valued on balance sheets.	Market growth and market orientation of the firm. Learning from competitors. Behavioural processes instead of value systems measured.	Market value-add, relative performance vis-vis major competitors. Further development of benchmarking.	Competitive intelligence effectiveness and on-line marketing effectiveness	ROI of marketing campaigns not working.
Innovation (N)	GE "vitality". Increasing interest in innovation.	No data	Innovation recognized as factor for organizational growth. Focus on innovation found to link to high customer satisfaction.	Propensity to understanding organizational effectiveness and innovation	Measures still crude and patent related.	Team Learning, innovation diffusion. Value Creation Model.	Innovation key but measurement systems poor.
Process (P)	Problems resolved, increases in productivity, meeting objectives, % of on-time deliveries. Move from hierarchical to process driven models. Quantitative metrics. Teamwork processes and feedback measured.	Insufficient detail for meaningful analysis.	Sharing best practices. Recognized lack of process measurement models.	Flexibility, ability to respond to customer requests, reliability, consistency, speed and dependability. Knowledge mapping. Sense-making. Metrics still very basic. In-process indicators.	Team effectiveness, effective use of resources. Process vs outcome measures debated. Process measures being adapted to healthcare. Project management maturity model developed.	Indirect/surrogate measures for process effectiveness.	Project Success being measured but difficult to compare with other organizations.
Quality (Q)	Quality culture. Self-assessment. Quality in healthcare measured.	Direct relationship found between quality improvement and financial improvement. QMS becoming popular. Behavioral approaches & management attitudes crucial to QMS.	No data.	Measuring quality of process flows.	Quality of services. More qualitative measures of quality emerging.	Use of QMS by private sector (but not public sector).	No data
Supplier	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis
Technology	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis	Insufficient data for meaningful analysis
Composite Measures (X)	Balanced Scorecard. Importance of measures that all employees can understand.	No data.	Intangible Asset Monitor and BSC. Learning connected to financial results.	No data	BSC, Value Creation Index. Intangible Asset Monitor.	BSC. Portfolio approach to measurement.	BSC and Intangible Asset Monitor, Technology Broker, Competence based Strategic Management Model. Value based management initiatives

Table 10: Summary of Chronological KM Evaluation Factors

4.4 Geographical Analysis

4.4.1 Overview

It was suggested by Adam et al. (1997) that location of an organization has a considerable influence on the business strategies chosen, the structures set up, and the performance achieved by managers. It is therefore reasonable to expect that different international locations would also impact the evaluation methods used to assess the effectiveness of these strategies, structures and performance and that such methods would in turn impact KM/IC evaluation models. A review of the KM measurement models extracted from the 220 source articles identified that the geographic location of an organization does indeed have a significant impact on the way the organization approaches knowledge, its management and how knowledge initiatives are measured.

Whilst the vast majority of KM evaluation case studies are sourced from developed nations (see Appendix C), the World Bank believes that it is difficult to envisage any organization, anywhere, commercial or not-for profit, arguing that it did not need to manage its knowledge (Martin 2000). A recent World Bank report called for the management of knowledge to assist in the development process both for fostering knowledge flows between developed and developing nations and in helping developing countries to more effectively manage and measure their knowledge (Martin 2000). Managers of firms operating in Asia and the Middle East were found by de Pablos (2000) to be very interested in KM and IC measuring and reporting that had become popular in Europe, but when it came to learning how to build this new type of report, they turned their attention to Scandinavian firms (de Pablos 2002).

Organizations in the developed world in particular have gone through somewhat of a metamorphosis in the last century, from capital intensive to information and more recently to knowledge intensive. In a study performed on 2,959 US corporations, Paul Strassmann determined that only 9.4% of the companies surveyed are now capital-intensive, with the remaining 90.6% being information-intensive (Strassmann 1996). Whilst this point alone is a significant driver for the need for most organizations to effectively manage and measure their knowledge and its organizational impact, another factor is that, over the past two decades, the difference between market and book values of large organizations in the developed world has gradually increased (Barsky and Marchant 2000). In addition, empirical studies have shown that there is a growing body of evidence depicting a steady decline in the relationship between tangible assets and market value right across the international industrial spectrum (Martin 2000).

4.4.2 North America (USA and Canada)

Empirical research has shown that top executives in large US and Canadian businesses agree that new IC measures are required to help manage knowledge assets (St Leon 2002). However, at the Fourth World Congress on the Management of Intellectual Capital held at the McMaster University in Canada in January 2001, a warning was issued that one of the greatest impediments to the progress and adoption of the IC paradigm was the lack of support among senior managers, particularly at the level of the CEO and board of directors (Bart 2001). There is pervasive evidence now to support the proposition that management in general agrees that embracing and measuring knowledge and other forms of IC is necessary, but many organizations still seem to be reluctant to take the first step.

Commenting on the papers at a conference on KM, Don Cohen noted that in the U.S., most knowledge practice focuses on collecting, distributing, re-using, and measuring existing codified knowledge and information (Pfeffer and Sutton 1999). Another example of the North American focus on quantitative measures is Sequent Computing in Oregon in the US who uses a best-practice, knowledge sharing initiative to analyse project costs and cycle times in its supply channels and other knowledge-intensive activities in the firm's value chain (Martin 2000). Generally, investment in IT is seen in the US as being closely related to, and an adequate measure of, innovative capability.

Despite being surpassed by Japan, Germany and Switzerland in patent applications per 10,000 population, the USA by far obtained the best dollar benefits from its past innovative activity (Leal and Powers 1997). The US captured the market for memory chips in the 1980s largely because it was better than its Japanese rivals at leveraging its IC (Carroll and Tansey 2000).

Highly conservative accounting and security regulators in the US have favoured strict adherence to historic cost measurement and proscribed capitalization of internally generated intangible assets with only a few exceptions, due to concerns with reliability of measurement (Wyatt 2002). The US Federal Accounting Standards Board (FASB) and the Securities and Exchange Commission (SEC) carry enormous weight in determining how expenditures are measured and reported by organizations and although both organizations have given some consideration to new standards or requirements in areas like human capital, significant changes are made slowly and often reluctantly, and neither has yet moved for more significant public disclosure of knowledge-related

capital generally (Bassi et al. 2002). Indeed, a study using the 1996 annual reports of all US Fortune 500 companies found that not a single organization released meaningful information on its training expenditures, and less than five released any information on training time. Canada is closely following the US model in terms of accounting and reporting.

Although the US still treats training as a hidden cost, there is an expected increase in the importance of human capital investments, such as training, in affecting organizations' financial performance as economic value becomes more highly dependent on firms' knowledge-based assets (Bassi et al. 2002). Despite the inappropriate treatment of training costs, research on a dataset of US publicly-traded companies found that training investments were positively related to a variety of measures of financial performance (Bassi et al. 2002). It was found that US firms that spend more than average on training have total stockholder returns that are 86 per cent higher than firms that spend less than average, and 45 per cent higher than the market average (Bassi et al. 2002). This establishes the connection between the generation of knowledge resulting from training activities and increased market value for the organization.

Another study by Bassi et al. (2002) analysed data for 157 manufacturing firms in the US that had applied for state subsidies to support private training programmes and found that receipt of a training subsidy increased training hours within a firm by a factor of two to three in the short term, and reduced output scrap rates by around 13 per cent (corresponding to savings of between US\$30,000 and \$50,000 per year). The connection established here is between knowledge generation and improved operational efficiency.

The American Society for Training & Development (ASTD), has standardised measures of training outcomes (as assessed by training participants and their managers), but currently, these have only been used by relatively few (some hundreds of) organizations (Bassi, Ludwig et al. 2002). One example is at Monsanto in the US, where the company's strategy for growth is linked to the development of core competencies such that knowledge and information are used effectively across the organization so as to create a learning and sharing environment (Martin 2000). This is an example of focus on the development of a long-term learning culture rather than a focus on short-term profit or operational efficiency.

Further findings from the US confirm that companies such as Sears are engaged in a number of knowledge communication activities including the use of so-called "town

hall meetings” and “learning maps” to inform its employees and through the establishment of Sears University as an internally focussed educational activity (Martin 2000).

One of the most celebrated knowledge cultures in the world is that at Buckman Laboratories in Memphis, Tennessee where the CEO, Robert Buckman estimates that 90 per cent of his company's KM efforts have gone into changing from a command-and-control culture with a focus on pharmaceutical products to a knowledge sharing culture focused on customers (Martin 2000). This knowledge sharing approach, which began in 1982 (long before KM became fashionable), was also needed to support a greatly expanded sales team as Buckman Laboratories moved to become a global operation (Martin 2000). Despite the focus on knowledge sharing, the solid business goal was to have 80 per cent of company associates effectively working on customer problems by the year 2000 (Martin 2000). This is a relatively simple and quantifiable measure which is a surrogate for a measure dealing with knowledge use. The use of surrogate measures for KM was found to be particularly prevalent in the US. This propensity for quantitative measures however, may have been distracting management from attempting to measure the effectiveness of the knowledge generation process.

Using a more balanced approach between quantitative and qualitative metrics, Dow Chemical in the US considers the most significant measures for IC to be: percentage of new business initiatives protected by intellectual assets; percentage of technically relevant, competitive intellectual assets that require a business response, and the value contributed to the business by significant and/or extraordinary intellectual asset management actions (Martin 2000).

A rare example of a departure from explicit/codified knowledge syndrome occurs at Bechtel in the US, where due consideration is given to the source of knowledge and its reliability, to potential users and to the degrees of its applicability (local or global) and transferability (ease and practicality of transferability between users) (Martin 2000). Categorisation of knowledge occurs by identifying knowledge respectively as quick access (easy to find and use when needed), broad-based (broadly applicable and easily transferable), complex (broadly applicable but not easily transferable) and one-off (neither easy to transfer nor broadly applicable) (Martin 2000).

The Kaplan and Norton Balanced Scorecard (BSC) model for evaluating intangibles has received much literary acclaim in the U.S (Hepworth 1998) and has been enhanced by different organizations that have gained significant experience in its use. As previously

identified in section 4.3.5, a US governmental body formed to consider government-wide procurement practices, successfully identified and included employee empowerment as an additional BSC focus (Hepworth 1998). The BSC has been applied successfully across many diverse industries and within the public sector in the USA. It has also been suggested that, despite the propensity for quantitative measurement in the US, the use of the BSC is more acceptable within the US management culture than in the more conservative British organizations (see 4.4.5).

4.4.3 Scandinavia

Scandinavian countries (in particular Denmark, Sweden and Norway) are the leaders in IC management and reporting (Petty and Guthrie 2000; Edvinsson et al. 2000; Wise 1999; Skyrme 1998; Wurzburg 1998). The reason appears to be partly because of strong federal government support in Scandinavia and to a lesser extent in Western Europe (Petty and Guthrie 2000; Wise 1999). Scandinavia also appears to be more open and transparent in its business conduct as evidenced by the nature and comprehensiveness of its external IC reporting.

IC Reporting in Scandinavia emerged in the early nineties. Skandia, a Swedish based insurance firm, has expanded its business evaluation processes to include an integrated evaluation model known as the Business Navigator, which classifies core business processes into five categories: Financial Focus, Customer Focus, Process Focus, Renewal and Development Focus, and Human Focus (Barsky and Marchant 2000). The Navigator model is based on Kaplan and Norton's Balanced Scorecard (BSC) method mentioned in 4.4.2 and is used for both internal and external reporting (Barsky and Marchant 2000).

Another model developed in Sweden by the Konrad Group, was the Intangible Assets Monitor approach to evaluation which ignores the balance sheet altogether and focuses instead on three core dimensions: external structure, internal structure and individual competence (Martin 2000). There is a clear distinction between these reporting approaches and that adopted by the US which (when reported at all) focuses on quantification of intangibles and IC reporting within the existing accounting framework.

Pioneers such as the Danish Government with their Guidelines for Intellectual Capital Reporting have contributed considerably to exploring the field of intangible assets and IC (Bornemann and Leitner 2002). In addition, the Norwegian Government has

sponsored research since 1992 to develop a competence capital model which has evolved into an ISO-type certification process that includes IC (Petty and Guthrie 2000). The initiatives taken by the Government of Norway have encouraged industry across Scandinavia to report on their performance in a variety of non-financial ways. Furthermore, the Danish and Norwegian governments have provided incentives for organizations to investigate and experiment with IC (Petty and Guthrie 2000). Telia in Sweden and Danisco in Denmark are examples of organizations that have successfully adopted the new reporting models. Arguably, the most advanced work in this area has been carried out in Denmark, where a set of descriptions of intangibles in company accounts has been prepared as a tool to measure, manage and report corporate intangibles on a comparable basis (Wurzburg 1998).

4.4.4 Europe (other than UK and Ireland)

The increased innovative capability of European countries was noted in the late seventies when it was observed that the perceived "technology gap" between the USA and Europe was closing (Leal and Powers 1997). Although not as advanced as Scandinavia in this regard, companies in Europe are way ahead of their counterparts elsewhere when it comes to the measurement, reporting and management of their IC (Guthrie 2002). The reader is reminded that KM has been described in section 2.5 as the discipline that manages a firm's IC. The Netherlands, UK and France have been frequently used as examples of European countries that appear to be adopting the Scandinavian model for IC and even top Spanish firms have started to build their IC accounts (de Pablos 2002). Leal and Powers (1997) established in their research that Germany, France and the UK fund R&D adequately, have inventiveness coefficients close to or greater than that of the USA, have relatively high diffusion ratios, and a rising technology balance of payments ratio thus eroding the US technology balance of payments coverage ratio.

In France, social account reporting (the bilan social and training expenditure reporting under the Law of 1971) is compulsory (Wurzburg 1998). Many publicly traded companies including Mannesmann in Germany and Pinault-Printemps Redoute in France, include varied information on human resources and other intangibles, such as training expenditure, participation in training and qualifications of workers, in their annual reports (Wurzburg 1998). The areas covered include information on operating results, as well as forms of IC that might have an effect on results, such as R&D,

patents, licenses, experience and qualifications of directors and managers, and numbers of employees (Wurzburg 1998).

Switzerland is second in the world behind Japan with number of patents per 10,000 population with Germany following closely in third position. The number of patents applied for or granted is a popular measure for national inventiveness and thus an indicator of a nation's ability to learn and convert its knowledge into innovative products. Middle of the road countries in terms of patent generation per head of population include Austria, Finland, France, Germany, Norway, Portugal, Spain, and the UK (Leal and Powers 1997). Germany is also a leading innovator and shows considerable openness in its inventive activity (Leal and Powers 1997).

A knowledge codification strategy was employed at the Swiss pharmaceutical giant Hoffman-LaRoche in an attempt to reduce the time and costs involved in new drug development (Martin 2000). A new division at Hoffman-LaRoche called Protodigm was established as a knowledgeable venture with a culture of sharing and the objective of delivering a document to drug approval authorities in Europe, the US or Asia (Martin 2000). By coordinating internal processes and capturing the knowledge imbedded in them on an intranet while outsourcing all nonessential operations, they are promising a 40 per cent reduction in costs and a reduction in the time taken for drug development from seven years to four (Martin 2000). Whilst many organizations regardless of geographic region find it difficult to prove conclusively that business benefits do indeed result from KM efforts, this example from Switzerland indicates that it can be done.

Following on from the pioneering work in Scandinavia, the first European Research Technology Organization (RTO) and the Austrian Research Centers (ARC) implemented and published two IC Reports for the business years of 1999 and 2000 (Bornemann and Leitner 2002). There are several bottom-up approaches and models quoted in the literature, ranging from indicator-based models derived from managerial information systems and performance monitoring instruments such as the Balanced Scorecard or the European Foundation for Quality Management (EFQM) model, to monetary-oriented solutions in search of the exact numerical figure with which to represent intangible assets (Bornemann and Leitner 2002). The problem with these methods is that the choice is left to individual organizations to select the most appropriate model for their individual operations with no guidelines being provided as to how to make an informed selection.

In general, structure-oriented models such as the Skandia model from Sweden, separate different intangible assets and are primarily intended to describe the organizational space or place of knowledge; whereas process-oriented models such as the Austrian ARC-IC model try to reflect the flow of knowledge (knowledge production and utilisation process) within an organization (Bornemann and Leitner 2002). The ARC-IC Model was designed to trace the knowledge production processes and knowledge flows of a research organization and is integrated with the classification of IC. It also meets the specific requirements for IC Reporting of RTO, with respect to providing information for management and assessing the various kinds of outputs that are important nodes of the Austrian National Innovation System (Bornemann and Leitner 2002).

4.4.5 UK and Ireland

In the late 1980's, "control" was a key word in UK management parlance in sharp contrast to the Japanese approach which, whilst equally highly controlled, included involvement of employees who were adding value to material (Barker 2001). By comparison, it was seen that when Japanese companies gained control of UK brownfield sites such as in the cases of Komatsu and Toshiba, the whole culture of the organization was changed by the arrival of a new Japanese management team (Barker 2001). The new Japanese culture tended to impact production systems integration, people and work organization and the focus of business development (Barker 2001). This new culture supported a learning orientation and supported an environment in which knowledge generation was facilitated. The UK manager was found to be focused on a confrontational relationship, rather than a partnership alliance with employees and a "crudeness" of style in contrast to the Japanese approach that began human development strategies twenty years earlier at companies like Toyota and Canon (Barker 2001). The UK approach was found to inhibit learning and knowledge generation.

Generally British service businesses score very highly in the European poll but, significantly, do not score as well in the manufacturing sections which are traditionally dominated by German, Swedish and Swiss companies (Thompson 1998). Hierarchical organizational structures which prevented employees from contributing more intellectual inputs into the workplace appeared to be common within the UK manufacturing sector with many re-engineering projects, at various locations within UK

industry being found to be managed under command-and-control type structures (Barker 2001).

In attempting to answer why a non-involvement management style should continue to exist within the UK, it was assumed by Barker (2001), that many UK managers are “naturally autocratic”. This management style is inconsistent with the evaluation of employee involvement or knowledge contribution. The UK has clearly adopted a more conservative style than North America or Australia (see 4.4.7) in terms of KM, ICM and their evaluation.

The Industrial Relations Services (IRS) in the UK in 1997 showed that, on a national level, there was still complacency and ignorance about world-class standards, an over-reliance on financial measures (which generally focused attention on the short rather than the long term), and a national adversarial culture which failed to integrate stakeholders into a cohesive network of inter-dependent organizations (Thompson 1998). Although this indictment would suggest a significant barrier to the implementation of KM initiatives in the UK, some significant UK based success stories such as British Petroleum (BP) have been frequently cited in Management, KM and IC journals (Allee 1999, Liebowitz 2002, Martin 2000). BP is widely acknowledged as a company that has succeeded in unleashing and then harnessing the power of learning (Martin 2000). BP sought to leverage learning by replicating what was learned throughout the company and linking these lessons directly to an understanding of company purpose (that is, who they are and what makes them distinctive) (Martin 2000). In teaching their organization how to learn, knowledge managers sought to instil the belief that generating value was everybody's job and reinforced this point by tying individual performance to the kinds of targets that would promote learning (Martin 2000). BP has developed models to measure this increase in organizational learning and appears to have closely aligned its KMI evaluation model with the Japanese model (see 4.4.6). The IRS research confirmed that an increasing number of UK organizations now accept that they must measure customer satisfaction, employee wellbeing and the contributions made by people at both the individual and team levels (Thompson 1998).

The use of composite evaluation models is rare in the UK. To date, the only evidence of the BSC being employed in the UK has been within The British Army, specifically the Food Services branch of The Royal Logistic Corps (Hepworth 1998). And whilst Continuous Improvement did not appear to be a common improvement regime in the UK in general, it did seem to get some support in Ireland where many enterprises

experienced beneficial effects of becoming more innovative from having adopted a programme of CI (McAdam et al. 2000).

4.4.6 Japan

Japan leads the world in patent applications per 10,000 population (the inventiveness coefficient) by a wide margin (Leal and Powers 1997) but follows a unique course regarding its technological and information management activities that strongly differentiate it from other countries (Ahmed 1999; Barker 2001; Francis and Mazany 1996). Quality of product and of process, and a commitment to proactive change, just-in-time, total quality management, Kanban, quality circles, and statistical quality control are a few examples of the Japanese approach to production management which have included integrated processes for the management (but not evaluation) of information and knowledge.

The Japanese have taught Western business a lot about how to run a good company and have also demonstrated that managers are neither omnipotent nor omniscient (Francis and Mazany 1996). In Japanese companies the management ethos is that the senior person knows that he (or she) is not there because he has the best ideas, he is there to listen to the ideas of others (Barker 2001). A large Japanese auto manufacturer (Toyota) was quoted as placing strong emphasis on mechanisms for embedding knowledge sharing behaviours in the culture so that they become the way things are done and taught to others (Bessant and Francis 1999). The success of Japan as a manufacturing nation and in particular the Toyota Motor Company is seen as simply a result of human intellectual energy overcoming adversity (Barker 2001).

Japan recognized the tangible versus intangible dilemma around 1980 when Hiroyuki Itami noticed a difference in performance among Japanese companies and after some study attributed it to differences in the firm's intangible assets (Harrison and Sullivan 2000). Pascale documented the "Honda effect" in 1984 whereby the Japanese automaker capitalized on its inexperience in the automotive industry and encouraged its members to try out new ideas when designing and building their first generation of automobiles (Mirvis 1996). This experimental philosophy persists today.

Case studies of suggestion systems presented by Bessant and Francis (1999) included companies such as TCM and Daikin Industries where reward and recognition for ideas varies with the level of suggestion. Appropriate reward systems have been found to

lead to higher levels of idea contribution and more valuable contributions. Some employees contribute over 200 suggestions per year. Ideas are evaluated and ranked in terms of their potential contribution to profit and a big idea would need to contribute 1M Yen upwards (Bessant and Francis 1999). This is a good example of providing an organizational environment within which knowledge generation in the form of ideas can thrive. The value of these ideas however is not likely to appear in the company's financial statements.

