



Intellectual capital – defining key performance indicators for organizational knowledge assets

Intellectual
capital

551

Bernard Marr

*Centre for Business Performance, Cranfield School of Management,
Cranfield, Bedfordshire, UK*

Gianni Schiuma

DAPIT – Facoltà di Ingegneria, Potenza, Italy

Andy Neely

*Centre for Business Performance, Cranfield School of Management,
Cranfield, Bedfordshire, UK*

Keywords *Intellectual capital, Assets, Performance measurement (quality),
Knowledge management*

Abstract *Measuring intellectual capital is on the agenda of most 21st century organisations. This paper takes a knowledge-based view of the firm and discusses the importance of measuring organizational knowledge assets. Knowledge assets underpin capabilities and core competencies of any organisation. Therefore, they play a key strategic role and need to be measured. This paper reviews the existing approaches for measuring knowledge based assets and then introduces the knowledge asset map which integrates existing approaches in order to achieve comprehensiveness. The paper then introduces the knowledge asset dashboard to clarify the important actor/infrastructure relationship, which elucidates the dynamic nature of these assets. Finally, the paper suggests to visualise the value pathways of knowledge assets before designing strategic key performance indicators which can then be used to test the assumed causal relationships. This will enable organisations to manage and report these key value drivers in today's economy.*

Introduction

In the last decade management literature has paid significant attention to the role of knowledge for global competitiveness in the 21st century. It is recognised as a durable and more sustainable strategic resource to acquire and maintain competitive advantages (Barney, 1991a; Drucker, 1988; Grant, 1991a). Today's business world is characterised by phenomena such as e-business, globalisation, higher degrees of competitiveness, fast evolution of new technology, rapidly changing client demands, as well as changing economic and political structures. In this new context companies need to develop clearly defined strategies that will give them a competitive advantage (Porter, 2001; Barney, 1991a). For this, organisations have to understand which capabilities they need in order to gain and maintain this competitive advantage (Barney, 1991a; Prahalad and Hamel, 1990).

Organizational capabilities are based on knowledge. Thus, knowledge is a resource that forms the foundation of the company's capabilities. Capabilities combine to



Business Process Management
Journal
Vol. 10 No. 5, 2004
pp. 551-569

The authors would like to thank, Göran Roos, Steven Pike, Oliver Gupta, as well as the two anonymous reviewers for their valuable comments which helped us to improve this paper.

© Emerald Group Publishing Limited
1463-7154
DOI 10.1108/14637150410559225

become competencies and these are core competencies when they represent a domain in which the organisation excels (Prahalad and Hamel, 1990). It is the result of both individual and organizational activities. In particular at the individual level, it includes personal knowledge and individual skills and talents; while at the organizational level, competence includes infrastructure, networking relationships, technologies, routines, trade secrets, procedures and organizational culture. Knowledge is today's driver of company life (Bontis *et al.*, 1999) and the wealth-creating capacity of the company is based on the knowledge and capabilities of its people (Savage, 1990). Today, many companies see themselves as learning organisations pursuing the objective of continuous improvement in their knowledge assets (Senge, 1990). This means that knowledge assets are fundamental strategic levers in order to manage business performance and the continuous innovations of a company (Marr and Schiuma, 2001; Mouritsen *et al.*, 2002; Quinn, 1992; Boisot, 1998).

In order to execute a successful strategy, organisations need to know what their competitive advantage is and what capabilities they need to grow and maintain this advantage. Capabilities are underpinned by knowledge. Therefore, organisations that seek to improve their capabilities need to identify and manage their knowledge assets. The perspective that knowledge assets represent the foundation of organizational capabilities explains the growing interest in knowledge management as an evolving discipline and approach to improve business performance. Although the management literature provides plentiful insights into knowledge management practices only little has been documented about the assessment of organizational knowledge assets. Given that it is difficult to manage something that is not being measured, organisations require frameworks to measure their knowledge assets. Managers need tools that help organisations in defining key performance indicators for those knowledge assets that are underpinning the strategic key capabilities of the organisation.

This paper will discuss the concept of knowledge and will then review approaches suggested in the literature to measure intellectual capital and knowledge assets. Subsequently, the paper will present the knowledge assets dashboard as a framework that allows companies to define key performance indicators for measuring knowledge assets. Finally, it discusses the findings and suggests possible paths of how to take this research further.

The concept of knowledge assets

The attempt to operationalise the employment of knowledge has led academics as well as practitioners to define new concepts to identify, classify and manage the knowledge resources of organisations. The management literature shows two main streams that discuss knowledge. One of them, taking an epistemological approach, interprets knowledge as an entity and discusses the differences between information and knowledge, and its implications for knowledge management, whereas the other stream of literature discusses knowledge as an organizational asset that has to be managed in order to improve organizational performance.

In the former stream of literature, knowledge is interpreted as information with an applied interpretation process (Penrose, 1959; Davenport and Prusak, 1998; Liebowitz and Wright, 1999). The attention is focused on the different features of knowledge in order to provide managers with meaningful guidelines to implement knowledge management processes (Albino *et al.*, 2001; Spender, 1996; Winter, 1987). One of the most

meaningful results from this discussion is the distinction between tacit and explicit knowledge (Prusak, 1997; Nonaka, 1991; Nonaka and Takeuchi, 1995; Polanyi, 1958).

The latter stream of research defines knowledge assets as a major part of an organisation's value. The research seeks to help managers in managing and evaluating the company performance (Teece, 2000; Roos *et al.*, 1997; Stewart, 1997). A major contribution provided by this research stream is the concept of intellectual capital (IC), which helps managers to identify and classify the knowledge components of an organisation. The two different streams are complementary and provide the cornerstones for the definition of a managerial framework to identify, assess, exploit and manage organizational knowledge.

IC has contributed to a better understanding of knowledge assets and was a first step towards a less abstract and more operative conceptualising of knowledge. The literature refers to IC in a number of different ways. The expression "intellectual capital statement" refers to "capital", emphasising the accounting value (Bukh *et al.*, 2001). Some authors use the concept of IC while referring to the knowledge of a social community, such as an organisation or professional practice groups (Nahapiet and Ghoshal, 1998). Other scholars interpret IC as a human resource (Boudreau and Ramstad, 1997; Liebowitz and Wright, 1999), while yet others associate it with information technology (Davenport and Prusak, 1998). Knowledge management practitioners often interpret IC as a portfolio of organised knowledge which can be leveraged into wealth-creating processes and activities (Chase, 1997). In recent years different definitions of IC have been provided in the management literature and some of the key definitions are summarised in Table I.

