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# Assessing knowledge assets: a review of the models used to measure intellectual capital

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This paper reviews the literature pertaining to the assessment of knowledge assets. Since knowledge assets are at the crux of sustainable competitive advantage, the burgeoning field of intellectual capital is an exciting area for both researchers and practitioners. Unfortunately, the measurement of such intangible assets is difficult. A variety of models have surfaced in an attempt to measure IC and this paper aims to highlight their strengths, weaknesses and operationalizations.

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## Introduction

> *By the year 2010, all of the world's codified knowledge will double every 11 hours*. Nick Bontis, Ph.D., September 15, 2000 – Santa Clara, California, Closing Keynote Presentation, KM World 2000

The quote above was received with a stir from the audience at KM World. It seems that cognitive psychologists are speaking with library scientists, and they are both trying to warn us about some pending doom. If individuals are being bombarded by information now, they haven't seen anything yet. The exponential velocity with which this rate of bombardment is increasing is unfathomable. Although society as a whole should benefit from the by-product of increased technology, the average business manager may not be prepared to take advantage of this truly knowledge-intensive world.

The popular use of the terms in the following list hint at the increased importance knowledge assets have in organizations: intellectual capital, knowledge capital, knowledge organizations, learning organizations, organizational learning, information age, knowledge era, information assets, intangible assets, intangible management, hidden value and human capital. These terms and others are part of a new lexicon describing new forms of economic value. They are descriptors belonging to a paradigm where sustainable competitive advantage is tied to individual workers' and organizational knowledge. Reliance on productive tangible assets such as 'raw materials, fixed capital, and even

managerial knowledge' no longer account for investments made and wealth created by new and prospering companies (Organization for Economic Co-operation and Development 1996, 15). Instead, leveraging knowledge is the key reason attributed to corporate success stories such as the tremendous 'overvaluation' of high-tech and Internet companies.

The adoption of this new lexicon, concepts and explanations has been swift and far-reaching. The notions of intellectual capital were first advanced by economist John Kenneth Galbraith, who wrote the following to fellow economist Michal Kalecki in 1969:

> I wonder if you realise how much those of us the world around have owed to the intellectual capital you have provided over these last decades. (cited in Hudson 1993, 15)

Intellectual capital was further expounded upon by management guru Peter Drucker (1993) in his description of post-capitalist society. By the end of the 1990s, references to intellectual capital in contemporary business publications were commonplace (Bontis 1999a,b). Intellectual capital management became the domain of the so-called CKO or Chief Knowledge Officer (Bontis 2001). Stewart, in his ground-breaking cover-story in *Fortune Magazine*, is credited with providing the main impetus for a new world of intellectual capitalists (Stewart 1991). The initial momentum was supported by his popular book several years later (Stewart 1997). Stewart (1997) defines intellectual capital as intellectual material – knowledge, information, intellectual property and experience – that can be put to use to create wealth.

Endorsements by highly respected scholars such as Dr Baruch Lev (from New York University) and Dr Tom Davenport (from Boston University) coupled with practitioner icons such as Leif Edvinsson (formerly of Skandia) and Hubert Saint-Onge (formerly of CIBC) help to round out the academic and practitioner love affair with this phenomenon.

Perhaps the most impressive evidence suggesting a transition in thinking about a new structure and process supporting a company's productive assets is in the inclusion of intellectual capital as a strategic performance measure. In 1998, Arthur Andersen conducted an international survey of the measurement of intellectual capital. A total of 368 companies from a pool of 2350 (15% response rate) European, North American and Asian organizations responded to direct mail surveys. The survey revealed some interesting results.