The Japanese have long viewed knowledge to be an integral part of their work, and hence have been using quality circles and job rotation as part of their knowledge programme for many years (Ahmed 1999). The Japanese have a structure laid out in the form of quality initiatives which is part of their organizational make-up, but this is relatively new in other western cultures (Ahmed 1999). This is evident in the workings of Japanese manufacturing organizations that often hold meetings with their suppliers to exchange views and to discuss new projects (Ahmed 1999). This is an example of judicious use of knowledge gained from outside the organization which was found to be rare in most other regions.

Bessant and Francis (1999) found CI to be particularly prevalent in Japanese firms but rare in the west. The Japanese approach to CI is entirely consistent with their approach to incremental step-by-step improvements (Bessant and Francis 1999, Kaye and Anderson 1999). The evolution of suggestions can be seen in data collected by the Japanese Human Relations Management Association which suggest that on one industrial site for example, there was 100 per cent participation of the "eligible employees" (around 85 per cent of the total workforce) in kaizen based team work (Bessant and Francis 1999). The characteristic feature of many Japanese CI systems of involving every employee may help explain why there is such a strong "track record" of strategic gains through CI (Bessant and Francis 1999).

In contrasting the approach to knowledge and learning of Japanese and Western organizations, Leitch et al. (1996) demonstrates that Japanese companies take a very pragmatic view of learning by treating the learning process as inseparable from taking action and applying knowledge to real situations. Senge's belief in continual learning is reminiscent of the Japanese concept where continual self-development is emphasized both at a personal and professional level (Leitch et al. 1996). In addition, another Japanese social attitude, that of team spirit or collective responsibility, has been adopted into the learning company concept (Leitch et al. 1996).

Much of the success of Japanese manufacturing giants such as Honda, Canon, Matsushita, NEC, Sharp and Kao has been attributed to their ability to manage the creation of new knowledge (Martin 2000). The desire for a wider perspective of people with a broad range of knowledge and skills which can provide the basis for functional flexibility rather than narrow task-based multi-skilling is echoed in the findings of Koike and Inoki, who reported that increased productivity as found in Japanese factories, (which were compared with those in Malaysia and Thailand at the time), resulted from the Japanese employees' ability to solve problems more effectively because of the depth and breadth of their training (Rexworthy and Rothwell 1996). The Japanese have clearly made the connection between individual training and organizational learning but see no need to measure the extent or strength of that connection.

4.4.7 Australia

Little work has been done to provide an understanding of where Australian organizations are situated in relative international terms when it comes to the measurement, reporting and management of their IC (Guthrie 2002). A study conducted by Guthrie in 2002 shows that the key components of IC in Australia are poorly understood, inadequately identified, inefficiently managed and are not reported within a consistent framework. While there is some evidence that Australian enterprises are engaging in the process of identifying their stock of IC, overall Australian companies do not compare favourably with their overseas counterparts in their ability to manage, develop, support, measure and report on their IC (Guthrie 2002).

One effort to address the measurement gap between book and market values in Australia was the development of the new Australian Accounting Standard AAS 38 Revaluation of Non-current Assets (adapted from the International IAS38). Caddy (2002) however, believes this approach has serious limitations. A sample of 172 large Australian listed companies found that they were reporting intangible assets superficially on the balance sheet in the form of capitalized purchased goodwill and identifiable intangible assets which is a long way short of the comprehensive IC reporting practiced by some Scandinavian firms (Wyatt 2002). Although favourable reviews of the BSC approach to managing intangibles from an accountancy perspective have been noted in Australia, no evidence to support its employment has been evident (Hepworth 1998).

Another Australian study found entrepreneurial spirit to be the most frequently favoured management quality that was often mentioned in reports, followed by the importance of customer relationships and management processes (Brennan and Connell 2000).

Entrepreneurial spirit, as a valued quality in an organization could be seen as another form of IC. Brennan's study did not specify how these valued attributes are being measured by Australian organizations.

With very little empirical data to work with, it is too early to assess whether Australia is following the US, Japanese, Scandinavian or the European models.

4.4.8 Geographic Summary

The geographic location of an organization is likely to impact its approach to knowledge and how it is managed and measured. Whilst the vast majority of KM evaluation models originated in the US, companies in Europe and Scandinavia are way ahead of their counterparts elsewhere when it comes to the measurement, reporting and management of their IC.

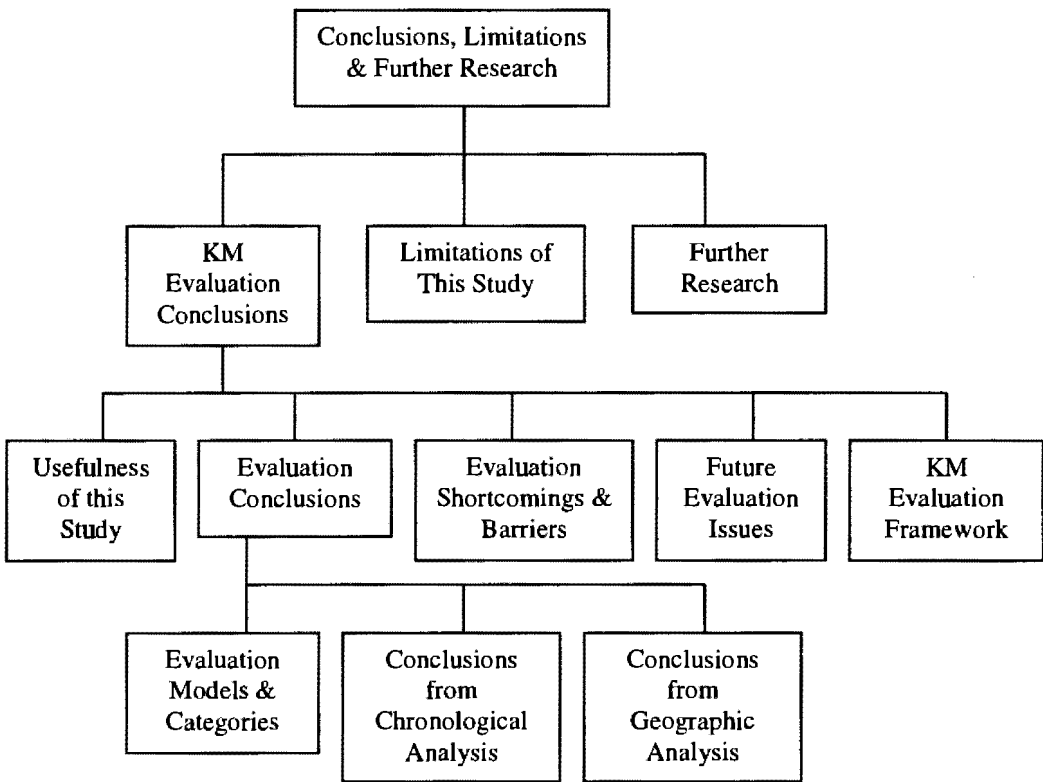
The following table summarises the major geographic factors impacting KM evaluation identified in this section.

Factor	USA/Canada	Scandinavia	W.Europe	UK/Ireland	Japan	Australia
Approach to knowledge	More than 90% of US organizations are now knowledge intensive. Knowledge treated as an artefact.	Balanced explicit/tacit approach	More explicit than tacit oriented.	Growing recognition of customer and employee knowledge.	Strong knowledge generation and sharing culture. Recognize importance of external knowledge.	Mixture between US and UK approach
Approach to learning and KM	Pragmatic. Collection, distribution and use of codified knowledge	Becoming normal practice. Highly structured.	An emerging management discipline. Flow and process oriented.	Control	Normal part of management – not a separate discipline. Built into Quality.	Too early to assess
Approaches to Measurement	Measure knowledge as an asset. High quantification focus	Balanced approach considering the context of knowledge in the organization	Focus on Quality and Process	Conservative. Heavy reliance on financial measures.	Measurement of KM not necessary.	A little less conservative than US
Continuous Improvement	Weak on CI. Improvement by Quantum leaps	Fairly strong	Implied in Business Processes.	Not popular in UK but gaining acceptance in Ireland.	Kaizen, small, proactive incremental improvements.	Emerging
Composite Measurement Models	Much literary acclaim, some support from industry & government. Mostly for internal reporting.	Leaders in “Balanced” reporting.	Emerging.	Rarely used.	N/a	Gaining corporate acceptance.
Accounting for KM/IC	Conservative. IC as an output from KM.	Developed their own.	developing	Conservative.	N/a	Little evidence
Reporting	Cautious and reluctant. Internal.	Open and transparent, strongly supported. Good balance between external & internal reporting.	Following the Scandinavian model	Mostly internal	N/a	A little more open and external than the US.
Government Support	Low. No direction.	Strong. Government incentives for business.	Supportive but little direction	Supportive but no direction.	High	Supportive but little direction
Senior Management Support	low	high	high	Generally low.	high	low
Culture	Mostly command & control but some exceptions	Focus on customers, employees and processes	Innovation and Customer focussed	Command & control. Based on hierarchical structures.	Tight control but employee focussed. Strong focus on organizational learning.	Less command and control oriented than US or UK, more collaborative culture.

Table 11: Summary of Geographic Evaluation Factors

5. Conclusions, Limitations and Further Research

This chapter expands on the results of the data analysis phase and discussions from Chapter 4, looks at the factors behind the KM measurement systems and models used by organizations, examines the problems being experienced by organizations in their evaluation experiences and makes conclusions as to what these issues mean to contemporary management and to the future of KM evaluation. The Chapter closes with a proposed framework for KM evaluation, limitations of this study and opportunities for further research. The following diagram shows the relationships between the sub-sections of this chapter.



5.1 KM Evaluation Conclusions

5.1.1 Usefulness of this Study

The major contributions of this study are in the areas of defining KM in the organizational domain, identifying what has been measured under the label of KM evaluation, identifying the numerous diverse factors that have contributed to its evaluation and the distillation of these factors into a KM evaluation framework (see Figure 9 in 5.1.5). The framework assists organizations in reducing the complexity and

“fuzziness” of the topic and provides a balanced generic and holistic approach on the basis of which organizations can develop a structured flexible KM evaluation model.

This study has taken a much broader view of KM than previous studies by including measurement models for topics that may not have been explicitly associated with KM or IC but nevertheless are relevant by virtue of their consistency with the objectives and definition of KM. This has broadened the perspective of KM and placed it in a strategic organizational context. KM was defined in the organizational environment by suggesting that any activity that exploits knowledge to enhance organizational learning or business performance is a KM activity. On the basis of findings to this point, a revised definition of KM can now be offered as: *“any process or practice of creating, acquiring, capturing, sharing, using and evaluating internal or external knowledge, to enhance organizational learning, performance and image.”*

The research design and methodology worked quite well with few problems being encountered during the data collection and analysis phases. The NUD*IST software product was instrumental in identifying the most relevant topics associated with KM and in constructing the evaluation categories by virtue of its ability to rapidly search all articles for specific words or phrases. More than one hundred text searches were conducted across all 220 articles to identify relevant evaluation themes. Apart from the speed and convenience afforded by NUD*IST, this software support allowed the focus to remain on the subject matter and objectives of the research rather than being overly distracted by the techniques of analysis.

This study has identified what organizations have been measuring between 1996 and 2002 in relation to KM initiatives. Trends were identified in the main categories of measures and differences in approach to KM evaluation between major geographic regions were identified. Factors inhibiting the development and use of KM evaluation models were explained and lessons distilled from the literature. The different types of measures that need to comprise a comprehensive KM measurement model were identified. These achievements effectively answer the research questions posed in 1.4.

As a journey of discovery, the chronological and geographic approaches to data analysis were enlightening as they allowed a wider variety of different perspectives of KM evaluation to be identified than would have occurred using only one domain. The chronological approach provided a detailed examination of trends which in turn highlighted many problems that organizations had experienced over the research period and provided an holistic picture of KM evaluation developments between 1996 and

2002. The geographic analysis indicated that factors such as regional culture and government policy and direction also impact the way in which organizations approach knowledge, its evaluation and how it is reported. The geographic analysis also provided some explanation as to why some organizations adopted particular KM evaluation approaches.

The results of this study have made KM evaluation somewhat less of an esoteric subject which in turn may improve the success rate of KM initiatives, may convince more organizations to embrace the activity and may improve the credibility of KM evaluation as a viable means of assessing the gap between market and book value. A strategically oriented framework is offered within which organizations can now plan their approach to KM evaluation. By using the framework developed as a by-product of this study, organizations may be in a position to more accurately identify the KM initiatives that contribute to their success and will be able to more effectively manage the knowledge at their disposal.

The future success of this study will depend on the extent to which it generates further more detailed research in the evaluation of KM.

5.1.2 Evaluation Conclusions

Models & Categories of KM Evaluation

KM/IC evaluation models have emerged, either directly or indirectly, from a number of diverse influences including Business Performance and Quality Management Models, development of IC as an ever increasing important factor of production, inadequacy of existing accounting systems to deal with intellectual assets, the emergence of organizational learning as an important management discipline and changing corporate values. Boulton et al. (2000) add that the Knowledge Economy is being built on the economic and social power of intangibles like relationships, knowledge, and intellectual property, the impact and importance of which are multiplied by the effects of the ever expanding networked global economy. In this complex and rapidly changing business environment that characterised the eighties and nineties, a number of specific models and approaches have been advocated and developed for achieving business excellence and continuous improvement. Examples included the Business Excellence Model, the Malcolm Baldrige National Quality Award, the Deming Model, Total Quality Management (TQM), Business Process Re-engineering (BPR), Investors in People (IIP), and ISO 9000 (Kaye and Anderson 1999). All of these models have measurement components associated with them and have impacted the development of KM/IC

evaluation models in varying degrees. The impact of these models on KM/IC evaluation however, has not been entirely positive and may have sent KM/IC evaluation on the wrong path.

This study supports the growing body of evidence depicting a steady decline in the relationship between tangible assets and market value across the entire industrial spectrum (Martin 2000). This phenomenon in itself has prompted research into viable systems to measure the extent and nature of this gap. Gap analysis as an evaluation model, identifies deficiencies in organizational processes which in turn leads to the development of new continuous processes and new process related measures. However, as identified in Chapter 4, very few organizations have actually implemented working measurement models that effectively and comprehensively measure this gap as part of their performance measurement regimes. In order to better understand this gap, it appears that KM/IC managers have lost faith in generic business measurement models and are searching for measurement models that are easy to apply and that will be acceptable to the financial and investment community (Wurzberg 1998).

The main problem with these generic business evaluation models is that they attempted to provide a holistic approach to evaluation of organizational performance but did not sufficiently emphasize the factors which are necessary to generate and sustain a continuous improvement momentum. The scoring mechanisms, which managers rarely had time to understand and implement, were shown to encourage number chasing rather than business improvement (Kaye and Anderson 1999). KM and IC measurement models seem to have inherited the same problems as evidenced by the continued focus on explicit knowledge and financially based measures of KMI effectiveness. Furthermore, management has not been adequately trained in how to develop appropriate measurement systems that will help to achieve organizational objectives. Some managers have demonstrated a willingness to learn “how” in terms of detailed practices, behaviours and techniques, but not “why” in terms of philosophy and general guidance for action (Pfeffer and Sutton 1999). This claim by Pfeffer and Sutton is supported by the current research findings as very little supporting documentation was found explaining “why” KM/IC measures were seen to be applicable to the organizations implementing them.

This study supports the findings of a number of studies since 1997 which found that most firms' KM efforts (particularly in the US) consisted of investing in explicit knowledge repositories in one form or another such as intranets, data warehouses and knowledge bases, building networks so that people could find each other, and

implementing technologies to facilitate workgroup collaboration and Communities of Practice. These are all activities that treat knowledge as products or assets, to be gathered, shared, and distributed. Few organizations measure the more tacit forms of knowledge implementation and how knowledge is actually used to promote learning and improve organizational performance. As can be seen from Table 10, qualitative measures for assessing the organizational impact of knowledge repositories and artefacts were found to be rare but are nevertheless gaining momentum. As a consequence of this explicit focus, KM measurement systems have correspondingly tended to focus on the stock of knowledge manifested in things like the number of patents, the compilation of skills inventories, and knowledge captured on overheads or in reports. Measuring organizational knowledge by, for example, the size of a knowledge base in mega-bytes or on the basis of number of records, has little relation to how the knowledge contained therein is actually distributed, shared and used and is thus of limited value in assessing the impact of the knowledge on the organization.

In the case of human capital, the evaluation of knowledge, skills, competencies and expertise of employees developed during the eighties and nineties to the point where human capital measures have become the most popular form of KM evaluation by 2002 (see Fig 8 section 4.2.3.). However this does not mean that human capital evaluation systems were necessarily well implemented or used particularly successfully. Evaluation techniques have been found to be fragmented and lacking in strategic purpose. Most studies of human capital measured work experience in terms of tenure, defined as years in a job, years in an organization, or by the number of times an individual has completed a certain task or operation. What these studies shared in common was that they all described and assessed work experience in quantitative terms instead of focussing on the value of that experience to the enterprise (Tesluk and Jacobs 1998). Qualitative measures of human capital such as employee satisfaction and morale, although growing, are still rare.

The ability of an organization to learn is an example of the application of human capital that was beginning to make inroads into KM evaluation models in the late nineties. Robinson and Kleiner (1996) recognized that the ability of an organization to learn in one sense depended on the mental models that decision makers had built and that these mental models (a form of tacit knowledge), made routine decision making easier and more effective. A measurement of the extent to which decision makers were encouraged to re-evaluate their mental models was recognized to be one way of identifying organizational learning ability but no examples of practical application of this technique were found at this time (Robinson and Kleiner 1996).

Acceptance of IC as a model for identifying and measuring intangibles in modern organizations appears to have been overcome, in large organizations at least. The works of Sveiby and Edvinsson amongst others in the early to mid nineties, have significantly influenced the thinking about the non-tangible factors that determine the success of companies. Despite these influences by early adopters of the concept, a particular weakness in the early stages of development of IC measurement models was the lack of coverage of elements of IC that needed to be derived from sources external to the organization. Although internal and external components of IC were intended to be included in the reporting models that were used at the time, the external focus was usually limited only to customer relations and not to other stakeholders such as suppliers and government advisory bodies (refer Table 10). One of the early exceptions was the Swedish company Skandia AFS, which first published an IC report in 1993 and targeted a wide range of both internal and external performance elements. After a decade, such success stories of comprehensive IC reporting even in large organizations, are still rare.

Apart from having learnt that measuring too much is neither efficient nor effective, organizations seemed to have had no means of assessing whether a small number of measures would provide a sufficiently complete and adequate coverage. Until now, managers who wished to manage intangibles have had to rely on a bewildering variety of available scorecard metrics without any understanding of which metrics were likely to be more important, how their company's metrics measured up to the competition, or whether the company's performance is enhanced as a result (Hurwitz et al. 2002). Many evaluation systems fail to be effective because they are disparate and often measure activities that are of a local or individual interest to a manager rather than a key activity for the business (Ahmed 1999).

There is currently no evidence to support the notion that qualitative and quantitative measures will work in harmony to achieve any form of balance between the currently available KM evaluation models. The only clue towards the future development of KM evaluation models is the strong growth of financial and human capital measures that have occurred since 1999 (see Fig 8) which may eventually lead to some degree of measurement duopoly which, without adequate balancing measures from other categories, will not enhance the cause of KM or its effective evaluation.

Conclusions from Chronological Analysis

KM evaluation appears to be struggling to develop significantly beyond its heritage in traditional measurement of organizational performance. The measurement of organizational performance appears to have undergone a number of phases in development since the eighties. The first phase, which is deemed to have started in the early 1980s, focussed heavily on financial measures such as profits, ROI and productivity. Within this system, measures were based on the traditional system of management accounting. This perspective was handicapped by a number of shortcomings (see 5.1.3), which fuelled the second phase characterised by the development of non-financial measures. Characteristically these are measures that are related to manufacturing strategy and operational matters that facilitate decision making for managers and workers, foster improvement rather than just monitor performance and change with the dynamics of the market place Ahmed (1999). The third phase is characterised by integrated use of financial and non-financial measures. The emergence of the second and third phases does not mean that the first phase has been totally superseded – it still persists and indeed appears to be growing in many organizations as shown in 4.2.3. Evidence of this third stage is apparent in the evaluation systems emerging under the umbrellas of KM and IC, particularly in the composite type measures such as the Balanced Scorecard.

Quality management and its associated metrics have undergone a separate and distinct history. Four major quality eras have been identified: inspection, statistical quality control, quality assurance, and strategic quality management (Kaye and Anderson 1999). In the fourth quality era the focus is on the customer and in this mode, the organization is more proactive in anticipating and responding to both customer and market needs. The strategic quality management approach, however, appears to be inadequate to meet today's rapidly changing business environment which is characterised by uncertainty and unpredictability. To meet these challenges, a fifth quality era known as “competitive continuous improvement” was identified by Kaye and Anderson (1999) as having developed in the late nineties where the primary concern is with the organization being flexible, responsive and able to adapt quickly to changes needed in strategy in the light of feedback from customers and from benchmarking against competitors. Based on a synthesis and interpretation of these views, five important and common evaluation factors were identified by Kaye & Anderson as: leadership, strategic focus, organizational culture and focusing on employees, processes, standardisation and measurement and learning from results. Elements of all these factors were found in varying degrees in the KM/IC evaluation

models in use over the past decade but generally in an ad hoc fashion and not part of, or integrated with, any structured or formal framework.