The ownership of specific knowledge provides organisations with particular capabilities (Leonard-Barton, 1992; Prahalad and Hamel, 1990). Therefore, the management of knowledge assets plays a key part in allowing an organisation to maintain and refresh its competencies over time. In order to manage knowledge assets, organisations need to measure them. The next section introduces the main approaches suggested to measuring knowledge assets.

Overview of measurement approaches

The aims of measuring knowledge assets can be twofold. First, to evaluate an organisation in order to communicate its real value to the market (external perspective). Second, to identify the knowledge components of an organisation in order to manage them so they can be turned into continuous performance improvement (internal perspective). Much attention in the IC literature has been on the market evaluation of an organisation's knowledge assets. Many people involved in the debate believe that the "true" value of a company can only be assessed by taking the intangible assets into account. They argue that assets such as brand equity, knowledgeable workers, corporate culture, stakeholder relations, access to markets, competitive position and a host of other off-balance sheet resources have to be considered (Harvey and Lusch, 1992). This external perspective of measuring IC appears to be particularly useful for accounting purposes since it allows organisations to place a value on their intangible assets. Internal measurement and reporting of IC is about knowledge-management activities.

On the basis of the above remarks it can be said that in terms of IC measurement knowledge management and accounting do not "serve the same masters"

Authors	Intellectual capital
Hall (1992)	May be classified as “assets” (e.g. brand, trademark, contracts, databases) or “skills” (e.g. know-how of employees, organizational culture)
Edvinsson and Sullivan (1996) Brooking (1996)	Knowledge that can be converted into value Consists of four main components: market assets, human-centred assets, intellectual property assets and infrastructure assets
Sveiby (1997)	Consists of three categories of intangible assets: internal structure, external structure and human competence
Roos <i>et al.</i> (1997)	It is composed of a thinking part, i.e. the human capital, and a non-thinking part, i.e. the structural capital
Stewart (1997)	Intellectual material that has been formalised, captured, and leveraged to produce a higher-valued asset
Edvinsson and Malone (1997)	It is the sum of human capital and structural capital. It involves applied experience, organizational technology, customer relationships and professional skills that provide an organisation with a competitive advantage
Bontis <i>et al.</i> (1999)	It is a concept that classifies all intangible resources as well as their interconnections
Lev (2001)	Sources of future benefits (value), which are generated by innovation, unique organizational designs, or human resource practices
Marr and Schiuma (2001)	It is composed of all knowledge-based assets, distinguished between organizational actors (relationships, HR) and infrastructure (virtual and physical)

Table I.
Definitions of
intellectual capital

(Birkinshaw, 2002). The former is concerned with optimising the management of knowledge resources in the company in order to continuously improve performance. The latter is aimed at setting standards for organizational accounting in order to give stakeholders a more comprehensive picture of the traditional monetary value of the company.

The assessment of knowledge in organisations is a difficult matter. However, since knowledge is of significant importance for a company's competitiveness its evaluation is a fundamental issue. Leif Edvinsson, ex-corporate director of intellectual capital at Skandia, highlights this with the words: “A company grows, because it has hidden values. To keep growing you must surface them, care for them, and transfer them through the business. . .if managers can measure it, they will value it” (Stewart, 1994). In recent years a number of models have been proposed to measure knowledge assets. They can be considered as an indicator of the ineffectiveness of traditional measurement frameworks in capturing the knowledge dimensions within an organisation.

A review of the literature of the traditional performance measurement frameworks revealed that little attention is being dedicated to assessing knowledge. The financially

biased management control of the 20th century has been heavily criticized (Kaplan, 1983; Meyer and Gupta, 1994; Johnson and Kaplan, 1987) and approaches such as the Performance Measurement Matrix by Keegan *et al.* (1989), Lynch and Cross' SMART Pyramid (1991) and the Macro Process Model (Brown, 1996) were proposed to reflect the need for more comprehensive measurement systems. Although, for example, the Performance Measurement Matrix allows any measure of performance to be accommodated within it, there is no explicit dimension for knowledge assets. Besides explicit performance measurement frameworks, other initiatives such as the Malcom Baldrige Award and its European equivalent the EFQM Excellence Model, have had an impact on the corporate measurement agenda and encouraged organisations to examine some of the "soft" dimensions of performance such as leadership, employees and impact on society.

The need to implement more balanced and integrated measurement frameworks led to the development of the Tableau de Bord (Epstein and Manzoni, 1997) and subsequently the Balanced Scorecard (Kaplan and Norton, 1992, 1996). Implicitly, the learning and growth perspective of the Balanced Scorecard incorporates measures about innovation capability and staff development, but it does not provide more detailed guidelines on which knowledge dimensions should be measured. A more recent performance measurement framework, the Performance Prism (Neely *et al.*, 2002; Neely and Adams, 2001; Marr and Neely, 2001), explicitly takes some knowledge assets of organisations into account. The capabilities facet considers some of the knowledge assets such as capabilities of the people, practices and routines, infrastructure as well as technological capabilities. Although the Performance Prism reflects the need to integrate the knowledge assessment with other more traditional aspects of performance measurement there are no explicit guidelines of which knowledge assets to choose. A systematic review of the management literature filtered out the following as key models that address the measurement of knowledge assets: the Skandia Navigator (Edvinsson and Malone, 1997), the IC-Index (Roos *et al.*, 1997), the IC Audit Model (Brooking, 1996) and the Intangible Asset Monitor (Sveiby, 1997). Each of these models will be discussed in the following sections.

Skandia navigator

In order to evaluate its market value Skandia proposed to split market value into financial capital and IC. The latter is considered to equate to the firm's intangible assets. The components of IC were subdivided into human capital, and other intangible assets embedded in the organisation itself called structural capital. Structural capital has been further subdivided into customer capital, e.g. the value of customer relations and organizational capital. The latter can be further broken down into process capital, related to the procedures and routines of the company's internal processes, and innovation capital, that represents the enablers to innovate products and processes. The Skandia approach, therefore, splits IC into the following four categories: human capital, customer capital, process capital and innovation capital (Figure 1).