First, the majority of respondents believed that intellectual capital (IC) reporting would increase. Secondly, about three-quarters of the respondents already tracked two or more non-financial metrics. Thirdly, most agreed that knowledge measurement would improve organizational performance. Fourthly, roughly half believed that what was learned from the process of measuring IC was as important as information received from the measures. Finally, while researchers admitted that the respondents may have represented a biased sample of 'pro-IC' organizations, they concluded that IC would not be likely to be included on financial balance sheets any time in the near future. External reporting of IC would be done on a voluntary disclosure basis, and IC measurement would be more useful as an internal management tool than as an external communication to shareholders or investors.

Similar research results have been found elsewhere. A 1998 study by Waterhouse and Svendsen of 65 CEOs and 49 Directors of Boards of large Canadian companies showed that IC disclosure was rated as a key strategic issue and should be regularly reported to boards. In addition to IC disclosure, the study highlighted other key strategic issues that received inadequate reporting, such as innovation capacity, product quality, customer relations and investor relations. Other strategic issues involving investor relations, partner relations, community relations and environment, health and safety were reported less often. Yet, of the nine strategic non-financial measures rated highly, CEOs and Directors

expressed least satisfaction with their IC measures.

Huseman and Goodman (1999) also examined IC disclosure as it related to human capital in 202 of the 1500 largest companies in the US. A small minority (i.e. 15%) had systems that attempted to quantify human capital as it is typically defined in the IC literature, and only 35% of senior HR respondents thought they would have an HC accounting system in the future. However, the large majority of companies were, in fact, actively collecting information about employees. This included 66% of all respondents who reported that they had programs or systems in place that tried to capture knowledge, skills and best practices.

The frustration expressed by the three aforementioned studies regarding IC measurement is interesting. It suggests a period in time when tangible measures of intangible assets of intellectual capital are wanted but early renditions have proven unworthy. This is fascinating because it is occurring in tandem with continuing high levels of satisfaction expressed by CEOs and Directors regarding traditional financial measures such as profit and loss statements and capital expenditure reports (Waterhouse and Svendsen 1998). Yet these traditional measures themselves are now generally acknowledged as inadequate. It is indeed ironic that the reason for their inadequacy is because of the same competitive forces that have given rise to the need for IC measures. Perhaps, IC measures are recognized as necessary but are unsatisfying owing to the embryonic stage of their development.

David Moore, research director for the CICA (Canadian Institute for Chartered Accountants) states:

> Financial performance measures derived from information in financial statements or other financial sources have been used by publicly listed companies for many years. They highlight specific aspects of a company's profitability, solvency, liquidity, productivity or market strength. Such performance measures, are however based on historical and transaction based information that does not take into account changes in values or internally generated intangibles. There is the growing view that financial performance measures by themselves are inadequate for strategic decision making. They need to be supplemented or even to some extent, *replaced* [italics the author] by non-financial measures that cover such matters as, for example, customer satisfaction and operating efficiency. (Waterhouse and Svendsen 1998, v)

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## Is a Paradigm Shift Occurring?

Brooking (1996) attributes the shift in thinking to information-age technology, the media and communications which have provided tools with enormous intangible benefits to organizations. Standfield (1999) believes the obvious impact of intangibles, such as knowledge technology and intellectual property, has made executives feel they need to factor in such intangibles, and lose confidence in their decision-making ability based on traditional tangible data. Yet to move from historical understandings of financial value based on accepted assumptions and concepts developed over 500 years to the identification of a new structure of assets is not an easy task. Some practitioners and scholars have labelled the process a paradigm shift. Is it?

Kuhn (1962) hypothesized that a scientific paradigm will change if sufficient anomalies appear in core concepts, methodologies and/or research findings. He also believed in the logical possibility of scientific revolutions versus more gradual evolutions when a paradigm (thesis) is undermined by the discovery of an antithesis (anomalies) sufficient to create a revolution and synthesis (new paradigm) (Scott *et al.* 1981).

A new model, whether introduced in theoretical or applied realms, must contain superior philosophical, conceptual and empirical elements before the model will replace any existing set of ideas. Moreover, like most transformational change efforts, model development is likely to proceed

through a relatively orderly series of change steps.