The theoretical roots of IC have followed two different streams of thought since the early nineties - the strategic stream and the measurement stream (Brennan and Connell 2000). The strategic stream focused on the creation and use of knowledge and the relationship between knowledge and value creation. The measurement stream related to the need to develop a new information system, measuring non-financial data with traditional financial tools (Brennan and Connell 2000). Despite the fact that the wisdom of using traditional financial tools to develop KM/IC evaluation models had been questioned by a number of authors (as identified in Chapter 4), the focus in 2000 was more on the measurement rather than on the strategic stream. Measurement of intangibles using traditional accounting tools however, was found to be a distraction and diverted the focus of KM evaluation away from the strategic advantages to be gained from a more balanced quantitative and qualitative evaluation approach.

The approach adopted by most organizations in the selection of KM evaluation models seems to have been very much trial and error and whatever was easy to measure with few organizations having any notion of how to systematically assess whether or not their evaluation regimes were producing the required information to enhance organizational learning and performance. A major challenge facing contemporary management in the development of KM/IC evaluation models, that no doubt contributed to this trial and error approach, has been the relentless and accelerating pace of change in all areas of management responsibility. Correspondingly, performance measures and measurement systems and models have been, and still are, in a state of constant and significant change as organizations seek better ways to communicate and support execution of business strategies in the knowledge economy. This is evidenced by a performance measurement survey conducted in 2001 where 80% of respondents reported making changes in their performance measurement systems within the previous three years (Frigo 2002). Many of these changes have included major overhauls of existing measurement systems and the implementation of new systems based on integrated, composite measurement frameworks such as the Balanced Scorecard and Value-Based Management initiatives. The Mason Haire University of California Institute of Industrial Relations subscribes to the notion that what gets measured gets done to the extent that, in order to change how an organization behaves, it is necessary to change the measurement system (Thompson 1998). This assumed relationship between measurement and action may have contributed to many organizations

measuring too much of the wrong things in the assumption that this would lead to higher productivity.

Efforts to revise and adapt financial accounting standards to cater for the measurement of intangibles have been slow to evolve and have fallen short of what was needed inasmuch as they continued to be overly concerned with financial information (Wurzberg 1998). Most of the solutions offered have been geared towards profit-making commercial firms by measuring IC and the intangible assets on a company's balance sheet and thus have had limited application for non-commercial enterprises such as the public sector (de Gooijer 2000). An attempted step in this new direction was the International Accounting Standards Committee that developed a new accounting standard on intangible assets (standard IAS 38) in 1998. Although IAS 38 provided for the disclosure of some IC elements in the annual report, it only went part of the way and most IC resources remain undisclosed.

Further to the tendency to cling to traditional accounting measurement, Allee (1999) established that organizations have been tempted to try to stretch the traditional Industrial era way of thinking and apply it to the idea of knowledge and value creation. This study supports Allee's findings. Allee found that this approach was useful for only a very limited range of knowledge products and that such models fell far short as a way to think about knowledge in its cyclical development between socialisation, externalisation, internalisation and combination (as discussed in 2.4.2). The old ways of modelling the enterprise via value chains, organizational charts, process diagrams and workflows have been found to be inadequate, slow and cumbersome in attempting to address the key business question of how to understand knowledge and the value creation processes associated with it (Allee 1999).

The adage "what you measure is what you get" has been generally shown to be true with the correlation between what is measured and what is achieved, being found to be imperfect, but definitely positive (Appelbaum and Reichart 1998). Some organizations seemed to rely on this as sufficient basis for implementing extensive evaluation models. More recently, it has begun to be recognized that parameters such as quality relationships and trust are fundamental principles of a successful value network, but few organizations had any idea of how to measure these elements of organizational performance.

It was established during the eighties and early nineties that, meeting the educational needs of experienced managers had the ability to enhance the reputation of a company

as an employer, enhance managerial excellence, positively impact the bottom line and lead to the growing realization that education was a strategic weapon for achieving competitive advantage (Francis and Mazany 1996). However, while the qualitative benefits of education were recognized to represent important contributions, organizations have found that each benefit was difficult to measure. The failure to conclusively relate OL to dollar benefits may have contributed to the waning of interest in the concept of OL in the mid nineties. Since then there have been important debates regarding the extent of the role of learning processes in creating organizational knowledge. Whilst models for measuring learning (such as Kirkpatrick's model¹⁵) have been available for some time, they have not been used effectively and have not been effectively integrated with KM/IC measurement tools. Models are still emerging from such debates to evaluate the effectiveness of learning programs in line with KMIs.

Emerging out of the debates in the late nineties was the notion that if the rate or quality of knowledge flow in the organization was increased, accumulation of IC stock in the form of human, structural or relationship capital would naturally follow and that value would consequently increase (Allee 1999). This may or may not be the case. Whilst the literature suggested the necessity to demonstrate the connection between these knowledge flows and *how* they generate value for the organization, no evidence was found of any cases where this connection had been systematically and demonstrably established. Many of the emerging theories in relation to KM and IC evaluation have not been tested in practice.

Creating value through the flow and management of knowledge takes a number of different forms. Some of the rarely quoted factors of IC such as human and organizational values, principles, and ethics have become critically important to organizational success over the past decade through core values such as integrity, honesty, responsibility, inclusion and respect (Allee 1999). These values contribute heavily to creating the "right conditions" for fair exchanges of knowledge to take place. In the old competitive business environment, one could occasionally jeopardise a relationship for the sake of a short-term gain. In the more complex and open world of Value Networks of the late nineties, such actions could damage a company's standing and trust, impacting its value creating capacity at multiple levels (Allee 1999). This study indicates that organizations are beginning to recognize that customer and public perceptions of organizational ethics and social responsibility are important components of their Intellectual Capital that need to be evaluated and reported, both internally and

¹⁵ see 4.3.1.

externally. Few organizations are actually doing this and those that are, are not doing it very well, partly due to lack of skills and lack of knowledge as to how to approach it.

After investing significant amounts of money and time in KM since 1996, managers towards the end of the nineties started to wonder whether their efforts had been worthwhile (Ahmed 1999). This is evidenced by the volatility in the use of major KM measurement categories between 1998 and 2000 before some clearer trend patterns started to emerge, particularly the upward trends in financial and human capital measures and downward trends in customer, market and process related measures¹⁶. KM measurement was found to be important to determine what to pay attention to and improve, to provide a scoreboard for people to monitor their own performance levels, to give an indication of the cost of poor implementation, to give a standard for making comparisons and to help efforts comply with business objectives (Ahmed 1999). However, many organizations found that randomly selecting a large number of measures without a plan, structure or framework, was not the answer. Supporting Ahmed's findings, more than half the respondents in a 2001 survey, rated their organizational performance measurement system¹⁷ as poor, or less than adequate, and less than 10% considered their performance measurement system excellent in communicating strategy (Frigo 2002). The literature does not offer any evidence to suggest that KM/IC measurement is any more or less effective than generic organizational performance measurement systems but it was found by Frigo (2002) that users of the Balanced Scorecard method, rated the effectiveness of their performance measurement systems in supporting and communicating strategy much higher than nonusers. This indicates that a balanced model drawing appropriate metrics from a variety of categories offers the most viable KM evaluation approach.

As established in Chapter 4, there is still a pervasive preference for quantitative measurement purportedly in the interests of objectivity. But perhaps 100% accuracy and reliability is no longer enough with relevance of issues becoming more important than absolute reliability and objectivity. A somewhat futuristic statement comes from Simon and Kumar (2001) who claim that increasing technological and communications advancements are leading to a society where information and intellectual property will be akin to currency. Being in the very early stages of this transition, it remains to be seen if and how this recognition and acceptance of IC as currency will occur.

¹⁶ See Fig 8 in section 4.2.3.

¹⁷ which has been taken to include KM/IC measurement in whatever form

The eclectic influences on KM/IC evaluation models present a complex but rich environment upon which current evaluation models are based. Evaluation has been recognized as a critical organizational performance issue but managers in 2003 are still a long way from being able to measure and manage knowledge and IC effectively. The raw materials in terms of variety of possible metrics are adequate and available, what is needed is a framework to assist organizations in putting together the appropriate raw materials into an integrated holistic model. This is discussed further in 5.1.4.

Conclusions from Geographic Analysis

As identified in Table 11, the main geographic factors impacting KM measurement are: the different approaches that countries take to learning, knowledge and to the discipline of KM; different approaches to measurement in general; attitudes towards business improvement concepts such as Continuous Improvement; accounting and reporting regulations; Government support; management attitudes and national cultures. Multi-national organizations in particular will need to be mindful of these factors as one form of KM evaluation is unlikely to be appropriate for branches in different major regions of North America, Scandinavia, Europe, UK, Japan and Australia.

In Japan and most of the western world, information and knowledge, or more precisely, the effective use of them, have become factors of production in their own right. Only the western world however, seems to be concerned with evaluation and measurement of KM and IC. Japan regards KM as such a natural and normal part of management that is integrated with their business processes in such a way that knowledge itself or the outputs from KMIs do not need to be measured because management and organizational performance evaluation encompasses the measurement of the effective use of corporate knowledge from the shop floor to senior management. The Japanese are more focussed on knowledge creation as shown by formal and comprehensive reward systems that they have put in place to encourage the generation of new ideas.

Management styles, attitudes and organizations cultures in different regions impact the organization structures which, as the UK has discovered with their traditional “command and control” type structures, can stifle the sharing and use of knowledge. The lack of senior management support for qualitative forms of KM evaluation in the US has had a significant impact on the way North American organizations manage and value their knowledge.

Government can also have significant impacts on KM evaluation through accounting and business regulations, incentive schemes for different types of performance reporting and provision of relevant infrastructures for training, higher education and knowledge dissemination. It is somewhat paradoxical that the US government has recognized that human capital is its most valuable asset and yet its distinctly conservative policy on reporting of intangibles has significantly impacted its ability to accept qualitative measures in any form as viable for reporting. By contrast, policy development by central governments in Japan and Scandinavia for initiatives such as Continuous Improvement is far more prevalent than in other regions. Government support for KM evaluation in the UK, Europe and Australia is still weak and provides little direction for industry.

Whilst Scandinavia continues to set the standard for IC reporting and seems to have found the appropriate balance between the explicit and tacit elements, Australia has a long way to go and as such, has significant opportunities to learn from the other major regions. While Australia seems to follow the North American model in things like quality improvement, it is more liberal than the US in accepting alternative accounting systems for measuring intellectual capital. Opportunities exist for Australia to take the best KM evaluation practices from the other regions and thus avoid many of the shortcomings encountered by early adopters.

Apart from Japan, East and South East Asia were conspicuous by their absence in KM/IC literature. Whilst Singapore, Malaysia and South Korea have established significant manufacturing bases in their respective regions, they do not seem to have adopted the Japanese penchant for KM. It remains to be seen if these non-Japanese industrial entities can compete with other knowledge based economies.

Different cultures and values inevitably result in different employee motivators which in turn have been found to lead to different evaluation approaches, particularly for intellectual assets. For example, the Japanese kaizen approach versus the US preference for quantum leaps in organizational change may suggest that the Japanese are more focussed on process while the US is more focussed on outcomes or results. The US preference for quantum leaps may also explain the US reluctance to embrace Continuous Improvement (CI) initiatives as the principles of CI are more supportive of incrementally managed procedural changes.

The global economy will no doubt demand that internationally accepted standards be developed for accounting and reporting of intellectual assets but it is difficult for such

standards to develop while there are such significant differences in the approaches by central governments and large organizations to knowledge, its management and evaluation. Significant additional work needs to be done by International Accounting Standards setting bodies to establish the standards for KM and IC evaluation and reporting that can be interpreted and adapted by national bodies to satisfy different national and professional standards and practices. Somehow international standards will need to consider the geographic factors mentioned above in the design of universally acceptable KM evaluation models that will cater for the unique needs of each and every organization. The extent to which this is possible is yet to be determined.

5.1.3 Evaluation Shortcomings and Barriers

The problems and shortcomings that were identified by this study as being experienced by organizations in their attempts to implement KM evaluation models between 1996 and 2002 have presented significant barriers to the development of effective KM/IC evaluation models and have significantly influenced the rate of acceptance and adoption of new measurement principles.

The following table represents the main shortcomings and barriers to KM evaluation and the contributors to each issue identified by this study.

Shortcoming of, or Barrier to, KM Evaluation	Contributors
Poor understanding of KM/IC measurement principles leading to measuring too much of the wrong things	Ahmed 1999, Kaye and Anderson 1999, Lenskold 2002, Liebowitz and Suen 2000, Brah, Ong et al. 2000, Clarke and Rollo 2001, Davis 1996, Kaplan and Aronoff 1996, Kleysen and Street 2001, Kuzmarski 2001.
Incompatibility of traditional financial accounting and reporting systems with KM/IC measurement and reporting	Ahmed 1999, Bassi 1999, Berkowitz 2001, Bontis 1998, Bornemann and Leitner 2002, Brennan and Connell 2000, Carroll and Tansey 2000, Collier 2001, Grossman 2000, Joia 2000, May 1997.
Excessive "command and control" rather than improvement and action orientation.	Lynn and Reilly 2000, Carroll and Tansey 2000, Li and Cavusgil 1999, Thompson 1996.
KM measures too narrowly focused, not strategically aligned and not embedded in overall business performance model.	Ahmed 1999, de Gooijer 2000, Kaye and Anderson 1999, Kruzner and Trollinger 1996, Frigo 2002.
Results of measures not being adequately communicated throughout the organization.	Thompson 1998, Grossman 2000, Frigo 2002.

Table 12: Shortcomings and Barriers to KM Evaluation

These issues are discussed in more depth below.

Poor Understanding of Principles

KM evaluation in the 21st century is being embraced with little common understanding of its principles to the point where poor and ineffective measurement system design and implementation is potentially destroying the opportunity of achieving significant benefits. Some organizations displayed particular weaknesses in regard to their approaches to performance evaluation which included: - lack of identification of critical success factors; lack of understanding of the concepts of measurement of quality and continuous improvement; insufficient integration of continuous improvement activities; existence of a "blame culture"; reliance on "quick fixes" and fire fighting; low level of employee empowerment and perceived lack of non-financial performance measures (Kaye and Anderson 1999; Barsky and Marchant 2000; Bontis 1998; Kleysen and Street 2001). In addition, many organizations failed to implement effective performance evaluation systems to support their development due to failure to operationally define performance, failure to relate performance to the process, failure to define the boundaries of the process, misunderstanding or misusing measures, failure to distinguish between control and improving measures, measuring the wrong things, fear of distorting performance priorities, fear of exposing poor performance and perceived reduction in autonomy (Ahmed 1999; Thompson 1998; Wise 1999; Liebowitz and Suen 2000). Ahmed (1999) also believed that the disillusionment by organizations to achieve the expected benefits from KM arose because management failed to put in place an appropriate tracking system to measure progress. All of these factors apply equally to KM evaluation methodologies as they do to organizational performance evaluation in general.

Contributing to the lack of understanding of KM/IC measurement, indications from this study are that many managers do not have the necessary expertise to carry out appropriate KM/IC evaluation. Poor skill levels may have contributed to many KM/IC measures in current use lacking focus and precision (Bontis and Fitz-enz 2002). The difficulties are exacerbated by the attitudes of particularly accounting and finance managers, who are less likely to appreciate or advocate the importance of such measurement and are thus not likely to develop the necessary skills in themselves or in their subordinates (Bontis and Fitz-enz 2002).

There are shortcomings with the tendency to see knowledge or know-how as something tangible or as an artefact like a patent. First, the conception of knowledge as something explicit and quantifiable draws a problematic distinction between knowledge as a

tangible good and the use of that good in ongoing practice (Pfeffer and Sutton 1999). Second, the emphasis that has resulted has been to acquire or develop intellectual property under the presumption that knowledge, once possessed, will be used appropriately and efficiently (Pfeffer and Sutton 1999). As intellectual assets do not behave in the same way as physical assets (Rodov and Leliaert 2002), they cannot and should not be measured the same way.

Inadequate Accounting and Reporting Systems

Performance measures in general and KM evaluation in particular, to a large extent are still locked in the traditional perception of measurement systems as "command and control" mechanisms, fitting comfortably with the Industrial era model of management which is still cripplingly prevalent in many managers' minds (Monkhouse 1996). This legacy has adversely impacted the development of KM evaluation models.

The traditional accounting system is historically based and focuses on monetary amounts of past transactions, while IC is future oriented and focuses on subjective qualities, making it difficult to value such assets in quantitative terms. IC accounting evolved in the early nineties as a tool to help measure the results of KM at all levels of the organization and was designed to show whether an organization was on the right track in implementing its strategies and policies (de Pablos 2002). The IC report as an output of the IC accounting process was developed in order to make the organizational intangible resources visible to internal and external stakeholders. According to Skyrme (1998) the underlying accounting principles for the emerging knowledge economy, shareholder value and innovative organizational practices and processes are still undefined and poorly understood. Furthermore, traditional accounting measures have been accused of being myopic, often sacrificing relevance for reliability and do not tell users anything about the psychological climate that motivates workers (Carroll and Tansey 2000). Traditional accounting practices do not appropriately measure or value attributes such as speed or velocity (e.g. time-to-market, time-to-full-value usage, customer responsiveness); they don't measure intelligence (e.g. what is known or how fast it is learnt); they don't measure degree of satisfaction (e.g. employee morale or customer satisfaction) and they fail to cover the critical dimension of connectedness in the form of ease of doing business, how appropriate and well-executed the channel strategy is or the quality of relationships (May and Kahnweiler 2000).

Although technology, connectivity and human capital are playing an increasingly dominant role in contemporary management, the inadequate accounting systems are proving to be slow to adapt to new measurement needs. Whilst most practitioners

would argue that the point of metrics is to provide a framework to measure the success or failure of a KM initiative (the ex post view), for senior executives the reality is still that measurement systems need to offer a way to justify the expenditure of resources (the ex ante view) in the first instance (Skyrme 1998). Many managers believe in the growing importance of investing in skills through formal and informal training but existing accounting and other structures mean that most organizations are unable to adequately measure, report and evaluate these key investments (Bassi, Ludwig et al. 2002). Existing accounting systems do a poor job of providing the necessary tools at either ends of the ex-ante/ex-post spectrum and are poor at conveying information on the skills and know-how of a company workforce, the ability of companies to systematically locate useful information and to get it quickly to where it can add value in the production process and the strength of relationships with suppliers and customers, etc (Wurzberg 1998). Reliance on financial statements measures are almost certainly impeding the financing of knowledge based initiatives because assets in the form of human resources are not given appropriate recognition.

In addition to these limitations it is well documented that relying on single financial measures such as ROI or net income to measure performance leads to sub-optimal business decisions and dysfunctional behaviour (Carroll and Tansey 2000). The failure to measure and record IC can lead to the misallocation of capital, under-investment in IC creating activities such as training, and unrealistic income reporting (Carroll and Tansey 2000). The bottom line of all these un-measured attributes of success are that return on investment (ROI) is no longer an appropriate indicator of business success and yet is still extensively relied upon as shown in Appendix E and section 4.2. Another problem with these measures is that they do not provide any mechanism for improvement.

Adding to the informal and fragmented approach to KM/IC evaluation, in the absence of appropriate accounting and reporting standards, each organization has had to develop its own reporting model and its own naming conventions for IC components making comparisons between organizations difficult. Without a common set of principles and shared understanding across organizations on how to measure IC, it would be extremely difficult for public disclosure to be useful, even if it were to occur (Bassi, Ludwig et al. 2002). Information disclosed voluntarily is available to competitors, and competitive advantages can quickly disappear if inappropriately reported (Brennan and Connell 2000). Moreover information manipulation can occur in a situation where there is no standard IC reporting framework and where surveillance by independent bodies is not required (Vander Meer-Kooistra and Zijlstra 2001). Managers are also reluctant to

disclose more than what is necessary for fear that they could create unrealistic expectations from internal and external stakeholders which may or may not be met (Vander Meer-Kooistra and Zijlstra 2001). HR managers in particular are worried about what they'll find if their programs are measured rigorously and accurately, and as a result, they often claim it's too hard to do (Grossman 2000). These issues not only reduce the credibility of IC reports, it makes them less likely to be produced at all.

Poor Orientation

A number of authors maintained that there was too much emphasis on command & control orientation in KM evaluation and not enough on improvement and action (Monkhouse 1996, Carroll and Tansey 2000, Thompson 1996).

According to Monkhouse (1996), the folly of steering the business entirely "through the rear view mirror", as conventional financial performance measures had been described, had been well documented and, by some businesses, well understood, but he questioned whether this understanding was being translated to action by anything but a relatively small number of high-profile organizations.

Whilst Thompson (1996) saw a "command and control" philosophy as valuable for managing resources efficiently, he believed it was not conducive to rapid change or organizational flexibility, which is critical for KM (Kaye and Anderson 1999). Command and control management also requires the organization to be separated into functions, businesses and/or divisions for clarity whilst knowledge oriented organizations demand different forms of organizational integration, both formal and informal, in order to share both information and learning (Thompson 1996).

An over-emphasis on financial measures are giving misleading signals for continuous improvement and innovation activities demanded by the contemporary competitive environment and they do not provide any mechanism for improvement (Carroll and Tansey 2000, Li and Cavusgil 1999). If companies could measure their innovation process and had reliable metrics to gauge their performance, specific problem areas could be addressed and managers might see improvement in their innovation efforts (Lynn and Reilly 2000).

Lack of Strategic Focus

Kaye and Anderson (1999) highlighted the need for strategic focus in the evaluation of continuous improvement initiatives which highlighted the importance of the linkage between strategy, actions and measures. This linkage is essential and unless organizations adapt their measures and measurement systems to facilitate compatible introduction of these elements, implementation will fail to reap the expected benefits (Ahmed 1999). The experiences of companies pioneering in the field of performance management demonstrate that, once the means are at hand to make measurements demonstrably linked to strategy, a whole new realm of managerial possibilities opens up particularly in regard to the transformation of passive data into actionable business knowledge (Kruzner and Trollinger 1996).