On the basis of the above classification Skandia has developed an IC assessment tool called the Skandia Navigator. It is very similar to the Balanced Scorecard proposed by Kaplan and Norton but adds a human perspective in order to have the following five foci of measurement: the financial focus, the customer perspective (customer focus),

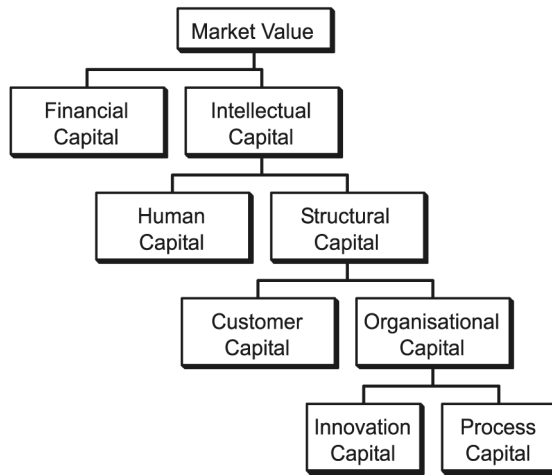


Figure 1.
Skandia's classification of
the intellectual capital

the process perspective (process focus), the human perspective (human focus), and the renewal and development perspective (innovation focus) (Figure 2).

Although Skandia made a significant contribution towards raising awareness of IC the problem with the Skandia approach is that it was developed specifically for one company. The classification of assets is primarily externally focused; its aim is to visualise the value of Skandia and to educate the analyst community. The Skandia Navigator is very similar to the Balanced Scorecard and is intended to function as a management tool. The problem is that all measures are eventually expressed in monetary terms and it is questionable that one can express knowledge assets in monetary terms. In the Balanced Scorecard approach there is a clear vision of how the different perspectives are related. In the Balanced Scorecard financial performance is achieved by meeting customers needs with a certain market proposition, in order to deliver this market proposition organisations have to execute their processes and in order to do this they need the right training and development. It is also not clear as how the five perspectives in the Skandia Navigator relate to each other. The overarching equation which sums IC and financial capital to give the market value of an organisation is wrong since the variables are not separable in this way as they interact with each other, they are not the same and rather represent two different sides of an equation.

IC-Index approach

The IC-Index approach represents an attempt to assess IC holistically. According its authors Johan and Göran Roos and colleagues it can be interpreted as an approach which consolidates IC indicators into a single index in order to provide a more comprehensive visualisation of the company's IC. The authors point out that one of the key advantages of this approach is that it enables organisations to correlate changes in IC with changes in the market (Roos *et al.*, 1997).

The IC-Index approach is based on an IC distinction tree which splits IC into human capital and structural capital, separating "thinking" and "non-thinking" knowledge assets. In other words, knowledge embodied in employees is separated from the

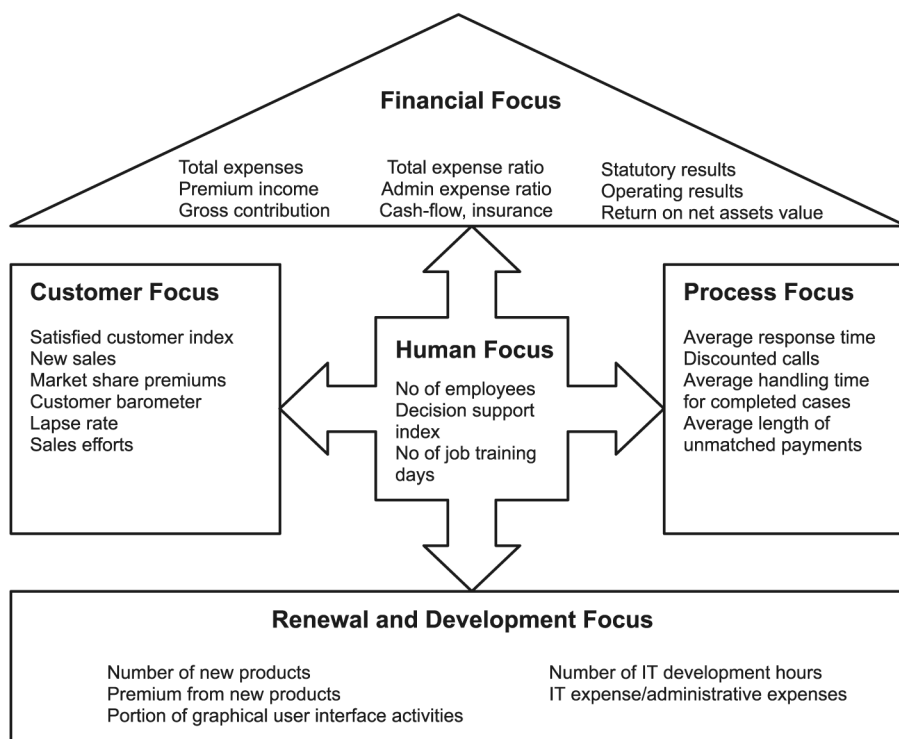


Figure 2.
Skandia Navigator

structural knowledge assets of a company. Human capital is further split into competence (i.e. skills and education), attitude (i.e. the behavioural components of employees' work), and intellectual agility (i.e. the innovation ability of employees). While Structural capital is seen as an aggregation of relationship capital (i.e. the relationships that company undertakes with customers, suppliers, allies, shareholders and other stakeholders), organizational capital (i.e. all sources of organizational, e.g. databases, process manuals, culture and management styles), and the renewal and development value (i.e. the intangible side of "anything" and "everything" that can generate value in the future, e.g. investments in training employees, reengineering and restructuring efforts, research and development). Figure 3 shows the complete IC distinction tree as proposed by Roos *et al.* (1997).

Roos *et al.* (1997) propose consolidating all the different IC measures into a single index or at least into a small number of indices. In this way it is possible to provide a comprehensive picture of a company's IC which would allow both an inter-company comparison as well as tracking of the relationship between the IC and the financial capital of an organisation.

In order to define an IC-Index, an organisation should identify and list the most important IC measures. The list of indicators to measure the organizational IC should be ranked and, for each category of IC, only a handful of meaningful indicators should be selected. Once the list of meaningful indicators has been defined, each indicator must be expressed as a dimensionless number. After the IC indicators are all expressed

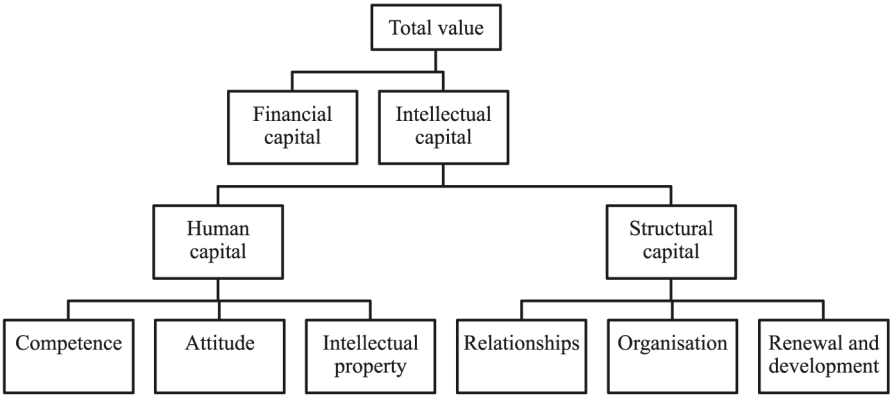


Figure 3.
The IC distinction tree

in dimensionless numbers the process of consolidation can start. The indicators chosen must be weighted and summarised into a single index.

There are three main factors affecting the selection process the company has to go through. These factors are the strategy, the characteristics of the company and the characteristics of the business the company operates. Figure 4 shows the importance of each role of the different factors in the selection of IC forms, weights and indicators. Strategy is the driver in making sense of different IC forms and in understanding which ones will support the company to perform its strategic goals. Therefore, when selecting the capital forms, strategy is the key issue. When choosing indicators the characteristics of the industry the company operates in are essential. Finally for the choice of weights managers need to consider the relative importance of each capital form in the creation of value in the particular business of the company.

The most valuable contribution of the IC Index approach is that it allows organisations to measure how changes in the market or changes in other performance indicators correlate with the changes in the IC Index. It can, therefore, be used as a tool for managers to test or challenge some of their assumptions about how the development of IC affects the business as a whole. On a critical note using aggregates makes it difficult to identify the key business drivers. Furthermore, the weightings for each of the different measures is done subjectively which can be dangerous if managers get it wrong as the index would not fully reflect the real IC of an organisation. On the other hand, if a good dialog about the weighting of IC forms takes place among the management team, then this can be one of the most valuable contributions of this approach. It is important that the management team understands

	Selection of capital forms	Selection of weights	Selection of indicators
Strategy	3	2	1
Business	2	3	2
Company	1	2	3

Figure 4.
The selection of capital forms, weights and indicators

Source: Adapted from Roos *et al.* (1997, p. 86)

and agrees which forms of IC are most important to the organisations and which forms of IC will drive sustainable performance.

It is also important to note that the IC Index does not allow organisations to benchmark their performance against each other because every company's IC Index will be made-up of different measures with different weightings. There is a danger that if organisations start to publish their IC Index, analysts might start comparing those, however, without some standardisation this will always mean comparing apples with pears.

IC Audit model

The IC Audit model proposed by Annie Brooking (1996) attempts to calculate a Dollar value for the non-tangible part of the organisation called IC. Brooking interprets IC as containing the following components: market assets, human-centred assets, intellectual property assets and infrastructure assets. Market assets are defined as market-related intangibles such as brands, contracts, customers, distribution channels, licensing agreements and franchise contracts. Human-centred assets are the knowledge of the people within the organisation and involve components such as expertise, problem solving capability, creativity, entrepreneurial and managerial skills. According to Brooking, intellectual property assets are corporate assets that can be expressed in financial terms. Examples of these assets are trade secrets, copyright, patent, service marks and design rights. Finally, infrastructure assets equal those technologies, methodologies and processes which enable the organisation to function.

The implementation of the IC Audit starts with a questionnaire containing 20 questions. This set of questions is designed to assess whether the organisation needs to develop new or strengthen existing areas of IC. In order to conduct a full IC Audit of a company a number of specific audit questionnaires are used. Once an organisation completes its IC audit, they can use three approaches to calculate a monetary value for its IC:

- (1) the cost-based approach – determining the value of an asset by ascertaining its replacement costs;
- (2) the market-based approach – determining the value of an asset by obtaining a consensus of what others in the market have valued the asset at; and
- (3) the income-based approach – determining the value of an asset by looking at the income-producing capability of the asset.

The IC Audit is heavily externally focused with the aim of placing a Dollar value against IC assets using one of the three approaches described above. There are various problems with these approaches of which some are already highlighted by Annie Brooking. The underlying assumption of the cost-based approach is that price of a new asset equals economic value of that asset during its lifetime. The major disadvantage with this approach is that it equates price with value. Baruch Lev explains that in most cases there is no effective market for intangible assets and that they are often not easily transferred, therefore it is a very risky approach to equate costs with value in the area of IC (Lev, 2001). Even in cases where replacement costs might reasonably be expected to provide a value, the valuer has to quantify the necessary adjustment from the brand new state of the replacement asset to the actual state of the asset under consideration (Brooking, 1996).

The problem of non-existent efficient markets is even bigger for the market-based approach. In order to obtain a consensus among participants in the market, there has to be a market in existence. IC is often very specific to organisations. With the exception of a few intangible assets like patents and brand names, there is no active or public market with any record of exchange, which makes it impossible to determine a value (Teece, 2000). The problem with the income-based approach is that it is hard to determine future economic benefits derived from the ownership of IC and equate this to value. For this it is important to use an appropriate discount factor in order to derive the present value of future earnings expectations. Besides this it is very hard to determine how much the ownership of a specific IC contributes to earnings, as there is mostly only an indirect link. Overall, the IC Audit is an interesting approach to identify IC within organisations and the work has contributed towards raising awareness about the importance of IC. However, the suggested valuation approaches need further refinement in order to be attractive for practical use.

Intangible asset monitor

The Intangible Asset Monitor was developed by Karl Erik Sveiby as a presentation format that displays indicators for internal management information purposes (Sveiby, 1997). It adopts the concept of Intangible Assets rather than IC. The following three categories of intangible assets are taken into account:

- (1) intangibles represented by competence of employees;
- (2) intangibles related to the internal structure of the organisation; and
- (3) those related to the external structure including brand names, image, and relationships with suppliers and most importantly relationships with customers.