Frigo (2002) also identified the gap between performance measures and strategy stating that the innovation component of an organization's knowledge strategy is often not clearly defined or articulated within the overall strategy for value creation. Organizations should examine how best to create and leverage intangible assets in conjunction with their business strategies.

Lack of Adequate Communication

Thompson's (1998) research suggests that even when IC related issues are actually evaluated and measured, the results are not always communicated through the organization to an appropriate and desirable degree. Frigo (2002) maintained that there are gaps in the effectiveness of performance measures to communicate strategy to employees and to support strategic initiatives such as innovation. Given that different measures apply at different levels of the organization it is often not clear how lower level production and service related measures translate into upper level financial results. It is possible that significant meaning and relevance could be lost in the translation from one level to another.

A common contemporary constraint to the evaluation of intangibles is that senior management, the market, and shareholders may not be willing to invest in change if the benefits cannot be adequately quantified (Stank et al. 2001). The perception is that if it cannot be quantified then the meaning will be unclear and therefore should not be reported at all. An example of this is human resource data which, unlike pure financial metrics, tends to derive from softer, qualitative sources like surveys and interviews, making them less exacting than number-crunchers would like (Grossman 2000).

5.1.4 Future Evaluation Issues

This section projects the results, shortcomings and conclusions in regard to KM evaluation into considerations and recommendations into how organizations can make their KM evaluation models more effective and potentially improve the effectiveness of their KMIs.

Overview

As highlighted by the findings in Chapter 4, KM/IC evaluation is far more involved than adding a few metrics to the accounting system – it requires a whole new way of thinking and a new approach to what is considered valuable to an organization. Indeed, progress in describing, measuring and analysing dynamics in the knowledge economy depends on a “paradigm shift” in economic thinking to accommodate changing relationships between the accumulation of knowledge and physical capital, the shift in the relative importance of tacit knowledge and codified information and differing conditions for efficient functioning of markets (Wurzberg 1998). There is also a need for progress with regard to measuring knowledge itself although, as identified earlier, measuring knowledge as an asset should not be the only consideration.

Significant opportunities exist for learning and cross fertilization of KM evaluation experience across industries and between organization types. The study of KM evaluation models over the past ten years has highlighted the need for all organizations, regardless of size or industry type, to not only learn how to learn in a knowledge oriented environment, but also to know how to measure what they have learnt and to extrapolate that into what needs to be learnt in the future. As part of this learning process, some un-learning may be necessary to discard inappropriate KM measurement practices before the course for the future can be confidently charted. Despite the encouraging progress, there is still a long way to go and progress is likely to be slow.

The major issues for the future of KM evaluation are shown in the following table with specific topics within each major issue identified.

Major Issues	Topics
Objectives of KM	<ul style="list-style-type: none"> • Converting knowledge to value
Measurement Approach	<ul style="list-style-type: none"> • Compliance with Measurement theory • Validity and reliability of measurement
Organizational Issues	<ul style="list-style-type: none"> • Strategy • Learning • Measuring corporate mission • Structure (levels)
Human Aspects	<ul style="list-style-type: none"> • Evaluation as a medium for communication • Language of measurement • Measurement and human behaviour
Metrics	<ul style="list-style-type: none"> • Service vs product • Explicit vs tacit • Internal vs external

Table 13: Future Evaluation Issues

Objectives of KM - Converting Knowledge to Value

Nowhere in KM does the clash of old thinking and new thinking show up more vividly than in the way people attempt to address knowledge flow and in the conversion of knowledge into some form of identifiable value (Allee 1999). It has clearly become necessary to consider value beyond simple monetary value, which practitioners and academics have already acknowledged is far too limiting. An expanded definition of value would be a tangible or intangible quality, good, knowledge, benefit or service that is desirable or useful to its recipient to the extent that they are willing to return a fair price or exchange (Allee 1999). Each of these types of value is in itself a potential medium of exchange, not just money. In other words, it is possible to exchange knowledge directly for knowledge, exchange knowledge for tangible goods, services or money or even exchange knowledge for an intangible value such as customer loyalty (Allee 1999).

Recent developments have recognised that value creation models must focus on managerial decisions in relation to the allocation of R&D funding, must provide management with information used to set baseline operations and objectives, must be easy to understand by all members of the organization, must be accessible interactively, must link R&D to corporate and financial strategies and must include the critical corporate value creation factors associated with all the objectives of the technology commercialisation process (Allee 1999). Few organizations were found to have reached this level of sophistication in process evaluation whether KM related or otherwise.

There is also a need to look towards the enablers that lead to the production of results (Ahmed 1999) and to measure the effectiveness of processes in order to develop an

understanding of the knowledge oriented factors that contribute to organizational success. The reason for the focus on knowledge is not to have more, better or faster, knowledge - but to create value from it (Allee 1999). Although companies must learn how to combine evaluation with a process for turning insight into action (Lynn and Reilly 2000), it is entirely conceivable that converting knowledge into value may involve doing more with less and perhaps even slowing down some processes in order to understand, manage and measure key processes more effectively. The focus needs to move from the current preference for explicit metrics to a balance between tacit and explicit measurement systems to provide the required information.

Measurement Approach

Compliance With Measurement Theory

KM evaluation should comply with the conventions of measurement theory in that they must represent the property or manifestation on an unambiguous scale that is not ad hoc; must be agreeable, objective, testable and repeatable and the mapping must be meaningful and empirical (McPherson and Pike 2001).

Balance between Validity and Reliability

Evaluation systems must be flexible and capable of dealing with both hard and soft issues and must support organizational decision making processes. Some elements of KM such as competencies, will need to be evaluated by indicators which are inevitably subjective in nature rather than by formalised, hard measures. Improving competence in key areas demands more robust measurement of effectiveness, stakeholder satisfaction and corporate values. Thompson (1998) believes that, just because this may be more difficult, is no excuse for concentrating on measuring those factors that are simply easy to measure as they may not be the ones which make a real difference. This introduces the validity versus reliability argument¹⁸. The focus in future should be more on arriving at a balance between validity and reliability rather than predominantly on reliability. An approach offered by Kuczarski (2001) that balances validity with reliability is that all firms should consider using two types of metrics: innovation performance metrics or those that measure growth, and innovation program metrics that measure and reflect program management and control.

¹⁸ This was introduced in section 3.8 in relation to the validity versus reliability of this study, but is also relevant in regard to KM measurement.

A few measures that are directly related to the basic business model are considered to be better than a plethora of measures that produce a lack of focus and confusion about what is important and what is not (Pfeffer and Sutton 1999). It is necessary for KM practitioners for example to get much better at measuring things like employee absenteeism that did not occur because air quality was improved, injuries that did not happen because ergonomically appropriate furnishings were chosen, or ideas and initiatives that were not lost because the work setting facilitated effective collaboration (Kaplan and Aronoff 1996). These are all important benefits that are virtually invisible to financial-accounting measures. However, whilst the validity of such measures would be relatively simple to demonstrate, it would be difficult to prove the reliability and verifiability of such measures to corporate regulators.

Organizational Issues

Matching Measures to Strategy

The effectiveness of the relationship between organizational knowledge and competitive advantage is moderated by the firm's ability to integrate, transfer, and apply knowledge at a strategic level (Bharadwaj 2000). According to Nonaka and Takeuchi (1995), KM requires a commitment to create new task-related knowledge, disseminate it throughout the organization, and embody it in products, services, and systems. Part of this strategic focus is a need to improve performance measures for the intangibles that drive most of the value creation in today's economy but there are gaps in the effectiveness of current performance measures to communicate strategy to employees and to support strategic initiatives (Frigo 2002). Performance measures for intangible drivers need to be closely articulated with strategy and every strategy requires a different set of measures. The key is to devise unique metrics that assess strategic value and effectiveness, not just efficiency. A linkage between strategy, actions and measures is essential and unless companies adapt their KM/IC measures and measurement systems to be strategically compatible, implementation will fail to reap the expected benefits. In addition, specific performance measures need to contribute to broader goals which require the implementation of KM measures that cross traditional organizational boundaries (Kruzner and Trollinger 1996). Such externally oriented measures are covered further in 5.1.4.6. Furthermore, KM performance measures need to be embedded in the overall business performance model, and not be a marginal "add-on" to the core measures (de Gooijer 2000) as has been found to be the case with contemporary approaches.

Embracing Organizational Learning and Associated Measures

For an organization to become a learning organization it is critical that both an evaluation methodology and communications medium be formalized (Appelbaum and Reichart 1998). What is required for a specific business must be evaluated by the organization itself with the first step being to define the status quo followed by a clear articulation of where the organization wants to be in the future. The actual journey from one state to another is also a learning experience, the effectiveness of which the LO evaluates in order to more effectively conduct such transitions in the future.

The learning organization should be meaningful, manageable, and measurable (Appelbaum and Reichart 1998). The three Ms may indicate why it has been so difficult to find examples of learning organizations, each M is independent, yet like the learning organization itself, is interdependent. Thus although many definitions have attempted to capture the essence of the learning organization it still remains difficult to move the theory to reality without effective measurement tools. Measurements must be taken to assess the status quo, in order to determine which actions must be taken to manage the progression towards a learning orientation. It is critical to select measures that reflect those competencies which hold the key to the organization's strategic and critical success. These must be measured rigorously and targeted, to ensure there is a drive to improve them. Vigilance must ensure that changes of emphasis and priority are also reflected in new or amended measures (Thompson 1998).

Measuring Corporate Mission

The actual measures and variables selected should be customized to the industry, the environment and to the strategy of the unit (Stivers and Joyce 2000). Further to the unique measurement framework for each organization recommended earlier, different evaluation models may be required depending on the characteristics that the organization decides are valuable to its internal and external stakeholders. The need to measure corporate values is particularly challenging as it involves measuring achievement of the corporate mission which may have been conceived without any consideration being given to how its achievement should be measured. Many organizations have no means of assessing whether or not they have in fact achieved their corporate missions.

Applying Different Levels of Evaluation

As identified in Chapter 4, the nature of the organization, its location and its approach to knowledge are amongst the many factors that will impact the choice of measurement systems and metrics employed. An important issue is to understand the quantity, format and nature of the knowledge that KM evaluation systems are required to deal with and

why the selected measures are the most appropriate to satisfy the performance measurement and learning objectives of the organization. As well as different models being applicable to different organizations, different metrics are required for different levels within the organization mainly because the measurement models need to be understood by the data collectors and the users of the information produced and these users will reside at different levels within the organizations.

Characteristics of a good knowledge evaluation system include: performance being measured at the strategic, tactical and operational levels; performance measurement being a distributed activity reflecting various levels of ownership and control; performance measurement reflecting a blend of measures for individual tasks and activities to manage processes and performance measurement and highlighting opportunities for improvement in all areas (Ahmed 1999). This leads to the need for a very complex vertically and horizontally oriented evaluation framework within which each organization needs to construct its unique KM evaluation model. Whilst a framework can be generic, the KM evaluation model must be unique for each organization. Part of this unique model for each organization is that measures must provide specific guidance to individuals telling them what they must do well for the organization to achieve its objectives.

Human Aspects

Using Evaluation as a Medium for Communication

Measures conducted by the organization (whether KM related or otherwise) provide indicators to stakeholders of what is important. They illustrate where the emphasis has been placed in the past and help in determining where the emphasis should be to achieve the company's goals in the future (Kennedy 1998). Employees and managers both pay attention to areas that are measured, although perhaps for different reasons and with different outcomes. It is logical therefore, that management can and should use measurement as a tool for communicating direction and priorities for the entire organization.

Language

There is a need for progress in the development of a KM language for conveying to capital markets credible information on their relationship to companies' performance because, without such progress, much of what is useful about KM risks being condemned to the status of something that is a marginally useful internal managerial

tool that has little impact for external stakeholders in how they view an enterprise (Wurzberg 1998). The required language and metrics (analogous to the language and metrics of financial standards) will help standardise the presentation of non-financial information. Indications from this study are that language and metrics are still in their early stages of development even in the more advanced regions of Scandinavia and Europe.

Measurement & Human Behaviour

Metrics to monitor key HR practices that have been proven to grow human capital in a broad spectrum of businesses for example need to be established. Organizational performance evaluation models need to maintain their current high human resource focus because performance measures need to promote and encourage appropriate behaviours within an organization (Ahmed 1999). This applies more so to KM than other performance measures because of the high people factor in KMIs. Any measurement system will drive behaviours to some extent, the challenge for KM in particular is to ensure that the most appropriate behaviours result from the KM evaluation effort. This concept extends into a new form of IC known as social capital. By managing and measuring social innovation capital, managers can improve the rate and quality of innovation in their firms, as well as their competitive stance in the marketplace (McElroy 2002).

Metrics

Balancing Service and Product Measurement Focus

A product oriented measurement focus alone will not work for KM/IC measures because products are "function-centric" whilst service is "customer-centric" (Davis 2000). Although one can draw parallels between the two relationships, the fundamental difference is that service equals perception while product equals function. A service focus considers the impact of intangibles, product focussed measures do not. Knowledge-intensive services are based on the professional's ability to apply and combine knowledge (facts, methods, rules, instruments, etc.) within different fields to find a more or less unique solution to each client's specific needs or problems. This type of operation is becoming more common as the knowledge front advances and broadens. The evaluation of knowledge itself and of KMIs will play a major role in the development of knowledge intensive services.

Balancing Explicit versus Tacit Metrics

As alluded to in section 2.6, a dilemma has emerged in how much qualitative data should be quantified. According to Vander Meer-Kooistra and Zijlstra (2001), trying to quantify IC information as much as possible is important but the inevitable problem arises when a large proportion of IC information is not suitable for quantification. A very important IC component is tacit knowledge and experience which cannot be made explicit, it can only be shared by working closely together in a master-apprenticeship relationship and measured in relation to the effectiveness of this relationship and the extent of knowledge sharing that occurs. As discussed in 2.6, it would appear to be prudent to make explicit whatever needs to be managed and measured in that format and leave in tacit form whatever does not benefit from such conversion.

Balancing Internal versus External Focus

Knowledge is transformed into value not only within the organization, but also through knowledge based interactions with its external entities such as customers, suppliers, and other partners (Chun 2001). As identified in Chapter 4, the predominant KM/IC evaluation focus to date has been on internal measurement. It is important to increase the focus on external components of learning and performance measurement.

Ultimately, the goal of KM is to leverage the IC that is resident in the organization and to convert that knowledge into sustainable competitive advantage through increased business performance (Bontis and Fitz-enz 2002). It is essential then, but only as a first step, to measure resource utilisation efficiencies. But this, by nature, is predominantly an internal perspective, and it has been established that a business cannot sustain long-term success if it fails to satisfy its external stakeholders. The external sources of knowledge consist of former employees, retirees, competitors, suppliers and customers, all of whom potentially provide a rich and valuable knowledge resource but are rarely considered as viable information sources.

In a competitive environment, effectiveness measures, such as customer satisfaction linked to service, are critical - as many organizations have now recognised. Selected aspects of this can be measured straightforwardly with various types of satisfaction surveys, but other elements are more complex. Innovation, supported by learning, underpins customer care and service. While this must, by nature, be difficult to measure objectively, attempts can be made to judge the level of activity and the extent to which it is growing (Thompson 1998).

Reporting externally on IC has its own requirements and challenges. External stakeholders expect that they can compare the companies' reports to other organizations.

This requires standardisation of the information and the way in which it is reported. They further expect that the information is reliable and objective, and that possibilities of window dressing and subjectivity are ruled out (Vander Meer-Kooistra and Zijlstra 2001). Auditing IC information would make it more credible, improving users' reliance on it (Brennan and Connell 2000). Such assets, however, due to their nature, cannot be audited in the same manner as tangible assets. New procedures to validate the evaluation techniques for KM need to be established and new auditing methods are required. Without new tools and techniques for auditors, the quality of the information (including standardisation, reliability, objectivity) cannot be guaranteed by demanding an independent assessment of the information. Therefore, including the IC report in the annual statement is not possible as it cannot be validated to the same level of confidence as the traditional financial statements. For the time being therefore, IC reports will need to be issued separately from the financial reports.

5.1.5 A KM Evaluation Framework

The current situation with KM measurement is very much trial and error and fragmented with little discernible interrelationships between the measurement categories identified in 4.2. It is organizational culture and management style that provides the environment within which knowledge in an organization is created, disseminated, used, managed and measured. In the absence of any mandatory reporting requirements, the organizational culture in turn determines its approach to knowledge itself, its management and its evaluation.

Five major branches of KM measurement were identified: Financial, Internal Infrastructure and Human Capital, Market and Customer metrics, Innovation and Intellectual Property and Quality/Process related metrics. Data from these five groups of metrics in the past have been used on an ad hoc basis without any consideration as to how they needed to fit together to produce a comprehensive measurement framework.

In the interests of avoiding the tendency to measure too much and as supported by Pfeffer and Sutton (1999) in 5.1.4, it is suggested that a manageable number of measures (perhaps four or five) from each of these branches would provide a comprehensive balanced measurement model for an organization to effectively assess the value of its KM initiatives. The following diagram describes the prescribed framework:

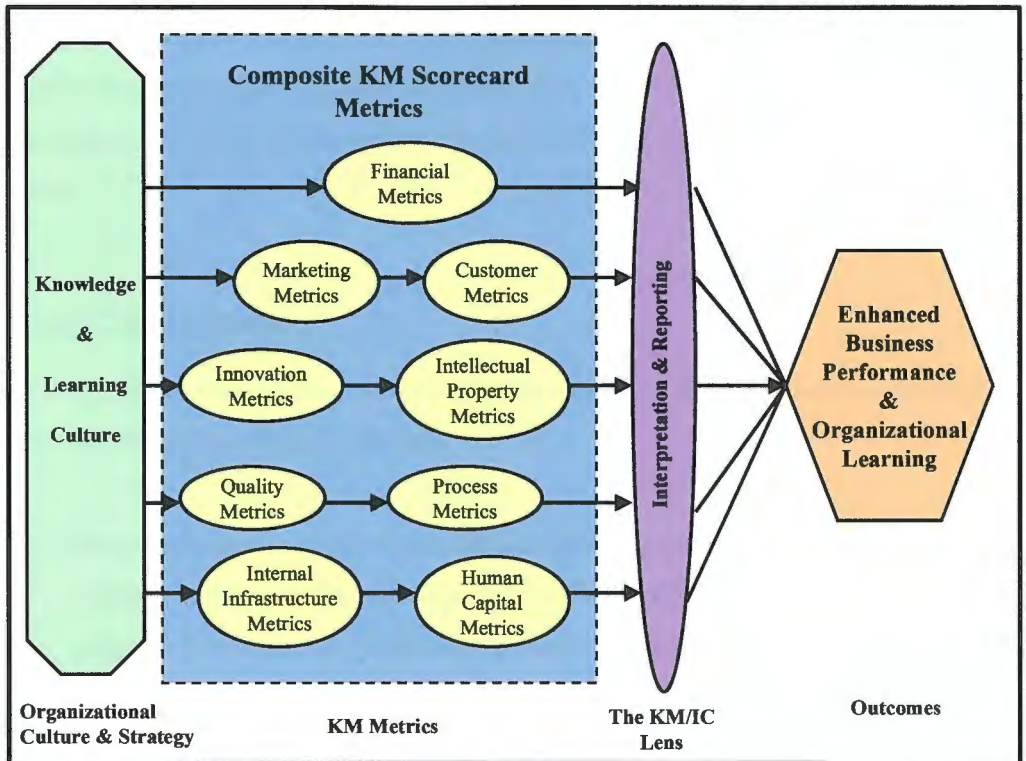


Figure 9: A Suggested KM Evaluation Framework

This diagram shows that a knowledge and learning oriented culture is necessary before an organization is likely to derive any benefits from KM. The culture and strategy determines why KM evaluation is considered to be necessary for the organization which in turn provides the ground rules for what needs to be measured. The main categories of metrics derived from this study are displayed in five branches. The Marketing/Customer branch provides the external component, Quality/Process metrics provide the necessary focus on process rather than products or outcomes and provide the continuous improvement mechanism. Tacit elements are covered in the Human Capital, Innovation and, to a lesser extent other factors, and all branches have a future orientation in the sense that they attempt to measure the propensity for the organization to learn, improve and create a positive image. Financial metrics are still important wherever relevant to add credibility, reliability and verifiability to the evaluation package. This framework also satisfies the conditions of effective evaluation systems as discussed previously.

A composite consolidated KM Scorecard Evaluation model (depicted as the shaded box behind the individual KM metrics) should be constructed by selecting a manageable number of strategically focussed appropriate metrics from each of the five branches.

The lens depicts the organizational approach to KM evaluation and measurement and represents the decision making processes that determine how the results are to be interpreted and reported to internal and external organizational stakeholders. It is suggested that by approaching KM evaluation in this way the desired objectives of KM, being enhanced business performance and organizational learning, are likely to be achieved.

5.2 Study Limitations

Some of the issues that were encountered during this study that may have impacted the validity and reliability of results include:

- Many organizations have implemented knowledge oriented programs but may not have called them “knowledge oriented” or “knowledge management” projects. However, KM is the only generally accepted term to describe these types of initiatives. This thesis attempted to minimize the impact of this by introducing the measurement of other topics (as identified in 2.9) that have been shown to be closely related to KM. The identification of topics related to KM may not have been exhaustive and no examination was conducted as to the degrees or strength of relevance or correlation that the identified related topics had to KM or IC. Thus the selection criteria for articles may not have been as broad as it could have been for a truly comprehensive literature review.
- Because of problems of definition and identification of knowledge versus information management, a number of invalid articles were included in the first phase of data selection. However, whilst accepting a certain amount of overlap in definition, articles which referred to initiatives which clearly did not satisfy the Swan et al definition of KM¹⁹ were rejected in subsequent phases of data analysis.
- Whilst the intention of this research was to focus only on empirical studies, it was often difficult to establish whether an article was purely theoretical or empirical or both from a review of the abstract. As a result, during the abstract review phase, some theoretical papers that may have contained some useful empirical data, may have been erroneously rejected. On the other hand some articles that appeared, from the abstract, to contain useful empirical evidence,

¹⁹ “any process or practice of creating, acquiring, capturing, sharing and using knowledge, wherever it resides, to enhance learning and performance in organizations”

were found to be less than useful during the data analysis phase. The impact of these data selection problems were not expected to significantly impact the overall results because they were relatively low in number and because the focus of the study is more on trends and comparisons than magnitude of occurrences.