Sveiby suggests that the first step is to determine who will be interested in the measurement of IC. He also distinguishes between external presentation, where the company describes itself as accurately as possible to its stakeholders (such as customers, creditors, or shareholders) and internal measurement, where management tries to gather as much information as possible in order to monitor progress and be able to take corrective actions (Sveiby, 1997). The Intangible Asset Monitor is internally focused.

For the purpose of classification employees have to be grouped into professionals (people who plan, produce, process, or present products and solutions) and support staff (those who work in accounting, administration, reception, etc.). The competence grouping only includes professionals. Professionals should be measured according to the type of activity, degree of responsibility, or area of competence. The internal structure only measures support staff, whereas the external structure measures independent contractors as well as measures for, e.g. the time employees spend developing and building customer relationships. Furthermore, Sveiby suggests that also customers should be categorised based on the type of intangible assets they provide (e.g. learning, image) as well as on the level of profitability they provide to the organisation.

Measurements for each of the three intangibles can then be divided into three measurement groups indicating the following:

- (1) growth and renewal;
- (2) efficiency; and
- (3) stability.

Organisations are advised to develop one or two indicators for each intangible under each of the measurement groups. Table II shows the basic structure of the Intangible Asset Monitor and includes some examples of measures companies might want to include for each of the intangibles by measurement groups.

The Intangible Assets Monitor is a valuable contribution to the debate on IC and especially emphasises the internal perspective. It is meant to act as a management and communication tool and not as a valuation approach although the derived business game “Tango™”, marketed by Celemi does use Sveiby’s methodology and “values” companies’ intangible assets. It is important to provide managers with a meaningful way to communicate information on intangible assets, whereas the Intangible Assets Monitor is an appealing approach to measure the performance of IC, the downside is that it is not clear as how to integrate it into any broader performance measurement frameworks in order to establish the link between intangible performance drivers and performance outcomes which become increasingly important (Kaplan and Norton, 2000).

Knowledge Assets Map

The “Knowledge Assets Map” provides managers with a broader framework of organizational knowledge from both an external and internal perspective (Marr and Schiuma, 2001; Schiuma and Marr, 2001). It is based on a broader interpretation of knowledge assets in companies and integrates the ideas put forward by authors discussed above. The Knowledge Assets Map provides a framework that allows organisations to identify the critical knowledge areas of their company.

The Knowledge Assets Map is based on an interpretation of the company’s knowledge assets as the sum of two organizational resources: stakeholder resources and structural resources. Figure 5 shows the classification of knowledge assets. Stakeholder resources are divided into stakeholder relationships and human resources. The first category considers relationships with external parties while the second considers the internal actors of the organisation. Structural resources are split into

	Human competence	Internal structure	External structure
Indicators of growth/renewal	Years in profession; Education level Training costs; Turnover	Investments in internal structure; Customers contributing to systems/process building	Profitability per customer; Organic growth
Indicators of efficiency	Proportion of professionals in the company; Leverage effect; Value-added per professional	Proportion of support staff; Sales per support person; Corporate culture poll	Satisfied customers index; Win/loss index; Sales per customer
Indicators of stability	Average age; Seniority; Relative pay position; Professional turnover rate	Age of organisation; Support staff turnover rate; Rookie ratio	Proportion of big customers; Age structure; Devoted customers ratio; Frequency of repeat orders

Table II.
Matrix of IC measures of
Internal Asset Monitor

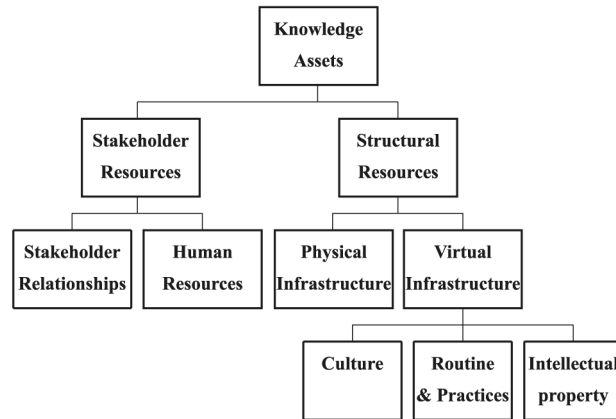


Figure 5.
Knowledge Assets Map

physical and virtual infrastructure, which refers to their tangible and intangible nature. Finally, virtual infrastructure is further sub-divided into culture, routines and practices and intellectual property.

The six categories of knowledge assets classified by the Knowledge Assets Map are defined in further detail below.

Stakeholder relationships include all forms of relationships a company has with its stakeholders. These relationships could be licensing agreements, partnering agreements, financial relations, contracts, and distribution arrangements. They also include customer relationships like customer loyalty and brand image, as a fundamental link between the company and one of its key stakeholders.

Human Resource contains knowledge assets provided by employees in forms of skills, competence, commitment, motivation and loyalty as well as in form of advice or tips. Some of the key components are know-how, technical expertise, and problem solving capability, creativity, education, attitude, and entrepreneurial spirit.

Physical infrastructure comprises all infrastructure assets, such as structural layout and information and communication technology like databases, servers, and physical networks like Intranets. In order to be a knowledge asset, physical infrastructure components have to be based on specific knowledge and are generally unique (often in their combination) to one organisation.

Culture embraces categories such as corporate culture, organizational values, networking behaviour of employees and management philosophies. Culture is of fundamental importance for organizational effectiveness and efficiency since it provides people with a shared framework to interpret events; a framework that encourages individuals to operate both as an autonomous entity and as a team in order to achieve the company's objectives.

Practices and Routines include internal practices, virtual networks and routines, like tacit rules and informal procedures. Some key components are process manuals providing codified procedures and rules, databases, tacit rules of behaviour as well as management style. Practices and routines determine how processes are being handled and how work flows through the organisation.

Intellectual property is the sum of knowledge assets such as patents, copyrights, trademarks, brands, registered design, trade secrets and processes whose ownership is

granted to the company by law. They represent the tools and enablers that allow a company to gain a protected competitive advantage.

It is possible to provide a wide range of indicators for each category of a company's knowledge asset. However, the management team has the task of identifying the most meaningful indicators that help to assess their company's knowledge assets. Therefore, it is important to warn managers not merely to adopt the metrics proposed in the literature since most of them are general and do not necessarily address the types of knowledge that have a critical role in the specific organisation's value-added processes (Grant, 1991b). Managers need to start from the recognition that the knowledge assets are unique to each company and that they have to design metrics that really address and measure the key knowledge assets that underlie their competencies and strategy.