- Rejection of documents as not being relevant to the scope and objectives of this study was based on the researcher's judgement by reading abstracts of all articles. Others reading the abstracts may disagree as to the level of relevance of the article to the study objectives and may arrive at a different list of selected articles. However there was no rigorous way of using the NUD*IST software to automate this selection process. It is possible that some articles that were rejected may have actually dealt with the subject in more depth than what was suggested in the abstract. However, such omissions are not likely to have significantly impacted the results.
- The geographic location of some organizations was not quoted in many articles selected. This resulted in the geographic analysis being based on a reduced data set than what was available for the analysis of evaluation models and was therefore not covered in the same depth.

5.3 Further Research

The research conducted in conjunction with this thesis opens up significant opportunities for further research by identifying many of the problem areas being faced by organizations in relation to KM/IC evaluation.

Identifying the factors that favour an accelerated rate of learning in organizations and the impact that evaluation of the learning experience can have on organizational performance is a promising area of future research. This comprehension can allow investments in training and innovation to lead to better and quicker results than those achieved up to the end of 1999 (Joia 2000). Another very important facet to be further researched is the corporate knowledge depreciation process which indicates that more research is necessary to identify the factors affecting the rate of learning and "forgetting" in organizations (Joia 2000).

The impact of KM/IC evaluation on strategic performance warrants further investigation. While some evidence on the important role of intangible measures in

effecting strategic priorities have been presented in this study, there is little empirical evidence on the nature of the relationship between intangible measures, strategies and organizational performance. Research into finding comprehensive models that can be adapted to all levels of the organization would also be useful.

Further work on developing a measure of self-awareness has been called for (Dulewicz and Higgs 2000) and applies to other disciplines as well as KM/IC. Although this may be seen to be perpetuating an internal focus, it has been established that organizational self-awareness is important before any meaningful comparisons can be made to other organizations.

Evaluation of innovation at organizational level as a significant KMI, requires a more comprehensive analysis. While some recent studies have used more comprehensive measures of individual innovation, little effort has been made to develop a richer measure with greater construct validity through a systematic review of the literature and development and test of a theoretical factor structure (Kleysen and Street 2001).

Opportunities exist to further examine the identified trends in KM evaluation. For example, explaining the decline in frequency of use of customer and market related measures would be particularly interesting as it was such an unexpected result. Conversely, it would also be enlightening to establish why human capital based measures have become the primary focus in KM evaluation.

Further research on geographic impacts on KM evaluation would be useful in the areas of cultural impacts on measurement and how cultural differences impact the knowledge and learning cultures of organizations, the selection of measurement models and the interpretation and reporting of results.

Testing the model presented in section 5.1.5 would prove the value of the model to organizations that are in the process of developing their KM strategies by either consolidating it as a valuable stepping stone for the development of further enhancements to this evaluation model or would prove the model ineffective, in which case further insights would be gained into why it was ineffective and what alternative approaches may prove to be more effective.

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Appendix A: List of Source Data Articles by Author.

Appendix A: List of Articles by Author (Data Reference List)

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Appendix B: Number of Articles by Journal

APPENDIX B: Number of Articles Per Journal

#	Journal Name	Jrnl Category	No of articles	Total per Catgry
1	Education & Training	Educ	2	
2	Review of Educational Research	Educ	2	
3	Educational & Psychological Measurement	Educ	1	
4	Journal of Adolescent and Adult Literacy	Educ	1	
5	Journal of Athletic Training	Educ	1	
6	The Journal of Management Education	Educ	1	8
7	Control Engineering	Eng	1	
8	Mechanical Engineering	Eng	1	
9	Oil & Gas Journal	Eng	1	3
10	Strategic Finance	F/AC/EC	3	
11	Accounting, Auditing and Accountability Journal	F/AC/EC	3	
12	Journal of Accountancy	F/AC/EC	2	
13	Journal of Economic Issues	F/AC/EC	1	
14	The American Economic Review	F/AC/EC	2	
15	Contemporary Economic Policy	F/AC/EC	1	
16	Economic Development Review	F/AC/EC	1	
17	Financial Executive	F/AC/EC	1	
18	International Tax Review	F/AC/EC	1	
19	Issues in Accounting Education	F/AC/EC	1	
20	Southern Economic Journal	F/AC/EC	1	
21	The CPA Journal	F/AC/EC	1	
22	The Journal of Political Economy	F/AC/EC	1	19
23	Policing	Gov	1	
24	Public Administration Quarterly	Gov	1	
25	Public Productivity and Management Review	Gov	1	
26	Review of Public Personnel Administration	Gov	1	
27	The International Journal of Public Sector Management	Gov	1	
28	The Journal of Government Financial Management	Gov	1	6
29	Career Development International	HR	1	
30	Employee Relations	HR	1	
31	HRMagazine	HR	1	
32	Human Relations	HR	1	
33	Journal of Counselling and Development	HR	1	
34	Personnel Review	HR	1	
35	The American Behavioral Scientist	HR	1	
36	The Journal of Applied Behavioral Science	HR	1	8
37	Journal of Intellectual Capital	IC	23	23
38	Information Resources Management Journal	IS	3	
39	The Journal of Computer Information Systems	IS	2	
40	Association for Computing Machinery: Communications of the ACM	IS	1	
41	IBM Systems Journal	IS	1	
42	Information Management & Computer Security	IS	1	
43	Journal of Database Management	IS	1	
44	Journal of Management Information Systems	IS	1	
45	MIS Quarterly	IS	1	
46	Link-up	IS	1	12
47	Journal of Knowledge Management	KM	11	11
48	Library Trends	LIB	3	3
49	Management Decision	M	6	
50	International Journal of Operations & Production Management	M	6	
51	Singapore Management Review	M	5	
52	International Journal of Quality & Reliability Management	M	5	
53	The Journal of Management Development	M	5	
54	Cornell Hotel & Restaurant Administration Quarterly	M	3	
55	Journal of Small Business Management	M	3	
56	Management Services	M	3	
57	Marketing Management	M	3	
58	S.A.M. Advanced Management Journal	M	3	
59	Academy of Management Journal	M	2	
60	Engineering Management Journal	M	2	
61	Journal of Management Issues	M	2	
62	Project Management Journal	M	2	
63	Team Performance Management	M	2	
64	The Journal of Business Strategy	M	2	
65	Total Quality Management	M	2	
66	Australian Journal of Management	M	1	
67	Business Process Reengineering and Management Journal	M	1	
68	California Management Review	M	1	
69	Communication Reports	M	1	
70	Competitiveness Review	M	1	
71	Consulting to Management	M	1	
72	European Journal of Innovation Management	M	1	
73	European Journal of Marketing	M	1	
74	Facilities	M	1	

	Journal Name	Jrnl Category	No of articles	Total per Category
75	International Journal of Logistics Management	M	1	
76	International Journal of Manpower	M	1	
77	International Marketing Review	M	1	
78	Journal of Occupational and Organizational Psychology	M	1	
79	Journal of Organizational Change Management	M	1	
80	Journal of Property Management	M	1	
81	Logistics Information Management	M	1	
82	Management International Review	M	1	
83	Managerial Auditing Journal	M	1	
84	Managing Service Quality	M	1	
85	Policy Studies Journal	M	1	
86	Technology Analysis and Strategic management	M	1	
87	The Journal of Personal Selling & Sales Management	M	1	
88	The Service Industry Journal	M	1	
89	The Southern Communications Journal	M	1	
90	Transportation Journal	M	1	
91	Women in Management Review	M	1	82
92	Integrated Manufacturing Systems	Man	2	
93	The Journal for Quality and Participation	Man	1	3
94	The Journal of Behavioral Health Services and Research	Med	2	
95	The Journal of the American Medical Association	Med	2	
96	American Dietetic Association	Med	1	
97	Community Mental Health Journal	Med	1	
98	Evaluation and the Health Profession	Med	1	
99	Journal of Management in Medicine	Med	1	
100	Journal of Medical Ethics	Med	1	
101	Nursing Administration Quarterly	Med	1	
102	Nursing Management	Med	1	
103	Occupational Health & Safety	Med	1	
104	Orthopedic Nursing	Med	1	
105	Pharmaceutical Executive	Med	1	
106	Veterinary Economics	Med	1	
107	Western Journal of Nursing Research	Med	1	16
108	Journal of Workplace Learning	OL	5	
109	Journal of European Industrial Training	OL	2	
110	The Learning Organization	OL	1	8
111	Journal of Managerial Psychology	Psych	2	
112	Personnel Psychology	Psych	2	4
113	Small Group Research	Res	3	
114	Journal of Consumer Research	Res	1	
115	Journal of Marketing Research	Res	1	
116	Research Technology Management	Res	1	6
117	Academy of Marketing Science	Sc	1	
118	Aviation Week & Space Technology	Sc	1	
119	Decision Sciences	Sc	1	3
120	American Sociological Review	Soc	1	
121	Demography	Soc	1	
122	Generations	Soc	1	
123	International Journal of Social Economics	Soc	1	
124	Regional Studies	Soc	1	5
			220	220

Journal Category Codes:

Educ	Educational
Eng	Engineering
F/AC/EC	Financial, Accounting, Economics
Gov	Government
HR	Human Resources
IC	Intellectual Capital
IS	Information Systems/Information Technology
KM	Knowledge management
M	Management
Man	Manufacturing
Med	Medical
OL	Organizational Learning/Learning Organizations
Res	Research
Sc	Scientific
Soc	Sociology

Appendix C: List of Developed Countries.

Australia	Austria	Belgium
Canada	Czech Republic	Denmark
Finland	France	Germany
Greece	Hungary	Iceland
Ireland (Republic of)	Italy	Japan
South Korea	Luxembourg	Mexico
Netherlands	New Zealand	Norway
Poland	Portugal	Slovakia
Spain	Sweden	Switzerland
Turkey	United Kingdom	United States of America

Source OECD: <http://www.hhs.se/personal/suzuki/default.htm>.

Appendix D: Articles by Country of Origin

Country of Publication	#	%
USA/Canada	135	60.5
UK	51	22.9
Australia/NZ	8	3.6
Western Europe (other than UK)	8	3.6
Scandinavia	7	3.1
Middle East	5	2.2
Asia (other than Australia and NZ)	5	2.2
Eastern Europe	2	0.9
Unknown/International	2	0.9
	223	100.0

Appendix E: Categorized KM Measures

KM/IC Measurement/Evaluation Categories

						Category
Code Category	Year	Author	Geographic Orientation	What is being measured	How or Why measured	refer codes
Financial	1996	Davis	US	customer complaints		C
Customer/Market	1996	Davis	US	customer satisfaction	customer service level	C
Customer/Market	1996	Edwards	US	customer service	internal	C
Quality	1996	Lynn	UK	customer expectations		C
Customer/Market	1996	Mortlock	UK	customer satisfaction		C
Customer/Market	1996	Thompson	US	customer satisfaction		C
Customer/Market	1998	Appelbaum	Canada	customer satisfaction		C
Customer/Market	1998	Appelbaum	Canada	customer satisfaction	organizational learning ability	C
Customer/Market	1998	AppiahAdu	UK	customer orientation		C
Customer/Market	1998	Eskildesen	Denmark	customer satisfaction		C
Customer/Market	1998	Eskildesen	Denmark	customer satisfaction	theory behind the customer satisfaction index	C
Customer/Market	1998	Kennedy	US	customer satisfaction.	frequency of repeat orders	C
Customer/Market	1998	Kennedy	US	customers	identifies the key customers who present challenging projects to encourage growth and knowledge enhancement.	C
Efficiency, Effectiveness, Productivity	1998	Kennedy	US	customers' needs.	how well the organization is satisfying customers' needs.	C
Customer/Market	1998	Kennedy	US	sales/customer ratios	measured by the percentage of sales of the top five customers or the number of customers accounting for fifty percent of the sales.	C
Customer/Market	1998	Thompson	UK	customer satisfaction		C
Customer/Market	1998	Thompson	UK	customer satisfaction	customer satisfaction	C
System/Technology	1998	Thompson	UK	customer satisfaction		C
Customer/Market	1998	Wurzburg	Internatnl	customer contact networks		C
Customer/Market	1998	Wurzburg	Internatnl	customer satisfaction		C
Customer/Market	1999	Ahmed	UK	Customer base	number of customers	C
Customer/Market	1999	Ahmed	UK	Performance	communicate how an activity is meeting the needs of internal or external customers	C
Customer/Market	1999	Ahmed	UK	repeat purchases	number of repeat customers	C
Customer/Market	1999	Armistead	UK	customer service	service quality and customer service	C
Customer/Market	1999	Baker	US	buyer power	relationship between market orientation & performance	C
Customer/Market	1999	Bryson	UK	Quality of supplied service	repeat business	C
Customer/Market	1999	Bryson	UK	success of a service/client interaction	client perception of the level of satisfaction with the service	C
Efficiency, Effectiveness, Productivity	1999	Buckmaster	Australia	customer perceptions	experiences of consumers during and after program participation	C
System/Technology	1999	Kaye	UK	customer and stakeholder focus		C
Customer/Market	1999	Li	UK	customer commitment		C
Customer/Market	1999	Li	UK	customer orientation	create customer value	C
Customer/Market	1999	Li	UK	customer orientation	customer satisfaction objectives	C
Customer/Market	1999	Li	UK	customer orientation	after sales service	C
Customer/Market	1999	Li	UK	knowledge about customers	depth of customer knowledge	C
Customer/Market	1999	Li	UK	market orientation	customer satisfaction	C
Customer/Market	1999	Pfeffer	US	customer satisfaction	Southwest Airlines focuses on the critical measures of lost bags, customer complaints, and on-time performance-keys to customer satisfaction and therefore to success in the airline industry.	C
Financial	2000	Ang	Malaysia	customer satisfaction		C
Financial	2000	Barsky	US	customer assets	each client's ability to attract new business and enhance Celemi's image.	C
Customer/Market	2000	Barsky	US	customer loyalty		C
Financial	2000	Brennan	Ireland	customer service		C
Customer/Market	2000	Carroll	US	customer complaints	number	C
Efficiency, Effectiveness, Productivity	2000	Dewan	US	customer satisfaction	with healthcare	C
Customer/Market	2000	Dube	US	customer satisfaction		C
Customer/Market	2000	Dube	US	customer satisfaction	the effects of that practice on customer satisfaction	C
Financial	2000	Enz	US	customer satisfaction		C
Customer/Market	2000	Grossman	US	service.		C
Customer/Market	2000	Ibbs	US	Customer service and quality (CSQ)		C
System/Technology	2000	Long	US	customer relationship	the extent to which our relationship with the client contributes to the creation of value.	C
Customer/Market	2000	Low	US	corporate value creation	customer relations	C
Customer/Market	2000	McGee	US	customer complaints	evaluated on seven-point scales, with values ranging from "much worse" to "much better."	C
Culture	2000	Noble	US	customer satisfaction	patient satisfaction surveys,	C
Customer/Market	2000	Noble	US	service effectiveness (healthcare)	Assessment measuras focus on symptoms, functionality (skill development, community adjustment, quality of life) and customer satisfaction.	C
Customer/Market	2000	Stivers	US	customer perceptions of image and reputation.		C
Customer/Market	2000	Stivers	US	customer acquisition		C
Customer/Market	2000	Stivers	US	customer retention		C
Customer/Market	2000	Stivers	US	customer satisfaction		C
Customer/Market	2000	Stivers	US	customer service factors		C
Customer/Market	2001	Goffin	UK	customer support	comprehensive evaluation of customer support at the design stage.	C
Customer/Market	2001	Kuczma	US	customer perceptions	brand innovation quotient (number of customers who view the brand as innovative divided by the total number of potential customers)	C
Customer/Market	2001	Kuczma	US	products and company's distinctiveness with (and perceived value to) customers.	innovation loyalty (number of repeat purchasers divided by total number of purchasers)	C
Financial	2001	Leese	UK	Customer service		C
Customer/Market	2001	Moore	US	customer loyalty		C
Customer/Market	2001	Moore	US	customer retention		C
Customer/Market	2001	Moore	US	customer satisfaction		C
Customer/Market	2001	Moore	US	value creation for customers.		C

Financial	2001	Poll	Germany	customer satisfaction	population satisfaction rate	C
Customer/Market	2001	Poll	Germany	service effectiveness	population satisfaction with library services	C
Quality	2001	Trombetta	US	customer ranking of the product		C
Customer/Market	2002	Bukh	Denmark	customer perceptions		C
Customer/Market	2002	Lenskold	US	customer perceptions	measurements as Web hits, clickthrough rates, or "stickiness" were held in high esteem, attracting capital and skyrocketing company valuations.	C
Customer/Market	2002	Lenskold	US	impact of marketing on purchasing behavior	customer lifetime value	C
Customer/Market	2002	Lenskold	US	Marketing campaigns intended to increase the profit per customer or improve retention rates	customer lifetime value	C
Financial	1996	Chenhall	Australia	performance	management	F
System/Technology	1996	Chenhall	Australia	performance	growth	F
Financial	1996	Davis	US	cash flow		F
Financial	1996	Davis	US	income	operating income by division	F
Financial	1996	Davis	US	inventory turnover		F
Financial	1996	Davis	US	ROE	NPAT/expenditure	F
Financial	1996	Davis	US	sales growth	quarterly sales growth	F
Financial	1996	Justman		investment in R&D	R&D intensity	F
Financial	1996	Kruzner	US	cost of manufacturing	cost of manufacturing a specific product and distributing it through a particular channel.	F
Financial	1996	Kruzner	US	value of distribution channels.	the true economic value of distribution channels.	F
Financial	1996	LoanClarke	UK	investment in management development		F
Human Capital	1996	Robinson	US	value of IP	discounted cash flow to measure the value of intellectual property.	F
System/Technology	1996	Sweetland	US	cost of education		F
Financial	1996	Weisberg	Israel	cost/benefit results of the incentive scheme.		F
Financial	1997	AbdulGader	Saudi Arabia	profit	performance	F
Human Capital	1997	Adam	Internatnl	profit / sales	ratio	F
Financial	1997	Adam	Internatnl	ROA	NPAT/assets over time	F
Financial	1997	Adam	Internatnl	sales growth	Average sales growth for past 3 years	F
Financial	1997	Leal	US	Expenditure on R&D	Expenditures on research and development as a percentage of GDP	F
Financial	1997	Leal	US	sales	export sales of technological capability	F
Financial	1997	Park	Internatnl	economic growth		F
System/Technology	1998	AppiahAdu	UK	investment in technology within ones industry		F
Financial	1998	Kennedy	US	EPS	EBIT per share	F
Efficiency, Effectiveness, Productivity	1998	Kennedy	US	market value over book value		F
Customer/Market	1998	Kennedy	US	profit	profit generated by the capital invested in a company	F
Financial	1998	Skyrme	US	cash flow		F
Financial	1998	Skyrme	US	economic value add		F
Financial	1998	Thompson	UK	cash flow		F
Financial	1998	Thompson	UK	EPS		F
Financial	1998	Thompson	UK	EVA		F
Financial	1998	Thompson	UK	price to earnings ratio		F
Financial	1998	Thompson	UK	ROCE		F
Financial	1998	Thompson	UK	ROSHF		F
Financial	1999	Ahmed	UK	profits	net income	F
Financial	1999	Ahmed	UK	ROI	NPAT/Investment	F
Customer/Market	1999	Ahmed	UK	sales per customer	per period eg qty or yly	F
Customer/Market	1999	Baker	US	growth	sales growth compared to competition	F
Financial	1999	Baker	US	ROI	NPAT/Investment	F
Financial	1999	Baker	US	sales growth	revenue over time	F
Financial	1999	Bessant	Japan	cost	cost reduction (by specific %)	F
System/Technology	1999	Bryson	UK	cost of assets		F
Financial	1999	Bryson	UK	profit	income - costs	F
Financial	1999	Bryson	UK	sales	export sales	F
Financial	1999	Bryson	UK	sales		F
Financial	1999	Haitwanger	US	sales	the natural log of firm sales divided by employment.	F
Financial	1999	Li	UK	pre-tax profit margin	profit margin	F
Financial	1999	Mohanty	India	strategic manufacturing initiative.	cost effectiveness	F
Financial	1999	Pfeffer	US	success	near-term economic returns on knowledge investment.*	F
Financial	2000	Ang	Malaysia	costs	Reductions in operating costs	F
Customer/Market	2000	AppiahAdu	UK	ROI	NPAT/Investment	F
Financial	2000	AppiahAdu	UK	sales growth	revenue	F
Financial	2000	Balkin	US	Expenditure on R&D		F
Financial	2000	Balkin	US	ROA	NPAT/net assets	F
Financial	2000	Barsky	US	economic value add (EVA)		F
Efficiency, Effectiveness, Productivity	2000	Bharadwaj	US	assets	total book value of assets	F
Financial	2000	Bharadwaj	US	income	operating income per employee	F
Financial	2000	Bharadwaj	US	ROA	NPAT/net assets	F
Financial	2000	Bharadwaj	US	ROS (return on sales)	NPAT/sales	F
Financial	2000	Bharadwaj	US	sales	income	F
Customer/Market	2000	Brennan	Ireland	cost of support		F
Financial	2000	Brennan	Ireland	costs	support costs	F
Financial	2000	Brennan	Ireland	expenditure per employee	IT spending per employee	F
Financial	2000	Brennan	Ireland	stock of intangible resources	assets	F
Financial	2000	Brennan	Ireland	cost	of IT spending per employee	F
Financial	2000	Carroll	US	knowledge management process	enhancing organizational efficiency resulting in identifiable cost savings and subsequent higher return of investment.	F
Financial	2000	Carroll	US	revenue	percentage of revenue coming from new products.	F
Financial	2000	Carroll	US	revenue from new products		F
Financial	2000	Davern	US	payback		F
Financial	2000	davern	US	potential value of IT	value of information for decision making	F
Financial	2000	Davern	US	realized value	value actually achieved	F
Financial	2000	Davern	US	revenue	realized revenue opportunity	F
Financial	2000	Davern	US	revenue	realized revenue value as % of potential value	F

Financial	2000	Davis	US	sales	product	F
Financial	2000	Dube	US	profitability	of a hotel	F
Financial	2000	Dube	US	profitability	increase in	F
Financial	2000	Enz	US	profitability	NPAT	F
Financial	2000	Grossman	US	revenue	total return to shareholders	F
Knowledge asset	2000	Grossman	US	Tobin's q		F
Financial	2000	Kuczma	US	expenditure on new products	the total of R&D expenditures allocated solely to new product development over a 3-to-5-year period divided by total R&D expenditures for the same time.	F
New Product Development	2000	Liebowitz	US	Expenditure on R&D		F
Financial	2000	Liebowitz	US	profits	profits from new business generation	F
Human Capital	2000	Liebowitz	US	value extraction		F
Financial	2000	Low	US	economic value add		F
Financial	2000	Low	US	expenditure on R&D		F
Financial	2000	Martin	Singapore	ROI	success by near-term economic returns on knowledge investment.	F
Financial	2000	Martin	Singapore	value add	the value contributed to the business by significant and/or extraordinary intellectual asset management actions	F
Financial	2000	McGee	US	gross profit		F
Financial	2000	McGee	US	sales growth over past 3 yrs	sales over time	F
Financial	2000	Noble	US	debt	debt service to coverage ratio	F
Financial	2000	Noble	US	profitability		F
New Product Development	2000	Noble	US	revenue		F
Financial	2000	Pegels	US	ROI	an index of relative efficiencies of how well the firms are converting strategic assets into economic performance	F
Financial	2000	Pegels	US	ROS (return on sales)	NPAT/sales	F
Financial	2000	Sanchez	Spain	ROA	NPAT/assets	F
Financial	2000	Stivers	US	cash flow		F
Financial	2000	Stivers	US	cost reduction		F
Financial	2000	Stivers	US	EVA		F
Financial	2000	Stivers	US	profitability		F
Financial	2000	Stivers	US	Revenue growth	revenue increase over time	F
Financial	2000	Stivers	US	ROC	NPAT/capital	F
Financial	2000	Stivers	US	customer profitability		F
Financial	2001	Berkowitz	US	cash		F
Financial	2001	Berkowitz	US	ROI	ROI in brainpower, information bases and technological capabilities over time	F
Financial	2001	Berkowitz	US	value of equipment	book value of assets	F
System/Technology	2001	Berkowitz	US	value of inventory	book value of assets	F
Financial	2001	Berkowitz	US	value of materials	book value of assets	F
Financial	2001	Berkowitz	US	value of plant	book value of assets	F
Financial	2001	Berkowitz	US	value of property	book value of assets	F
Financial	2001	Berkowitz	US	value of supplies	book value of assets	F
Financial	2001	Collier	UK	costs	computer databases	F
Financial	2001	Collier	UK	costs	equipment	F
Financial	2001	Collier	UK	costs	software	F
Financial	2001	Collier	UK	costs	maintenance	F
Financial	2001	Goffin	UK	revenues from customer support	percentage of revenues from customer support	F
Financial	2001	Groom		ROA	NPAT/net assets	F
Financial	2001	Kirchhoff	US	ROI	return-on-investment measure based on estimated future cash flows.	F
System/Technology	2001	Kirchhoff	US	financial effectiveness of the research projects in the portfolio	the value creation model includes the portfolio value metric (PVM), which measures the expected (future) financial effectiveness of the research projects in the portfolio	F
Human Capital	2001	Kuczma	US	viability of a new product	viability of a new product initiative.	F
Financial	2001	Moore	US	customer satisfaction	growth in profitability	F
Financial	2001	Moore	US	economic value add (EVA)		F
Financial	2001	Moore	US	expenditure on R&D		F
Financial	2001	Moore	US	expenditure on R&D		F
Financial	2001	Moore	US	income	net	F
Financial	2001	Moore	US	operational alignment with strategic goals	financial ratios	F
Financial	2001	Moore	US	profitability	short term	F
System/Technology	2001	Moore	US	ROI	NPAT/investment	F
Financial	2001	Moore	US	sales	sales from new products	F
Financial	2001	Poll	Germany	costs		F
Financial	2001	Poll	Germany	costs of the library's products and services;		F
Financial	2001	Roslender	UK	Calculated intangible value (CIV)		F
Financial	2001	Roslender	UK	cost	cost of information systems per sales dollar	F
Financial	2001	Roslender	UK	market-to-book ratio		F
Financial	2001	Roslender	UK	Tobin's q		F
Financial	2001	Stank	US	cash to cash cycle		F
Quality	2001	Trombetta	US	brand awareness	financial impact of brand awareness	F
Financial	2001	Trombetta	US	brand knowledge	financial impact of brand knowledge	F
Financial	2001	Trombetta	US	brand loyalty	financial impact of brand loyalty	F
Financial	2001	Winkworth	UK	expenditure per FTE		F
Financial	2001	Winkworth	UK	expenditure per FTE		F
Innovation & Creativity	2001	Winkworth	UK	expenditure per FTE on information provision		F
Customer/Market	2002	Bassi	US	future market returns	firms' training investments	F
Customer/Market	2002	Bassi	US	future market returns	gross profit margin	F
Customer/Market	2002	Bassi	US	future market returns	ROA	F
Customer/Market	2002	Bassi	US	future market returns	sales per employee	F
Financial	2002	Bassi	US	future market returns	market to book ratio	F
Financial	2002	Bassi	US	gross profit margin		F
Financial	2002	Bassi	US	income per employee		F
Customer/Market	2002	Bassi	US	price to book ratio		F
Financial	2002	Bassi	US	ROA	NPAT/net assets	F

Financial	2002	Bontis	US	cost of training		F
Financial	2002	Bontis	US	investment in training		F
Financial	2002	Bontis	US	profit per employee		F
Financial	2002	Bontis	US	revenue per employee		F
Financial	2002	Bontis	US	wages/salaries	The compensation factor metric measures the average compensation paid to each employee	F
Financial	2002	Bukh	Denmark	revenue	revenue created by add-on sale.	F
Financial	2002	Bukh	Denmark	sales	turnover from new customers in the new target segment	F
Financial	2002	Christl		profitability	Tobins q	F
Financial	2002	Christl		stock market valuation of firms	contribution of IC	F
Financial	2002	dePablos	Internatnl	investment in training		F
Financial	2002	deTore	US	cash flow	DCF	F
Customer/Market	2002	Hurwitz		value relative to market value	called the comprehensive-to-market value (CM) ratio.	F
Financial	2002	Lenskold	US	ROI	ROI	F
Financial	2002	Lenskold	US	ROI of market programs	NPAT/Investment	F
Financial	2002	McElroy	US	effects on the bottom line	changes in P&L	F
Composite measures	2002	Rodov		value of intangible assets	links the IC value to the market valuation over and above book value	F
Financial	2002	Turner	UK	cost of education	surrogate measure for the value of the knowledge acquired from a particular level of education.	F
Financial	2002	Turner	UK	value of knowledge.	pragmatic cost based measures	F
Teamwork & participation	1996	Barberis	US	Human capital	measured by the combined management and ownership change	H
Human Capital	1996	Black	US	training	increase in productivity	H
Knowledge asset	1996	Francis	NZ	job performance	job performance over time	H
Customer/Market	1996	Francis	NZ	meeting objectives	meeting the defined workshop objectives	H
Outcomes	1996	Francis	NZ	participant evaluation		H
Human Capital	1996	Francis	NZ	team effectiveness	change in team functioning	H
Human Capital	1996	LoanClarke	UK	management behaviour	absenteeism and turnover, may reflect the behaviour of the manager in charge.	H
Customer/Market	1996	LoanClarke	UK	performance	league tables (individual)	H
Financial	1996	LoanClarke	UK	performance	performance (individual)	H
Human Capital	1996	LoanClarke	UK	training	90% of organizations used the reaction level of training evaluation, but only 19% attempted to evaluate training in terms of benefits to the organization.	H
Human Capital	1996	LoanClarke	UK	training	86% of the Fortune 500 companies "usually" evaluated their courses at a reactions level at the end of the course.	H
System/Technology	1996	Robinson	US	know-how, problem solving and accountability.		H
Human Capital	1996	Robinson	US	organizational learning ability.	extent to which decision makers are encouraged to re-evaluate their mental models	H
Human Capital	1996	Robinson	US	training	amount of training per employee	H
Human Capital	1996	Savery	Australia	work satisfaction	the importance of job satisfaction factors on an individual's level of satisfaction and dissatisfaction with the job	H
Learning ability	1996	Sweetland	US	education	years of tenure	H
Learning ability	1996	Sweetland	US	education	formal	H
Learning ability	1996	Sweetland	US	employee utilization	number of weeks worked	H
Human Capital	1996	Sweetland	US	ignorance		H
Learning ability	1996	Sweetland	US	work experience		H
Human Capital	1996	Weisberg	Israel	education	years of schooling	H
Teamwork & participation	1996	Weisberg	Israel	teamwork performance	employee perception of their own participation; managerial attitudes; age of the programme in a company; expectations of the plan; and whether an executive takes a leading role.	H
Human Capital	1996	Weisberg	Israel	tenure	measured according to the average worker's experience as represented by work tenure and indicated the SHC.	H
Financial	1996	Zea	US	ability to cope	During the past 15 years, several measures to assess coping have been developed.	H
Teamwork & participation	1997	AbdulGader	Saudi Arabia	productivity	user assessment	H
Human Capital	1997	AbdulGader	Saudi Arabia	user satisfaction		H
Human Capital	1997	Adam	Internatnl	employee turnover		H
Financial	1997	Clark	US	education level	graduate GPA	H
Human Capital	1997	Clark	US	education programs	affect on student learning	H
Financial	1998	Hepworth	US	empowerment		H
Human Capital	1998	Higgs	UK	performance	teamwork	H
Financial	1998	Kennedy	US	Employee attitudes	polls & questionnaires over time	H
Human Capital	1998	Kennedy	US	skill and experience of a company's professional body	The total number of years employees have worked in their profession as well as the average per professional.	H
Customer/Market	1998	Snyderhalpern	US	employee perceptions and attitude	an individual's belief in and acceptance of organizational goals and values, willingness to exert a considerable effort on behalf of the organization, and desire to maintain membership in the organization	H
Human Capital	1998	Tesluk	US	experience quality	types of environments, duties, training classes, supervisory opportunities, and activities involved in training.	H
Culture	1998	Tesluk	US	work experience	the number of times an individual has completed a certain task or operation	H
Customer/Market	1998	Tesluk	US	work experience	tenure, defined as years in a job years in an organization or years in a position	H
Human Capital	1998	Tesluk	US	work experience	measures of length of time in a position	H
Human Capital	1998	Tesluk	US	work experience	an understanding of experience along dimensions of the density and timing of the experience.	H
Human Capital	1998	Tesluk	US	work experience	level of responsibility	H
Human Capital	1998	Tesluk	US	work experience	task frequency, recency of task performance,	H
Human Capital	1998	Tesluk	US	work experience	amount of training, and amount of feedback,	H
System/Technology	1998	Tesluk	US	work experience	type of assignment or complexity of previous work,	H
Human Capital	1998	Thompson	UK	contributions	individual & team	H
Human Capital	1998	Thompson	UK	employee satisfaction		H
Human Capital	1998	Thompson	UK	employee wellbeing		H

Quality	1998	Wurzburg	Internatnl	quality of management		H
Customer/Market	1998	Wurzburg	Internatnl	retention		H
Human Capital	1998	Wurzburg	Internatnl	training		H
Human Capital	1999	Ahmed	UK	communication	knowledge performance	H
Human Capital	1999	Ahmed	UK	employee utilization	number of workers rotated	H
Human Capital	1999	Ahmed	UK	learning	knowledge performance	H
Teamwork & participation	1999	Ahmed	UK	quality	number of workers participating in QCC and number of workers rotated.	H
Human Capital	1999	Ahmed	UK	teamwork	knowledge performance	H
Teamwork & participation	1999	Ailee	US	Human capital	new measures for knowledge sharing, as well as metrics for increases in external, internal or human capital.	H
Learning ability	1999	Armistead	UK	process performance	learning at individual and organisational level, and the potential for knowledge productivity	H
Human Capital	1999	Bryson	UK	employment	employee numbers	H
Human Capital	1999	Bryson	UK	impact of external consultancy use on firm performance	employment change, but not necessarily employment growth.	H
Learning ability	1999	Buckmaster	Australia	outcome	outcome measure is the number and percentage of illiterate children gaining effective reading skills and successfully completing the program.	H
Capability & Competency	1999	Buckmaster	Australia	performance	peer reviews	H
Human Capital	1999	Cook	UK	social skills		H
Outcomes	1999	Cook	UK	trustworthiness		H
Teamwork & participation	1999	Edens	US	capacities of defendants with respect to these legal domains.	a rational (appreciation) and factual (understanding) comprehension of the proceedings, as well as the capacity to consult with counsel (reasoning).	H
Human Capital	1999	Freeman	US	performance	to level and quality of participation.	H
Human Capital	1999	Gardiner	UK	organizational learning	interviews & questionnaires	H
Communications	1999	Gibb	UK	mentoring schemes	Evaluation is typically done by self-reports from mentors and/or learners, asking participants how they rate their mentoring experiences.	H
Human Capital	1999	Haltiwanger	US	performance	labor productivity computed as the natural log of firm sales divided by employment.	H
Human Capital	1999	Haltiwanger	US	workforce	age, education, gender, and foreign-born variables.	H
Human Capital	1999	Haltiwanger	US	workforce	composition of the firm's workforce as measured by observable worker characteristics.	H
Capability & Competency	1999	Karp	US	competency of entry-level dieticians	based on employer ratings and self-ratings of graduates in dietetics.	H
Capability & Competency	1999	Kaye	UK	leadership and direction setting	availability to staff, recognition of successes; - employee involvement; - use of improvement teams; - training and development and use of the Investors in People standard; - the constructive use of self-assessment techniques; - measurement and feedback.	H
Financial	1999	Kaye	UK	leadership and direction setting	development of a culture for continuous improvement and communications	H
System/Technology	1999	Keeble	UK	learning capacity		H
Human Capital	1999	Lamb	US	knowledge, unit beliefs about practice patterns, ethical concerns		H
Human Capital	1999	Li	UK	market knowledge competence	measurement of market knowledge competence dimensions in new product development.	H
Capability & Competency	1999	Li	UK	organizational competence	using the outcome of learning to measure competence.	H
Knowledge asset	1999	Li	UK	organizational competence	viewing Market knowledge competence as a series of behavioral processes in new product development.	H
Human Capital	1999	Pfeffer	US	employee retention		H
Financial	1999	Savulescu	UK	critical thinking skills	being able to identify ethical issues (awareness) and being able to reason about these issues and come to a justifiable resolution as to what should be done.	H
Human Capital	1999	Savulescu	UK	organization orientation	measured three variables: knowledge, confidence and responsiveness.	H
Human Capital	1999	Shaw	US	Work experience		H
Capability & Competency	1999	Wise	US	organizational culture	extent to which managers believe their organization demonstrates a concern for employees' well-being.	H
Human Capital	2000	Ang	Malaysia	employee satisfaction		H
Human Capital	2000	Bharadwaj	US	competency	in a study of IT management competencies, provide measures for assessing the managerial IT competencies of firms.	H
Human Capital	2000	Bharadwaj	US	IT capability	peer ranking of IT leaders	H
Human Capital	2000	Bharadwaj	US	peer evaluations	used the IW ranking as a measure of an organization's IT capability.	H
Financial	2000	Brennan	Ireland	human capital	human capital in firms and the renewal and development of those resources.	H
Financial	2000	Brennan	Ireland	skills	stock of intangible resources	H
System/Technology	2000	Carroll	US	employee competencies	an inventory of employee competencies; - identifying and listing competencies that must be mustered to implement firm strategy; - developing a system to acquire these competencies; implementing a performance appraisal and reward system linked to matching of the attainment of IC resources to strategy implementation.	H
Human Capital	2000	Carroll	US	ideas	employees' views were listened to and evaluated based on their intellectual merit	H
Learning ability	2000	Dube	US	employee productivity	the effect of a monetary-- incentive scheme on employee productivity or satisfaction)	H
Teamwork & participation	2000	Dulewicz	UK	EQ, IQ and MQ competencies		H
Human Capital	2000	Dulewicz	UK	social intelligence	means of explaining variations in outcome measures not accounted for by IQ.	H
Performance	2000	Enz	US	education and training	access to education and training by all employees	H
Customer/Market	2000	Enz	US	employee satisfaction		H

Human Capital	2000	Enz	US	employee performance evaluation	continuous	H
Human Capital	2000	Enz	US	empowerment		H
					absenteeism: Calculate the average number of employees per unit and multiply it by the average number of workdays in the measurement period. Take the result of that calculation and divide it into the number of person days lost during the measurement period.	H
Human Capital	2000	Enz	US	HR effectiveness		H
Human Capital	2000	Enz	US	HR effectiveness	employee turnover rate	H
Human Capital	2000	Enz	US	leadership potential		H
Customer/Market	2000	Enz	US	management performance	management performance appraisals by peers subordinates & superiors	H
Human Capital	2000	Enz	US	motivation	continuous	H
Customer/Market	2000	Enz	US	performance		H
Human Capital	2000	Enz	US	training	interactive CD based training	H
Culture	2000	Gilbert	US	employee knowledge and expertise		H
					measures the extent to which the work force believes the organization treats its employees fairly and genuinely cares about the employees' welfare.	H
Human Capital	2000	Gilbert	US	employees (treatment of)		H
					the degree to which employees report their pay and benefits to be good when compared with those of employees elsewhere	H
Customer/Market	2000	Gilbert	US	perception of remuneration		H
					the extent to which employees view their supervisors to be providing positive training, coaching, involvement, team work and direction enabling the employees to perform effectively	H
Human Capital	2000	Gilbert	US	perception of supervision		H
Human Capital	2000	Grossman	US	absenteeism		H
Human Capital	2000	Grossman	US	employee productivity		H
Human Capital	2000	Grossman	US	employees quits and discharges	as % of total employees	H
Human Capital	2000	Grossman	US	IC		H
Human Capital	2000	Grossman	US	quality of new employees		H
Human Capital	2000	Grossman	US	tenure of employees in various jobs	average	H
Human Capital	2000	Grossman	US	turnover		H
Efficiency, Effectiveness, Productivity	2000	Harold	US	training		H
Info/knowledge sharing	2000	Liebowitz	US	education	years of	H
Human Capital	2000	Liebowitz	US	experience	years of	H
Financial	2000	Liebowitz	US	relationships	number of new colleague relationships developed	H
Financial	2000	Liebowitz	US	scholarships	number	H
Financial	2000	Liebowitz	US	student/faculty ratio		H
Financial	2000	Liebowitz	US	students	number	H
					the extent to which sharing responsibility leads to all the key people in a project being able to make decisions and take action on the spot as opportunities present themselves	H
Financial	2000	Long	US	action orientation		H
Capability & Competency	2000	Low	US	capabilities	management	H
	2000	Low	US	employee relations	corporate value creation	H
Human Capital	2000	Low	US	intangibles	value-based management.	H
System/Technology	2000	Lynn	US	effectiveness of project team	frequency & effectiveness of meetings	H
Teamwork & participation	2000	Lynn	US	effectiveness of project team	team stability	H
Teamwork & participation	2000	Lynn	US	effectiveness of project team	Team learning capacity	H
					with the hope that shortcomings can be identified and, using this information, management can then begin to systematically address and improve the deficiencies in its ability to innovate better and faster.	H
Learning ability	2000	Lynn	US	performance of product team		H
					Consultants at both Ernst & Young and McKinsey for example, are evaluated partly on the knowledge they contribute to human networks	H
Capability & Competency	2000	Martin	Singapore	Consultants evaluation		H
Teamwork & participation	2000	Maythe	US	cognitive recall	measured knowledge retention 4 weeks after training	H
					immediate knowledge, knowledge retention, and behavior/skill demonstration.	H
Capability & Competency	2000	Maythe	US	Learning		H
Learning ability	2000	Maythe	US	listening skills		H
					measure the distinctive competencies and their relationship to the performance of large Health Maintenance Organizations (HMOs).	H
Capability & Competency	2000	McGee	US	competencies	required respondents to evaluate their company's respective competencies on a seven-point scale was constructed.	H
					measure the competencies of small Turkish casting and machinery manufacturing firms.	H
Learning ability	2000	McGee	US	competencies		H
Capability & Competency	2000	McGee	US	competencies of industrial or manufacturing firms.	a 19-item scale used to measure the distinctive competencies of industrial or manufacturing firms.	H
Capability & Competency	2000	McGee	US	competency activities and their relationship to the performance of large industrial firms.	measured 55 distinctive competency activities and their relationship to the performance of large industrial firms.	H
Customer/Market	2000	McGee	US	competency and performance measures.	the ability to recognize opportunities.	H
Human Capital	2000	McGee	US	competency and performance measures.	propensity to take risks	H
Customer/Market	2000	McGee	US	strengths	awareness of store strengths	H
Composite measures	2000	Neuliep	US	communication competence	assertiveness and interpersonal responsiveness.	H
Teamwork & participation	2000	Neuliep		communication competence.		H
social capital	2000	Onyx	Australia	social capital.		H
Customer/Market	2000	Peabody	US	competence and practice of physicians		H
					(1) functional heterogeneity; (2) educational heterogeneity; (3) age heterogeneity; (4) firm tenure; (5) TMT tenure; and (6) tenure in current position.	H
Human Capital	2000	Pegels	US	group or team heterogeneity		H
System/Technology	2000	Sanchez	Spain	innovation	knowledge	H
					developed our own measures of communication with supervisors and general relations with the company, measures of general communication/teamwork and concern for performance	H
Capability & Competency	2000	Siegall	US	communication		H
Human Capital	2000	Siegall	US	competence	related to self-esteem	H
Human Capital	2000	Siegall	US	competence	managerial effectiveness	H