The dynamic nature of knowledge assets

The Knowledge Assets Map allows classifying knowledge assets and helps managers to gain an understanding of their structure and hierarchy. It can be used as a tool to facilitate the discussions about which are the important knowledge assets in an organisation. However, it can only provide a static view of the knowledge asset base and does not indicate how these assets lead to value creation. Knowledge assets interact with each other and get transformed along a value creation pathway in order to contribute to the overall business performance and value creation. This interaction takes place not only between actors but in particular between actors and infrastructure. In an attempt to clarify the existing relationship between actors and infrastructure in each organisation, or as Roos *et al.* (1997) describe them the thinking and non-thinking parts of the organisation, we created the Knowledge Assets Dashboard. The Knowledge Assets Dashboard is a different visualisation of the Knowledge Asset Map in order to emphasise the difference between acting and infrastructure knowledge assets. The four perspectives taken from the Knowledge Assets Map are placed along two axes. The vertical axis includes the knowledge assets concerning the actors of an organisation – stakeholder relationships and human resources. The horizontal axis includes knowledge assets linked to the organizational infrastructure – physical and vertical infrastructure (Figure 6). This should highlight the dynamic nature of knowledge assets and the flows between the actors and the infrastructure assets (Nonaka, 1994). Knowledge assets interact with each other to create capabilities and competencies, and it is often this interaction which delivers a competitive advantage because it makes these assets difficult for competitors to imitate (Barney, 1991b; Teece *et al.*, 1997; Roos and Roos, 1997).

As with other management approaches, it is important to link them into corporate strategy (Kaplan and Norton, 1996). To identify the knowledge assets, the first task is to define the core capabilities and competencies that will allow an organisation to execute their strategy. Following the identification of core capabilities a set of critical knowledge assets can be defined that is needed to maintain these capabilities in order to execute the strategy. The set of core capabilities can be derived using a classical top-down approach or the bottom-up approach based on the knowledge-based or resource-based view of the firm (Figure 7).

Using the classical top-down approach the strategy and core-capabilities are derived from understanding the external market conditions by taking into account

Figure 6.
Knowledge Asset
Dashboard

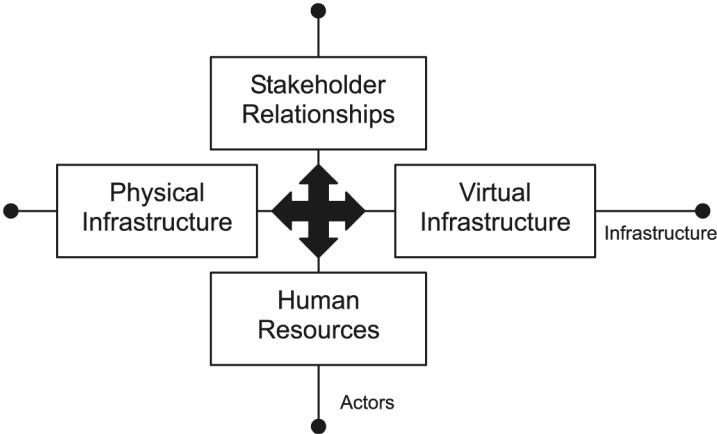
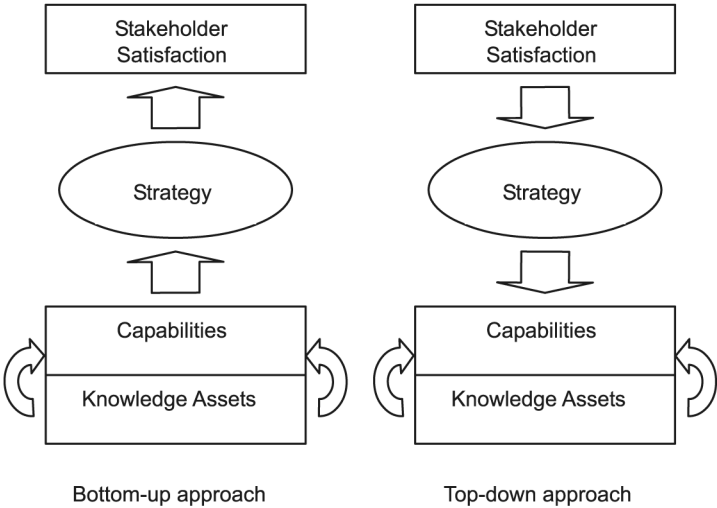


Figure 7.
Top-down vs bottom-up



factors such as the bargaining power of suppliers, customers, entry barriers, and potential substitute products and technologies (Porter, 1979). The role of capabilities is to enable companies to perform the necessary processes to execute their strategy, which in turn fulfils the needs of a clearly defined market. Using this approach organisations can understand whether they have the capabilities they need to deliver their strategy and see whether they have any development needs.

The bottom-up approach, on the other hand, takes a knowledge-based view of the firm to guide strategy formulation (Grant, 1997; Sveiby, 2001). In this approach organisations match more closely their internal capabilities with the opportunities in the market (Andrews, 1971). The bottom-up concept of corporate strategy definition is more internally focused and allows organisations to first identify what they do

well and then go out and look for ways to exploit it in the market (Collins and Montgomery, 1995).

Using either of the two strategy definition approaches outlined above, the final strategy is based on the capabilities to execute the strategy. Having identified the capabilities organisations can then, using the Knowledge Asset Dashboard, find the knowledge assets that underlie these capabilities. The Knowledge Assets Dashboard will draw attention to the fact that there is usually a combination of actor and infrastructure knowledge assets which is a first step towards recognising the dynamic nature of knowledge assets.

A next step towards measuring knowledge assets is to visualise the interactions and flows of knowledge assets. This can be done in a mapping process indicating causal relationships and showing how exactly knowledge assets interact and create value. This can take the form of strategy maps (Kaplan and Norton, 2000), success maps (Neely *et al.*, 2002), or the Navigator model developed by Roos *et al.* (Chatzkel, 2002). For a simplified model of such a map refer Figure 8.

When organisations have identified the core capabilities and the underlying knowledge assets, and when they have mapped the value-creating pathways, only then should organisations start designing measures to track the performance. The identification of knowledge assets and the mapping technique provides organisations with a hypothesis about how they think the business works. Performance measures can now be used to test these causal relationships or the assumed correlations. Measures can therefore be designed with a clear purpose in mind and are not picked at random will. This should naturally reduce the number of performance measures to a minimum and avoid that organisations measure everything without a clear understanding of why they are measuring (Neely, 2002).

Business performance measurement conducted in the structured way outlined above will allow organisations to gain real insights that will allow managers to make better-informed decisions in order to reach the strategic objectives and improve performance. The insights can be used to influence the management of knowledge assets and drive strategic knowledge management practices (Marr and Schiuma, 2001) or to report and disclose this information to interested stakeholders.

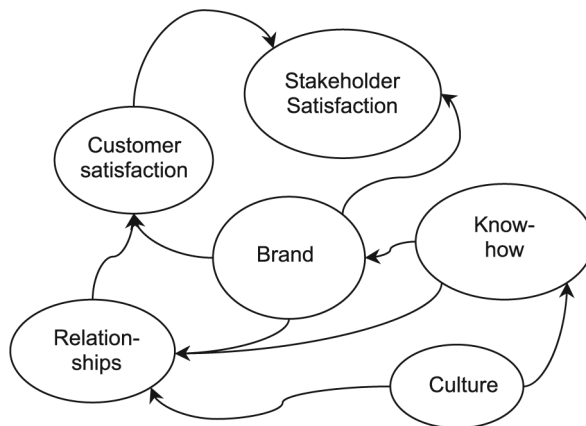


Figure 8.
Success map

Conclusion

A long-term competitive advantage can only be gained from the management of the knowledge assets underlying organizational capabilities. Building on existing literature this paper introduces the Knowledge Asset Map and Knowledge Asset Dashboard in order to provide organisations with a comprehensive tool that can help them to identify their key knowledge assets. The Knowledge Asset Map is grounded in the existing literature on performance measurement of intellectual capital and knowledge assets. The Knowledge Asset Dashboard represents a different visualisation of the Knowledge Asset Map. The aim of this visualisation along two axes is to clarify the interaction between actor and infrastructure knowledge assets in order to illuminate the fact that all knowledge assets are dynamic and are constantly interacting and evolving (Nonaka, 1994). We further suggested that organisations first map the dynamic transformations or causal interactions of knowledge assets (Kaplan and Norton, 2000; Neely *et al.*, 2002; Chatzkel, 2002) in order to visualise the value-generation pathways and to formulate a business hypothesis that can then be tested in a more scientific way.

We would like to encourage more empirical research into business performance measurement in knowledge-based organisations. More case research would help to further empirically ground the suggest frameworks. Furthermore, we call for more empirical work on the mapping approaches and investigations into the circumstances where more rigid approaches such as strategy maps or more open approaches such as success maps or navigator-type approaches are most appropriate.

References

- Albino, V., Garavelli, A.C. and Schiuma, G. (2001), "A metric for measuring knowledge codification in organisation learning", *Technovation*, Vol. 21 No. 7, pp. 413-22.
- Andrews, K.R. (1971), *The Concept of Corporate Strategy*, Dow Jones-Irwin, Homewood, IL.
- Barney, J.B. (1991a), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.
- Barney, J.B. (1991b), "Types of competition and the theory of strategy: towards and integrative framework", *Academy of Management Review*, Vol. 11 No. 4, pp. 791-800.
- Birkinshaw, J. (2002), "Managing internal R&D networks in global firms: what sort of knowledge is involved?", *Long Range Planning*.
- Boisot, M.H. (1998), *Knowledge Assets: Securing Competitive Advantage in the Information Economy*, Oxford University Press, Oxford.
- Bontis, N., Dragonetty, N.C., Jacobsen, K. and Roos, G. (1999), "The knowledge toolbox: a review of the tools available to measure and manage intangible resources", *European Management Journal*, Vol. 17 No. 4, pp. 391-402.
- Boudreau, J.W. and Ramstad, P.M. (1997), "Measuring intellectual capital: learning form financial history", *Human Resource Management*, Vol. 36 No. 3, pp. 343-56.
- Brooking, A. (1996), *Intellectual Capital: Core Assets for the Third Millennium Enterprise*, Thompson Business Press, London.
- Brown, M.G. (1996), *Keeping Score: Using the Right Metrics to Drive World-Class Performance*, Quality Resources, New York, NY.
- Bukh, P.N., Larsen, H.T. and Mouritsen, J. (2001), "Constructing intellectual capital statements", *Scandinavian Journal of Management*, Vol. 17, pp. 87-108.

-
- Chase, R.L. (1997), "Knowledge management benchmarks", *Journal of Knowledge Management*, Vol. 1 No. 1, pp. 83-92.
- Chatzkel, J. (2002), "A conversation with Göran Roos", *Journal of Intellectual Capital*, Vol. 3 No. 2.
- Collins, D.J. and Montgomery, C.A. (1995), "Competing on resources: strategy in the 1990s", *Harvard Business Review*, pp. 118-28.
- Davenport, T.H. and Prusak, L. (1998), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School, Boston, MA.
- Drucker, P.F. (1988), "The coming of the new organization", *Harvard Business Review*.
- Edvinsson, L. and Malone, M.S. (1997), *Intellectual Capital: The Proven Way to Establish Your Company's Real Value By Measuring Its Hidden Values*, Piatkus, London.
- Edvinsson, L. and Sullivan, P. (1996), "Developing a model of managing intellectual capital", *European Management Journal*, Vol. 4 No. 4, pp. 356-64.
- Epstein, M.J. and Manzoni, J.F. (1997), "The balanced scorecard and tableau de bord: translating strategy into action", *Management Accounting*, Vol. 79 No. 2, pp. 28-36.
- Grant, R.M. (1991a), *Contemporary Strategy Analysis*, Blackwell, Oxford.
- Grant, R.M. (1991b), "The resource-based theory of competitive advantage: implications for strategy formulation", *California Management Review*, Vol. 33 No. 3, pp. 14-35.
- Grant, R.M. (1997), "The knowledge-based view of the firm: implications for management practice", *Long Range Planning*, Vol. 30 No. 3, pp. 450-4.
- Hall, R. (1992), "The Strategic analysis of intangible resources", *Strategic Management Journal*, Vol. 13 No. 2.
- Harvey, M.G. and Lusch, R.F. (1992), "Balancing the intellectual capital books: intangible liabilities", *European Management Journal*, Vol. 17 No. 1, pp. 85-92.
- Johnson, T.H. and Kaplan, R.S. (1987), *Relevance Lost: The Rise and the Fall of Management Accounting*, Harvard Business School, Boston, MA.
- Kaplan, R.S. (1983), "Measuring manufacturing performance – a new challenge for managerial accounting research", *The Accounting Review*, Vol. 58 No. 4, pp. 696-705.
- Kaplan, R. and Norton, D. (1992), "The Balanced Scorecard – measures that drive performance", *Harvard Business Review*, Vol. 70 No. 1, pp. 71-9.
- Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard – Translating Strategy into Action*, Harvard Business School, Boston, MA.
- Kaplan, R.S. and Norton, D.P. (2000), "Having trouble with your strategy? Then map it", *Harvard Business Review*, pp. 167-76.
- Keegan, D.P., Eiler, R.G. and Jones, C.R. (1989), "Are your performance measures obsolete?", *Management Accounting*, pp. 45-50.
- Leonard-Barton, D. (1992), "Core capabilities and core rigidities: a paradox in managing new product development", *Strategic Management Journal*, Vol. 13.
- Lev, B. (2001), *Intangibles: Management, Measurement, and Reporting*, The Brookings Institution, Washington, DC.
- Liebowitz, J. and Wright, K. (1999), "Does measuring knowledge make 'cents'?", *Expert Systems with Applications*, Vol. 17 No. 5, pp. 99-103.
- Lynch, R.L. and Cross, K.F. (1991), *Measure Up! The Essential Guide to Measuring Business Performance*, Mandarin, London.
- Marr, B. and Neely, A. (2001), "Organizational performance measurement in the emerging digital age", *Int. J. Business Performance Management*, Vol. 3 Nos. 2-4, pp. 191-215.