	2000	Siegall	US	competence	person's confidence in his/her ability to do the job, self-assurance about personal capabilities to perform work activities, and sense of mastery regarding necessary job skills.	H
Capability & Competency	2000	Siegall	US	empowerment	low role ambiguity, strong sociopolitical support, access to information, and a participative climate were associated with perceptions of empowerment.	H
Human Capital	2000	Siegall	US	empowerment	employees' perceptions of their workplace	H
Human Capital	2000	Siegall	US	empowerment		H
Teamwork & participation	2000	Siegall	US	teamwork	measured teamwork, which referred to 'group processes characterized by helpfulness, coordination of effort, open communication, and friendliness'.	H
Human Capital	2000	Siegall	US	work effectiveness	degree of empowerment	H
Human Capital	2000	Siegel	US	empowerment and measures of general communication/teamwork and concern for performance		H
Financial	2000	Stivers	US	employee productivity.		H
Financial	2000	Stivers	US	employee retention		H
Financial	2000	Stivers	US	employee satisfaction		H
Learning ability	2000	Stivers	US	learning & growth	people	H
New Product Development	2000	Vorhies	US	marketing capability		H
Innovation & Creativity	2000	Waldron	US	communication	The communication characteristics of successful clients	H
Learning ability	2000	Waldron	US	communication competence	the effects of the training on measures of communication competence	H
Capability & Competency	2000	Walters	UK	appraisal of investment alternatives	experience (personalised knowledge)	H
System/Technology	2001	AlGahtani	UK	system success	user satisfaction	H
Human Capital	2001	Bain	US	knowledge, motives, and skills	systematic and creative evaluation of knowledge, motives, and skills in relation to organizational needs.	H
Human Capital	2001	Barker	UK	success	human intellectual energy	H
Human Capital	2001	Bart	Canada	training	training as a percent of payroll, percentage of employees trained, number of employee suggestions and employee attitudes about (and satisfaction with) the organization	H
System/Technology	2001	Berkowitz	US	Human capital	measure whether human capital is appreciating or depreciating	H
Human Capital	2001	Boland	US	performance on a subsequent decision-making task	decision satisfaction, decision diversity, decision richness, and decision task realism.	H
System/Technology	2001	Collier	UK	costs	experience	H
Performance	2001	Collier	UK	incidents,	post-incident evaluation, similar to the after-action review that takes place in the military.	H
Human Capital	2001	Hao	US	education	Schooling	H
Human Capital	2001	Hao	US	education	work experience	H
Human Capital	2001	Hao	US	educational level	the highest educational level, English proficiency and the total number of workers in the unit.	H
social capital	2001	Hao	US	social capital (community)	contact with co-ethnics and coethnics' economic inactivity, and examine the use of AFDC and SSI in two subpopulations: single-mother families and elderly units.	H
Human Capital	2001	Kirch	US	suitability for employment	grade point average, and IQ-related measure, and a relatively short interview.	H
Capability & Competency	2001	Kocarek	US	competency	Relationship, Comfort, and Multicultural Awareness, Knowledge, and Skills.	H
Capability & Competency	2001	Kocarek	US	competency	awareness of self, knowledge, and communication skills	H
System/Technology	2001	Miller	US	criterion validity measures	supervisory ratings of individual effectiveness on what was referred to as the technical or task performance (an average of scores on technical knowledge and learning orientation) and supervisor's ratings of the individual's team performance (an average of scores on self-management, team contribution, and communication).	H
Teamwork & participation	2001	Miller	US	effectiveness of project team	supervisor ratings of an individual's team performance	H
Customer/Market	2001	Miller	US	employment aptitude tests	verbal, quantitative, perceptual, and mechanical reasoning abilities.	H
Financial	2001	Miller	US	performance	measures of individual task knowledge and task-related skills and abilities	H
Human Capital	2001	Moore	US	employee morale survey.		H
Human Capital	2001	Moore	US	employee attitudes		H
Human Capital	2001	Moore	US	employee response time		H
Knowledge asset	2001	Moore	US	instances of successful conflict resolution		H
	2001	Moore	US	performance	investment in people	H
social capital	2001	Pino	UK	social trust.	examine the effectiveness of networks built from norms and values of trust and reciprocity	H
Human Capital	2001	Ranchod	UK	effectiveness of on-line marketing	the marketing executives' knowledge of Internet technology.	H
System/Technology	2001	Roslender	UK	employee productivity		H
System/Technology	2001	Roslender	UK	employee retention		H
System/Technology	2001	Roslender	UK	employee satisfaction		H
Human Capital	2001	Roslender	UK	user satisfaction	system usage	H
Communications	2001	Sacks	US	enrollments	secondary education enrollments as a percentage of the population age 14 to 17 in a particular year.	H
Capability & Competency	2001	Shama	Russia	behavior	in-depth interviews	H
Capability & Competency	2001	Shama	Russia	economic performance	in-depth interviews	H
Capability & Competency	2001	Shama	Russia	entrepreneurial values	in-depth interviews	H
Learning ability	2001	Simon	Australia	co-operation		H
Learning ability	2001	Simon	Australia	effective skills transfer,		H
Learning ability	2001	Simon	Australia	integration of consultant into organisation.		H
Innovation & Creativity	2001	Stank	US	competence	internal integration	H
Innovation & Creativity	2001	Stank	US	competence	customer integration	H
System/Technology	2001	Stank	US	competence	measurement integration & relationship integration	H
Efficiency, Effectiveness, Productivity	2002	Bassi	US	performance	quantity of training	H

Outcomes	2002	Bassi	US	training	evaluations of training outcomes.	H
Capability & Competency	2002	Bassi	US	financial performance	training	H
Human Capital	2002	Bontis	US	human capital depletion		H
System/Technology	2002	Bontis	US	human capital effectiveness	the aggregate result of all drivers of HC management that influence employee behaviour	H
Communications	2002	Bontis	US	involuntary turnover		H
Outcomes	2002	Bontis	US	organizational development rate	The development rate describes how well an organization provides access to training programs for its workforce.	H
Human Capital	2002	Bontis	US	voluntary turnover		H
Human Capital	2002	Caddy	Australia	employee retention		H
Communications	2002	Collardin	UK	company value	people and ideas	H
Knowledge asset	2002	dePablos	Internatnl	absenteeism		H
Human Capital	2002	dePablos	Internatnl	employee satisfaction		H
Learning ability	2002	dePablos	Internatnl	lost time injuries		H
Human Capital	2002	dePablos	Internatnl	ratio of training hours/working hours		H
Human Capital	2002	dePablos	Internatnl	training	training days per employees	H
social capital	2002	Dika	US	social capital	family structure, parent-child discussion, intergenerational closure, moving, and religious participation	H
social capital	2002	Dika	US	social capital	language proficiency as a source of cultural and social capital measured social capital with social network indicators (e.g., status of network members, number of non-kin).	H
social capital	2002	Dika	US	social capital	most of these measures (e.g., number of parents, number of siblings or household size, church attendance) are crude and arbitrary.	H
social capital	2002	Dika	US	social capital		H
Financial	2002	Friqo	US	human capital	performance measures for employees	H
System/Technology	2002	McElroy	US	capacity to innovate	Social innovation capital managers can not only measure and value their firms' capacity to innovate, but also enhance their performance and output	H
Efficiency, Effectiveness, Productivity	2002	Mitra	US	effects of knowledge	near-market economic knowledge.	H
social capital	2002	Schmid	US	social capital	measures of connection, support, belonging, participation, empowerment, and safety.	H
social capital	2002	Schmid	US	social capital	family structure, crime, trust, values, and civil society.	H
social capital	2002	Schmid	US	social capital	Peoples' trust in various organizations has been measured over time.	H
social capital	2002	Schmid	US	social capital	inquire of the radius of preferential treatment.	H
social capital	2002	Schmid	US	social capital	Measures the mix of one's own motives and those expected of others.	H
Human Capital	2000	Maythe	US	knowledge retention		H
Human Capital	2001	Bart	Canada	knowledge and skill base		H
Culture	1996	Chenhall	Australia	culture of fast response.	how often they are first to market with new products and the time to design new products	I
Commitment, action orientation	1997	Park	Internatnl	protection against losses	measures protection against losses arising from three sources: working requirements, compulsory licensing, revocation of patents.	I
Knowledge asset	1998	Snyderhalpem	US	organizational culture	The measurement of organizational commitment.	I
Info/knowledge sharing	1998	Thompson	UK	corporate logic		I
Decision making	1999	Armistead	UK	knowledge transfer success	reliability of knowledge its timeliness, completeness and accessibility.	I
Communications	1999	Kaye	UK	organizational culture for CI and communications		I
Human Capital	1999	Li	UK	communication		I
Innovation & Creativity	1999	Li	UK	customer learning	information acquisition	I
System/Technology	1999	Li	UK	Information Integration	Customer information is barely/fully integrated in new product software design*.	I
System/Technology	1999	Li	UK	market orientation	cultural norms	I
Customer/Market	1999	Pfeffer	US	data collection	a telecommunications company expected its managers to review 100 to 200 pages of data a week.	I
Human Capital	2000	Barsky	US	company's value	organizational culture,	I
Culture	2000	Barsky	US	IC	organizational culture	I
Customer/Market	2000	Bharadwaj	US	IT infrastructure.	Keens reach and range framework	I
Knowledge creation & use	2000	Brennan	Ireland	IC	in a way that is useful for decision making.	I
Communications	2000	Davern	US	organizational culture	fostering of a knowledge-sharing culture	I
Info/knowledge sharing	2000	Davern	US	potential value of IT	the value of the information they provide for decision making under uncertainty.	I
Losses	2000	Edvinson	Sweden	transforming velocity	measured as the ratio of structural capital to human capital, also called "the IC-multiplier".	I
System/Technology	2000	Gilbert	US	organizational structures and processes	measures of internal organizational structures and processes or organizational effectiveness.	I
Human Capital	2000	Ibbs	US	communication	quantity of information passed and the number of messages sent	I
Customer/Market	2000	Lynn	US	project team effectiveness	implementation of learning	I
Capability & Competency	2000	Martin	Singapore	Consultants evaluation	Consultants at Ernst & Young and McKinsey are evaluated partly on the knowledge they contribute to repositories	I
Innovation & Creativity	2000	Martin	Singapore	knowledge flows	the flow of knowledge between those who produce information, to those who add value to it, to those who finally need and consume this knowledge.	I
Customer/Market	2000	McAdam	UK	innovation	the innovation model which collectively creates that innovation culture.	I
Knowledge asset	2000	McGee	US	competencies	company's functional activities rated as a distinctive strength, weakness, or as average.	I
Human Capital	2000	McGee	US	competency and performance measures.	level of innovation,	I
Capability & Competency	2000	McMillan	US	quality measure of a company's scientific knowledge	analyzing the citation patterns of its papers and its technological knowledge (by examining the citation patterns of its patents).	I
Human Capital	2000	Neuliep	US	communication	measures of communication satisfaction and uncertainty.	I

Knowledge asset	2000	Siegall	US	competence	access to information about the organization's mission, the extent to which the mission statement influences the day-to-day behavior of members throughout the organization; the extent to which the mission statement is actually being achieved	I
Communications	2001	Bart	Canada	organizational culture		I
Culture	2001	Berkowitz	US	ROI	return on investment in information bases	I
Decision making	2001	Boland	US	knowledge representations in a laboratory experiment with managers.	evaluated interpretative, general, and particular knowledge representations in a laboratory experiment with managers.	I
Info/knowledge sharing	2001	Boland	US	managerial decision making.	evaluate the impact of knowledge structures on managerial decision making.	I
Culture	2001	Collier	UK	knowledge environment	developing organizational knowledge structures	I
Structural capital	2001	Collier	UK	knowledge sharing		I
Knowledge asset	2001	Karr	US	specific abilities.	certification	I
System/Technology	2001	Poll	Germany	utilization of information and services	studying the use of their collections and services;	I
Financial	2001	Reingle	US	organizational culture.		I
Human Capital	2001	Stank	US	competence	internal integration	I
Human Capital	2001	Trombetta	US	effectiveness of a marketing campaign	unaided recall	I
Customer/Market	2002	Bomemann	Austria	knowledge flows & outputs		I
	2002	deTore	US	outcomes of R&D	knowledge assets	I
Capability & Competency	2002	Frigo	US	information capital		I
Customer/Market	2002	Galup	US	enterprise knowledge	evaluating an enterprise's knowledge assets.	I
Culture	2002	Mitra	US	effects of knowledge	near-market cultural knowledge	I
Learning ability	2002	Mitra	US	impact of economic and cultural knowledge	a firm's understanding of the culture of potential new markets based on knowledge generated from operating in similar markets.	I
Info/knowledge sharing	2002	Mitra	US	impact of knowledge generated in similar markets		I
Teamwork & participation	2002	Mitra	US	knowledge transfer	transfer of knowledge within multinational corporations.	I
Info/knowledge sharing	2002	Turner	UK	store of knowledge embodied in an organisation	composite of each individual's explicit or domain knowledge	I
Efficiency, Effectiveness, Productivity	1997	Leal	US	innovative activity	Patents,	IP
Financial	1997	Leal	US	patent quality	citations	IP
Knowledge asset	1997	Leal	US	patents	inventions output of research and development in the form of inventions	IP
	1997	Leal	US	patents	the number of patent applications per 10,000 population, representing an inventiveness coefficient (OECD, 1993).	IP
Knowledge asset	1997	Leal	US	relative competitiveness of an economy	Patents,	IP
Knowledge asset	1997	Park	Internatnl	intellectual property rights		IP
Customer/Market	1998	Skyrme	US	brands		IP
Knowledge creation & use	1998	Skyrme	US	patents		IP
Learning ability	1998	Skyrme	US	value-based models, such as brands and patents.		IP
Structural capital	1998	Wurzburg	Internatnl	Innovation	patents and licenses	IP
Knowledge asset	1999	Armistead	UK	patents	number of patents as indicator of level of R&D	IP
Financial	1999	Armistead	UK	process performance	protection of the value of knowledge	IP
Knowledge asset	1999	Pfeffer	US	knowledge	Patents,	IP
Info/knowledge sharing	2000	Balkin	US	innovation	measured by number of patents and R&D spending.	IP
Knowledge asset	2000	Balkin	US	IP	copyright	IP
Knowledge asset	2000	Balkin	US	IP	trade secrets	IP
Knowledge asset	2000	Balkin	US	patents	number	IP
Knowledge asset	2000	Carroll	US	knowledge management process	acquiring a patent or trademark	IP
Knowledge asset	2000	carroll	US	patents or trademarks	acquisition	IP
Learning ability	2000	Low	US	corporate value creation	brand value	IP
Info/knowledge sharing	2000	Martin	Singapore	IC	percentage of technically relevant, competitive intellectual assets that require a business response,	IP
Knowledge asset	2000	Martin	Singapore	IC	percentage of new business initiatives protected by intellectual assets;	IP
	2000	McMillan	US	knowledge development	Self-citation has been examined in the patenting literature with a theoretical base that it is a measure of internal knowledge development	IP
Knowledge asset	2000	Vorhies	US	innovation	Patents,	IP
Knowledge asset	2001	Berkowitz	US	patents	government-owned patents generated per employee	IP
Financial	1996	Chenhall	Australia	performance (divisional)	compared to industry averages over the prior three years	M
Customer/Market	1996	Davis	US	market share	market share	M
System/Technology	1996	LoanClarke	UK	competitiveness	long term competitiveness over time	M
Knowledge asset	1996	Robinson	US	ability to learn and change	a way of tracking how well an organization will be able to maintain its competitive advantage.	M
System/Technology	1997	Park	Internatnl	market freedom		M
Financial	1998	AppiahAdu	UK	behaviour and ability of competitors to be distinctive.		M
Efficiency, Effectiveness, Productivity	1998	AppiahAdu	UK	competition	nature of competitors' strategies and actions	M
Knowledge asset	1998	AppiahAdu	UK	competitive intensity		M
Customer/Market	1998	AppiahAdu	UK	market dynamism	evaluated the degree to which changes occurred in the types and preferences of a firm's customers	M
Measures of Competition	1998	AppiahAdu	UK	market dynamism	nature of competitors' strategies and actions	M
Financial	1998	AppiahAdu	UK	threats posed by a business environment		M
Customer/Market	1998	Thompson	UK	market share		M
Financial	1998	Thompson	UK	organisational performance	comparing and contrasting one company with another, against some selected and defensible criteria.	M
Customer/Market	1998	Thompson	UK	share price		M
Measures of Competition	1999	Ahmed	UK	Customer measurements	market share	M
Measures of Competition	1999	Baker	US	ease of entry		M
Customer/Market	1999	Baker	US	market growth		M
Knowledge asset	1999	Baker	US	market share	changes in market position	M
Customer/Market	1999	Baker	US	market share	market position	M

Financial	1999	Baker	US	market share	change in market share relative to the firm's largest competitor	M
Customer/Market	1999	Baker	US	relationship between market orientation & performance	ease of entry	M
Measures of Competition	1999	Baker	US	relationship between market orientation & performance	market growth	M
Customer/Market	1999	Baker	US	seller concentration		M
Measures of Competition	1999	Buckmaster	Australia	external benchmarking		M
Customer/Market	2000	Barsky	US	brand equity		M
Financial	2000	Barsky	US	market value-added (MVA)		M
Customer/Market	2000	Bharadwaj	US	IT capability & firm performance	measurements based on actual results and uses it to generate qualitative information that can be compared with data from other companies	M
Customer/Market	2000	Brah	Singapore	success of benchmarking	the extent to which practitioners of benchmarking have attained their objectives, justified costs by the benefits attained from benchmarking and their perception of the overall success of the process.	M
Customer/Market	2000	Brennan	Ireland	market share		M
Knowledge asset	2000	Grossman	US	benchmarking	outside benchmarking	M
Customer/Market	2000	Grossman	US	market value		M
Financial	2000	Stivers	US	market performance		M
System/Technology	2000	Stivers	US	market share		M
Customer/Market	2000	Vorhies	US	market orientation, marketing capabilities, and performance		M
Measures of Competition	2000	Vorhies	US	market orientation	generation of market intelligence, dissemination of market intelligence across departments and work groups, and responsiveness to market intelligence.	M
Financial	2000	Vorhies	US	Product-market scope		M
Measures of Competition	2000	Vorhies	US	Relative performance	measured by asking respondents to assess their business unit's performance relative to that of major competitors.	M
Knowledge asset	2001	Groom	US	competitive intelligence effectiveness.		M
Customer/Market	2001	Ranchod	UK	on-line marketing effectiveness	the approaches used to evaluate on-line marketing effectiveness	M
Measures of Competition	2002	Bukh	Denmark	turnover	turnover from new customers in the new target segment	M
Measures of Competition	2002	Harrison	US	results of its Web site.		M
Innovation & Creativity	1996	Davis	US	innovation	Vitality refers to new products which have been introduced within the last five years.	N
Innovation & Creativity	1997	Leal	US	innovative activity	sales and purchases of technological capability	N
Financial	1997	Leal	US	potential competitive performance	measures of innovative activity	N
New Product Development	1998	Appelbaum	Canada	innovation & improvement activities		N
Innovation & Creativity	1998	AppiahAdu	UK	innovation orientation,		N
New Product Development	1998	AppiahAdu	UK	new product success		N
New Product Development	1999	Baker	US	new product success	success level	N
Strategy	1999	Bessant	Japan	ideas	High-grade ideas move up to the company committee responsible for evaluation and these are rewarded with larger sums.	N
New Product Development	1999	Bobic	UK	Innovativeness	measured by the dimension "departure from standard practice."	N
	1999	Cady	US	ideas	each idea a team develops is evaluated to compute an overall score for the quality of innovation	N
Customer/Market	1999	Cady	US	quality	of ideas	N
Innovation & Creativity	1999	Freeman	US	innovation capacity of this program	evaluated using Debra Amidon's innovation assessment, and the results are presented.	N
Learning ability	1999	Kathuria	US	Product Flexibility	the importance given to product variety, ability to make rapid changes in product mix, and the ability to customize products.	N
Outcomes	1999	Kaye	UK	CI	strategic focus;	N
Innovation & Creativity	1999	Li	UK	new product competitiveness	newness, reliability, productivity, and uniqueness	N
Innovation & Creativity	1999	Li	UK	new product competitiveness	the extent of cooperation in establishing product development goals, generating and screening new product ideas, and evaluating and refining new products.	N
New Product Development	2000	AppiahAdu	UK	new product success	success level	N
Innovation & Creativity	2000	Carroll	US	knowledge management process	improved innovative capacity measured by performance indicators.	N
Innovation & Creativity	2000	Harrison	US	innovative ideas	Most firms have a method for evaluating the innovative ideas that emerge from the innovation process.	N
Innovation & Creativity	2000	Kuczma	US	Innovation portfolio mix	the percentage of new products commercialized by number and by revenue.	N
Teamwork & participation	2000	Kuczma	US	ratio of new products to total product mix	divide the number of new products exceeding the 3-to-5-year original revenue forecast by the total number of new products commercialized over the same period.	N
Innovation & Creativity	2000	Liebowitz	US	knowledge assets	Number of new products.	N
Financial	2000	Low	US	corporate value creation	innovation	N
New Product Development	2000	Low	US	innovation	number of patents and the importance of patents has the greatest impact on market value.	N
Financial	2000	Lynn	US	learning by teams	speed of development and new product success, scale items were developed based on past exploratory research	N
New Product Development	2000	Lynn	US	new product success	scale items were developed based on past exploratory research	N
New Product Development	2000	Martin	Singapore	Success	measured by a long-term capability to succeed through innovation	N
System/Technology	2000	McAdam	UK	innovation	continuous improvement	N
Innovation & Creativity	2000	McAdam	UK	innovation.	The Centrim Innovation Model	N
Innovation & Creativity	2000	Sanchez	Spain	innovation process	technological innovation	N
System/Technology	2000	Siegall	US	competence	innovative behavior,	N

Innovation & Creativity	2001	Bain	US	innovation measures	individuals' and teams' ratings of their innovation, lists of innovations, and experts' ratings of the magnitude, adicalness, and novelty of innovations listed by the teams.	N
Customer/Market	2001	Boland	US	ideas	Depth was measured as the maximum number of appropriate idea units in a major category.	N
Innovation & Creativity	2001	Goffin	UK	new product development		N
Measures of Competition	2001	Kleysen	Canada	employee behaviors	looking for opportunities to innovate, recognizing opportunities, gathering information about opportunities, and paying attention to opportunity sources.	N
Innovation & Creativity	2001	Kleysen	Canada	innovation	measure of role innovation which captures how many changes an individual has initiated in his or her job in comparison to the last role occupant and Roger's (1983) operationalization of innovators as persons who adopt innovations before others.	N
Measures of Competition	2001	Kuczma	US	company's distinctiveness with (and perceived value to) customers.	brand innovation quotient (number of customers who view the brand as innovative divided by the total number of potential customers)	N
System/Technology	1996	Chenhall	Australia	manufacturing performance	both survey and case evidence indicated that a significantly large proportion of high performing divisions achieving high levels of manufacturing flexibility were using manufacturing performance measures as part of their formal managerial evaluation systems.	P
Customer/Market	1996	Chenhall	Australia	outputs of manufacturing	Formal measurement of process and outputs of manufacturing can provide feedback that may lead to improved learning and, consequently, enhanced performance.	P
Customer/Market	1996	Chenhall	Australia	productivity	cycle-time	P
System/Technology	1996	Chenhall	Australia	technological factors	preventive maintenance	P
Efficiency, Effectiveness, Productivity	1996	Chenhall	Australia	technological factors	productivity measures related to physical inputs; - minimum inventory levels	P
System/Technology	1996	Chenhall	Australia	technological factors	materials' throughput time; - set-up times; - success in making new technologies work; -	P
Financial	1996	Davis	US	cost control	productivity improvement from year to year.	P
Operational Processes	1996	Davis	US	Customer service levels	percentage of line items filled with an overall goal of 95%	P
Quality	1996	Davis	US	equipment downtime		P
Performance	1996	Davis	US	on time delivery;	percentage of on time deliveries.	P
Quality	1996	Davis	US	overtime usage.		P
Customer/Market	1996	Davis	US	plant efficiency and effectiveness	Manufacturing plant scorecard In each plant, measures were developed to track speed, quality and cost.	P
Quality	1996	Davis	US	production rates	per period daily	P
System/Technology	1996	Davis	US	speed	delivery	P
Customer/Market	1996	Francis	NZ	effectiveness of a workshop	meeting the defined workshop objectives, measuring the change in team functioning, a participant evaluation questionnaire, and job performance over time.	P
	1996	Kruzner	US	strategy.	performance gaps	P
System/Technology	1996	Kruzner	US	value chains	measured the refining, distribution, and marketing process as an integrated value chain.	P
Learning ability	1996	LoanClarke	UK	performance	departmental outcomes	P
Outcomes	1996	LoanClarke	UK	performance	activity levels	P
Capability & Competency	1996	Mortlock	UK	call centre efficiency	number of calls per week answered within a number of seconds by a certain number of staff - the processes themselves were more difficult to evaluate.	P
Financial	1997	AbdulGader	Saudi Arabia	organizational effectiveness	impact of IS	P
System/Technology	1997	AbdulGader	Saudi Arabia	system utilization	frequency of use	P
System/Technology	1997	AbdulGader	Saudi Arabia	time saving		P
Efficiency, Effectiveness, Productivity	1997	AbdulGader	Saudi Arabia	use of systems	the success level of CMCS and the factors that influence CMCS	P
Customer/Market	1997	Adam	Intematnl	effectiveness of decision making	level of centralisation vs decentralisation	P
Customer/Market	1997	Adam	Intematnl	employee selection	effectiveness of the selection process	P
Efficiency, Effectiveness, Productivity	1997	Adam	Intematnl	inventory reduction	inventory movements over time	P
System/Technology	1997	Adam	Intematnl	performance	objectivity of feedback	P
System/Technology	1997	Adam	Intematnl	work measurement	work flow effectiveness and industrial engineering analysis	P
Efficiency, Effectiveness, Productivity	1997	Leal	US	innovative activity	sales & purchases of technological capability	P
Customer/Market	1998	Appelbaum	Canada	processes	internal	P
	1998	AppiahAdu	UK	market dynamism	rate at which products/services become obsolete	P
Efficiency, Effectiveness, Productivity	1998	Eskildesen	Denmark	Project success	ability to complete according to spec	P
Financial	1998	Eskildesen	Denmark	Project success	ability to complete within time	P
System/Technology	1998	Kennedy	US	Efficiency	how well an organization is using its capacity.	P
Financial	1998	Kennedy	US	information productivity index	management costs/benefits received	P
Customer/Market	1998	Wurzburg	Intematnl	decision making practices		P
	1999	Ahmed	UK	achievement of specified goals	the vital signs which quantify how well activities within a process or the outputs of a process achieve a specified goal	P
Knowledge process	1999	Ahmed	UK	contribution	contribution of each team or process to the organisation's goal	P
System/Technology	1999	Ahmed	UK	knowledge performance measures	knowledge processes	P
Operational Processes	1999	Ahmed	UK	Performance	reflect the contribution of each team or process to the organisations' goals.	P
Customer/Market	1999	Ahmed	UK	productivity		P
Innovation & Creativity	1999	Armistead	UK	capability to perform well	dependability to keep arranged times	P
Efficiency, Effectiveness, Productivity	1999	Armistead	UK	capability to perform well	ability to respond quickly to changes requested by customers	P
System/Technology	1999	Armistead	UK	operational processes	measures of quality in consistency, speed and dependability of delivery and flexibility to cope with changes to order, while at the same time improving productivity.	P
Project Success	1999	Armistead	UK	quality	speed and dependability of delivery	P
Teamwork & participation	1999	Armistead	UK	quality	flexibility to cope with changes to order	P
Knowledge process	1999	Bessant	Japan	delivery reliability	improve delivery reliability (by specific %)	P

Customer/Market	1999	Bessant	Japan	material usage	reduction over time	P
Composite measures	1999	Bessant	Japan	speed	reduce setup time	P
Logistics & Delivery	1999	Bloemer	Belgium	Perceived service quality	22-item SERVPERF instrument with a nine-point scale ranging from 1 (= completely disagree) to 9 (= completely agree)	P
Customer/Market	1999	Buckmaster	Australia	benchmarking.	internal	P
Financial	1999	Buckmaster	Australia	efficiency and effectiveness	inputs, processes & outputs	P
System/Technology	1999	Buckmaster	Australia	learning	outcome measurement	P
Efficiency, Effectiveness, Productivity	1999	Kaye	UK	processes		P
Financial	1999	Mohanty	India	flexibility	strategic manufacturing initiative.	P
Financial	1999	Mohanty	India	productivity,	strategic manufacturing initiative.	P
Efficiency, Effectiveness, Productivity	1999	Mohanty	India	reliability	strategic manufacturing initiative.	P
	1999	Mohanty	India	responsiveness,	strategic manufacturing initiative.	P
Customer/Market	1999	Pfeffer	US	outcomes	General Motors attention switched to enhancing measures of intermediate outcomes and in-process indicators.	P
Logistics & Delivery	1999	Pfeffer	US	output	cycle time, line yield, and defect density, based on the management practices used.	P
	2000	Ang	Malaysia	IT support of QM	Quality management supported by IT	P
Efficiency, Effectiveness, Productivity	2000	Bharadwaj	US	effectiveness of data center networks, application development, and outsourcing.		P
New Product Development	2000	Brennan	Ireland	asset use	use of IT resources	P
System/Technology	2000	Brennan	Ireland	time, workload, error ratios and quality.		P
Customer/Market	2000	Carroll	US	defective units	% of total units shipped	P
Financial	2000	Carroll	US	on time delivery	measured as the percentage of shipments made on or before the promised delivery date	P
System/Technology	2000	Carroll	US	speed	on-time delivery	P
Efficiency, Effectiveness, Productivity	2000	Dewan	US	effectiveness	of healthcare	P
Efficiency, Effectiveness, Productivity	2000	Dewan	US	utilization	of healthcare	P
Operational Processes	2000	Dube	US	productivity	the effect of a monetary incentive scheme on employee productivity or satisfaction	P
Financial	2000	Enz	US	process	group process feedback	P
Operational Processes	2000	Gilbert	US	Operational efficacy	a measure of both efficient and effective operational practices.	P
Customer/Market	2000	Grossman	US	efficiency		P
Teamwork & participation	2000	Grossman	US	quantity	quantity	P
Quality	2000	Grossman	US	satisfaction of the hiring manager with the process.		P
Financial	2000	Grossman	US	speed	time	P
Customer/Market	2000	Hamson	US	work-in-progress.		P
Financial	2000	Ibbs	US	project management level and actual project performance	a three-part project management process maturity assessment questionnaire.	P
Knowledge process	2000	Ibbs	US	project management maturity	Analyze collected information to evaluate and benchmark an organization's project management processes and practices level using specific criteria.	P
Efficiency, Effectiveness, Productivity	2000	Liebowitz	US	output	thousand lines of code/person-month.	P
Teamwork & participation	2000	Liebowitz	US	research	amount of research being conducted	P
Quality	2000	Liebowitz	US	software coding productivity	function points per month	P
Customer/Market	2000	Lynn	US	effectiveness of project team	overall project success	P
Measures of Competition	2000	Lynn	US	effectiveness of project team	project process	P
Operational Processes	2000	Lynn	US	effectiveness of project team	speed of development	P
Project Success	2000	Lynn	US	effectiveness of project team	Recording Systems,	P
Financial	2000	Martin	Singapore	efficiency		P
Financial	2000	Martin	Singapore	growth and renewal		P
Financial	2000	Martin	Singapore	stability.		P
Teamwork & participation	2000	Peabody	US	quality	process measures	P
Measures of Competition	2000	Stivers	US	learning & growth	procedures	P
	2000	Stivers	US	goal achievement		P
System/Technology	2000	Thompson	US	technological advance,	quality change	P
Efficiency, Effectiveness, Productivity	2001	AlGahtani	UK	impact of IT	system usage	P
Strategy	2001	AlGahtani	UK	system success	frequency of use	P
Strategy	2001	AlGahtani	UK	system success	system sophistication	P
	2001	AlGahtani	UK	system success	system usage	P
Financial	2001	AlGahtani	UK	user acceptance	number of applications used	P
	2001	Groom	US	strategy	SWOT	P
Human Capital	2001	Kirchhoff	US	productivity	Value Creation Model (VCM) measure meaningfully a portfolio of projects.	P
Teamwork & participation	2001	Kirchhoff	US	research-to-commercialization process.	new decision support system developed by Bell Laboratories to measure the research-to-commercialization process.	P
Customer/Market	2001	Miller	US	project team effectiveness	task coordination, communication, and task management	P
Customer/Market	2001	Moore	US	cycle time		P
Operational Processes	2001	Moore	US	performance	enhancing business processes	P
Financial	2001	Moore	US	speed	cycle time	P
System/Technology	2001	Moore	US	speed	throughput efficiency	P
Innovation & Creativity	2001	Poll	Germany	accuracy	accuracy of delivery	P
Financial	2001	Poll	Germany	accuracy of delivery;		P
Operational Processes	2001	Poll	Germany	adequacy of processes		P
Financial	2001	Poll	Germany	processes	adequacy of processes	P
Financial	2001	Poll	Germany	speed of delivering information and services;		P
	2001	Ranchhod	UK	marketing effectiveness	internet technology levels and Web site capabilities	P
System/Technology	2001	Sim	US	JIT adoption		P
Customer/Market	2001	Stank	US	inventory dwell time	ratio of days that inventory sits idle in the supply chain relative to the days it being productively used	P
System/Technology	2001	Stank	US	perfect order achievement		P
System/Technology	2001	Stank	US	supply chain inventory	days	P
Performance	2002	Bukh	Denmark	processes	processes related to the execution and delivery of the software products, and measure the progress of software projects.	P

Financial	2002	Globerson	Israel	project manager's role	evaluate the extent of the project manager's involvement in the planning processes and to evaluate their quality.	P
					ability to complete the project according to desired specifications and within the specified budget and the promised time schedule, while keeping the customer and stakeholders happy.	P
Efficiency, Effectiveness, Productivity	2002	Globerson	Israel	Project success		P
System/Technology	1996	Chenhall	Australia	productivity	TQM program.	Q
Customer/Market	1996	Chenhall	Australia	quality of component parts	number of defects	Q
Customer/Market	1996	Chenhall	Australia	quality of component parts	defect free output;	Q
System/Technology	1996	Davis	US	quality	number of defects	Q
	1996	Davis	US	quality	customer feedback	Q
Quality	1997	Adam	Internatnl	quality	% items defective	Q
Quality	1998	Wurzberg	Internatnl	quality of goods & services		Q
Quality	1999	Armistead	UK	quality	improving productivity.	Q
Quality	1999	Armistead	UK	quality	consistency	Q
					emphasizes the level of consistency and is measured using three items: conformance to product specifications, ensuring accuracy in manufacturing, and consistent quality.	Q
Quality	1999	Kathuria	US	Quality of Conformance		Q
Quality	1999	Kathuria	US	Quality of Design	emphasizes product performance,	Q
Quality	2000	Dewan	US	quality	evaluation of healthcare quality	Q
Knowledge process	2000	Dube	US	quality	service quality	Q
Financial	2000	Grossman	US	quality		Q
Knowledge process	2000	Liebowitz	US	defects	bad lines of code	Q
Financial	2000	Low	US	corporate value creation	quality	Q
Financial	2000	McGee	US	quality	service quality	Q
Quality	2000	McGee	US	quality	quality of services provided to customers	Q
Quality	2000	McMillan	US	quality	bibliometrics	Q
Quality	2000	Thompson	US	quality	change	Q
Customer/Market	2001	Leese	UK	quality		Q
Financial	1999	Buckmaster	Australia	public perceptions		R
Customer/Market	2000	Enz	US	reputation	guest surveys	R
Image, reputation	2000	Grossman	US	perceptions	human reaction	R
					Peoples' trust in various organizations has been measured over time.	R
Human Capital	2002	Schmid	US	trust		R
System/Technology	1996	Chenhall	Australia	productivity	supplier reliability	S
Relationships/Alliances	1996	Chenhall	Australia	Supplier reliability		S
Relationships/Alliances	1996	Chenhall	Australia	technological factors	vendor reliability and responsiveness	S
System/Technology	1999	Ahmed	UK	Supplier rating	supplier meetings; - supplier development programmes; - benchmarking activities between suppliers.	S
				relationship between market orientation & performance		S
Customer/Market	1999	Baker	US	relationship between market orientation & performance	seller concentration	S
Relationships/Alliances	1999	Baker	US	supplier power		S
Relationships/Alliances	1999	Baker	US	supplier power		S
	1999	Bal	US	turbulence.	instability in the supply chain	S
Human Capital	2000	Liebowitz	US	amount of industry contacts	partnerships	S
Customer/Market	2000	Low	US	corporate value creation	alliances	S
						S
	2001	Farmer	US	program evaluation	appraise public-private alliances for technology development.	S
Customer/Market	2001	Leese	UK	success	factors relating to facilitation of future change, for example, the development of good internal and external relationships.	S
Financial	2001	Stank	US	competence	material & service supplier integration	S
System/Technology	1998	AppiahAdu	UK	market dynamism	technology within the industry	T
System/Technology	1999	Ahmed	UK	knowledge performance measures	tools & techniques	T
				relationship between market orientation & performance		T
System/Technology	1999	Baker	US	technological change	technological change	T
Customer/Market	1999	Baker	US	technological change		T
Customer/Market	2000	Bharadwaj	US	performance	IT capability	T
					the total number of systems and number of specific hardware systems such as point-of-sale systems, etc.	T
System/Technology	2000	Bharadwaj	US	technology		T
System/Technology	2000	Brennan	Ireland	use of technology	effective IT use	T
Customer/Market	2000	Low	US	corporate value creation	technology	T
Human Capital	2000	Stivers	US	learning & growth	systems	T
System/Technology	2001	Bruce	US	technology	IT use	T
System/Technology	2001	Ranchod	UK	technology	aspects of technology capacity	T
System/Technology	2001	Roslender	UK	database growth	database consultation	T
System/Technology	2001	Roslender	UK	database growth	database upgrades	T
conflict, turbulence, instability	2001	Stank	US	competence	technology & Planning integration	T
Customer/Market	2002	Bornemann	Austria	technology transfer performance		T
System/Technology	2002	dePablos	various	utility of a firms databases and intranets		T
Composite measures	1996	Davis	US	balanced scorecard in a manufacturing plant	quality, volume, material cost, yields and labour usage.	X
Composite measures	1996	Davis	US	GE corporate scorecard	BSC	X
Customer/Market	1996	Edwardš	US	the 360 degree feedback system		X
					single common, comprehensive measurement system across all plant and business unit organizations.	X
Composite measures	1996	Kruzner	US	composite		X
Composite measures	1998	Appelbaum	Canada	learning performance.	BSC	X
Composite measures	1998	Hepworth	US	performance	BSC + employee empowerment	X
Composite measures	1998	Kennedy	US	intangible assets	BSC	X
Composite measures	1998	Kennedy	US	intangible assets	Intangible Asset Monitor	X
					BSC to describe a framework of four groups of measures, and argue that organisations should select critical measures for each one of these areas.	X
Composite measures	1998	Thompson	UK	competency		X
Composite measures	2000	Barsky	US	integrated set of measures.	Navigator (Skandia)	X
Composite measures	2000	Brennan	Ireland	IC	Skandia model	X
Composite measures	2000	Carroll	US	performance	BSC	X

				Knowledge Management Performance Scorecard	performance in four key result areas: (1) financial performance; (2) internal business processes; (3) customers; and (4) growth.	X
Composite measures	2000	deGooijer	Australia			
Human Capital	2000	Dulewicz	UK	composite indicator	overall rate of advancement (ROA)	X
Composite measures	2000	Grossman	US	performance	BSC	X
Composite measures	2000	Liebowitz	US	IC (Skandia)	measurements covering the financial, customer, human, renewal and development, and process areas.	X
Composite measures	2000	Low	US	intangibles	the balanced scorecard	X
Composite measures	2000	Low	US	performance	value creation index	X
Composite measures	2000	Low	US	value creation	Cap Gemini Ernst & Young researchers to develop a rigorous, comprehensive model	X
Composite measures	2000	Martin	Singapore	KM	BSC which combines financial measures with others related to customer satisfaction, internal processes and the organisation's ability to learn and improve.	X
Human Capital	2000	Stivers	US	balanced performance	market standing, innovation, productivity, customer service, and employee involvement are critical measures for inclusion in a balanced performance management system.	X
Human Capital	2000	Stivers	US	balanced performance	Increase grant income, Decrease operating expenses, Increase collections with service, Increase new patient revenue, Customer Perspective Goals Patient satisfaction, Patient retention, Patient acquisition, Service accessibility, Internal Processes Goals Patient visit efficiency Collection efficiency, Physician productivity Administrative efficiency, Learning and Growth Goals Employee empowerment Employee development Embrace technology Measures Number and income per grant Cost per patient visit per service Average collections at time of service New patient revenue Measures Satisfaction survey scores Number of patients transferred Number of new patients by payer Number of services provided Measures Throughput time for service Collection rate at time of service Patients seen per month per physician Percentage of revenue for administration Measures Percentage of suggestions implemented Dollars invested in employee training Number of technological enhancements	X
Financial	2000	Stivers	US	balanced scorecard	combined measures in four perspectives: financial, customer, internal processes, and learning and growth.	X
Composite measures	2000	Stivers	US	strategy	financial, customer, internal processes, and learning and growth.	X
Composite measures	2001	Guthrie	UK	IC	Balanced Scorecard and Karl-Erik Sveiby's Intangible Asset Monitor.	X
Composite measures	2001	Moore	US	performance	balanced scorecard in which performance measures are linked to the firm's strategy.	X
Composite measures	2001	Poll	Germany	Performance	finances, internal processes, and potentials (innovation)-are combined to produce a "balanced" evaluation of the library.	X
Composite measures	2001	Roslender	UK	IC	measures that meet the needs of specific businesses, and that by implication vary over time.	X
Composite measures	2002	Bukh	Denmark	performance	BSc	X
Composite measures	2002	Collardin	UK	IC	Intangible Asset Monitor	X
Composite measures	2002	Collardin	UK	IC	BSC	X
Composite measures	2002	dePablos	Asia	IC	Skandia navigator, intangible assets monitor (Sveiby), technology broker (Brooking, 1996) and competence-based strategic management model (Bueno, 1998,1999).	X
Composite measures	2002	Frigo	US	performance	Balanced Scorecard	X
Composite measures	2002	Frigo	US	performance	Value-Based Management initiatives.	X