- Marr, B. and Schiuma, G. (2001), "Measuring and managing intellectual capital and knowledge assets in new economy organisations", in Bourne, M. (Ed.), *Handbook of Performance Measurement*, Gee, London.
- Meyer, M.W. and Gupta, V. (1994), "The performance paradox", *Research in Organizational Behavior*, Vol. 16, pp. 309-69.
- Mouritsen, J., Bukh, P.N., Larsen, H.T. and Johnson, T.H. (2002), "Developing and managing knowledge through intellectual capital statements", *Journal of Intellectual Capital*, Vol. 3 No. 1, pp. 10-29.
- Nahapiet, J. and Ghoshal, S. (1998), "Social capital, intellectual capital, and the organizational advantage", *Academy of Management Review*, Vol. 23 No. 2, pp. 242-66.
- Neely, A. (2002), *Business Performance Measurement: Theory and Practice*, Cambridge University Press, Cambridge, NY.
- Neely, A. and Adams, C. (2001), "The performance prism perspective", *Journal of Cost Management*, Vol. 15 No. 1, pp. 7-15.
- Neely, A., Adams, C. and Kennerley, M. (2002), *The Performance Prism: The Scorecard for Measuring and Managing Business Success*, Financial Times Prentice Hall, London.
- Nonaka, I. (1991), "The knowledge-creating company", *Harvard Business Review*, Vol. 69 No. 6, pp. 96-104.
- Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.
- Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, Oxford.
- Penrose, E.T. (1959), *The Theory of the Growth of the Firm*, Wiley, New York, NY.
- Polanyi, M. (1958), *Personal Knowledge: Towards a Post-Critical Philosophy*, University of Chicago Press, Chicago, IL.
- Porter, M.E. (1979), "How competitive forces shape strategy", *Harvard Business Review*, Vol. 57 No. 2, p. 137.
- Porter, M.E. (2001), "Strategy and the Internet", *Harvard Business Review*, Vol. 79 No. 3, p. 63.
- Prahalad, C.K. and Hamel, G. (1990), "The core competence of the corporation", *Harvard Business Review*, Vol. 68 No. 3, pp. 79-91.
- Prusak, L. (1997), *Knowledge in Organizations*, Butterworth-Heinemann, Washington.
- Quinn, J.B. (1992), *Intelligent Enterprise: A Knowledge and Service Based Paradigm for Industry*, Free Press, New York, NY.
- Roos, G. and Roos, J. (1997), "Measuring your company's intellectual performance", *Long Range Planning*, Vol. 30 No. 3, p. 325.
- Roos, J., Roos, G., Dragonetti, N.C. and Edvinsson, L. (1997), *Intellectual Capital: Navigating the New Business Landscape*, Macmillan, London.
- Savage, C.M. (1990), *Fifth Generation Management: Co-creating Trough Virtual Enterprising, Dynamic Teaching, and Knowledge Networking*, Butterworth-Heinemann, Newton, MA.
- Schiuma, G. and Marr, B. (2001), "Managing knowledge in e-businesses: the knowledge audit cycle", *Profit with People*, in Deloitte & Touche, Russel Publishing, London, pp. 82-5.
- Senge, P.M. (1990), *The Fifth Discipline: The Art and Practice of the Learning Organization*, Doubleday/Currency, New York, NY.
- Sponder, J.C. (1996), "Dynamic theory of the firm", *Strategic Management Journal*, Vol. 17, pp. 45-62.

-
- Stewart, T.A. (1994), "Measuring company IQ", *Fortune*, p. 129.
- Stewart, T.A. (1997), *Intellectual Capital: The New Wealth of Organizations*, Doubleday/Currency, New York, NY.
- Sveiby, K.E. (1997), *The New Organizational Wealth: Managing and Measuring Knowledge-based Assets*, Barrett-Kohler, San Francisco, CA.
- Sveiby, K.E. (2001), "A knowledge-based theory of the firm to guide in strategy formulation", *Journal of Intellectual Capital*, Vol. 2 No. 4.
- Teece, D.J. (2000), *Managing Intellectual Capital: Organizational, Strategic, and Policy Dimensions*, Oxford University Press, Oxford.
- Teece, D.J., Pisano, G. and Shuen, A. (1997), "Dynamic capabilities and strategic management", *Strategic Management Journal*, Vol. 18 No. 7, pp. 509-33.
- Winter, S.G. (1987), "Knowledge and competence as a strategic asset", in Teece, D.J. (Ed.), *The Competitive Challenge*, Ballinger, Cambridge, MA.

Further reading

- Huber, G.P. (1991), "Organizational learning: the contributing processes and the literatures", *Organization Science*, Vol. 2 No. 1, pp. 88-114.