First, there must be an awareness that something is amiss. Old methods will be used to try to explain new information. A general dissatisfaction must be created around flaws in existing procedures and explanations. Alternative solutions based on new conceptualizations that have probably already being advanced must be subject to testing and promoted as having the potential of providing superior understanding. These solutions must represent a *whole new way of doing business* to qualify as a true paradigm shift. Furthermore, it is important for respected champions to advocate a change. Finally, those solutions found superior to others must be supported, while others must be discarded – at least for the time being.

There is ample evidence that at least the first few change steps to valuing new forms of economic wealth have occurred. In some large measure, we have also moved into the final two stages as respected practitioners and scholars with impressive credentials line up to acknowledge that traditional measures are insufficient, and promote the use of alternative financial performance models.

What about the critical step? Currently, measuring knowledge assets is in an *experimental* phase where a myriad possible solutions (i.e. new concepts, definitions, criteria and operational measures) are being promoted and tried.

If our understanding of paradigms is correct and useful (i.e. that 'order out of chaos' can be acquired through the rational acquisition of knowledge), we shall be able to continue and proceed through this critical step. To solve this challenge requires a multi-layered structure of ideas. At its foundation are philosophical *assumptions*, or as Lincoln and Gubba (1985) describe them 'metaphysical truths' of what we think but cannot prove. These assumptions in turn support *presuppositions* or an orientation regarding how beliefs are to be organized logically and defended or else remain as beliefs. *Commitments* are then made as to a research design and accepted measurement. Finally, a paradigm requires *actual findings* from measured variables to confirm observed and expected events. Of all business models advanced to date, it would be truly ironic if the IC model could not be tested for its defensibility as a new paradigm.

## Reviewing Measurement of Knowledge Assets

The purpose of this paper is to summarize what is currently known about assessing knowledge assets through trends and features of current IC measurement models. Each section reviews the assumptions of the measurement model and describes its main conceptualizations as well as its strengths and weaknesses.

## Skandia Navigator

Skandia is considered the first large company to have made a truly coherent effort at measuring knowledge assets (Bontis 1996; Huseman and Goodman 1999). Skandia first developed its IC report internally in 1985, and became the first company to issue an IC addendum accompanying its traditional financial report to shareholders in 1994. Other companies, including Dow Chemical's initiatives in valuing its R&D and patent process, have relied extensively on Skandia's multi-dimensional conceptualization of organizational value.

Leif Edvinsson, the chief architect behind Skandia's initiatives, developed a dynamic and holistic IC reporting model called the *Navigator* with five areas of focus: financial, customer, process, renewal and development and human capital. This new accounting taxonomy sought to identify the roots of a company's value by measuring hidden dynamic factors that underlie 'the visible company of buildings and products' (Edvinsson and Malone 1997, 11). According to Skandia's model, the hidden factors of human and structural capital comprise intellectual capital when added together.

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*Human Capital* is defined as the combined knowledge, skill, innovativeness and ability of the company's individual employees to meet the task at hand. It also includes the company's values, culture and philosophy. Human capital cannot be owned by the company.

*Structural Capital* is the hardware, software, databases, organizational structure, patents, trademarks and everything else of organizational capability that supports those employees' productivity – in other words, everything that gets left behind at the office when employees go home. Structural capital also provides customer capital, the relationships developed with key customers. Unlike human capital, structural capital can be owned and thereby traded.

*Intellectual Capital* equals the sum of human and structural capital. According to Edvinsson and Malone (1997), IC encompasses the applied experience, organizational technology, customer relationships and professional skills that provide Skandia with a competitive advantage in the market.

In sum, Skandia's value scheme contains both financial and non-financial building blocks that combine to estimate the company's market value shown below. This conceptualization achieved a balance for Skandia in trying to represent both financial and non-financial reporting, uncovering and visualizing its intellectual capital, tying its strategic vision to the company's core competencies reflecting knowledge-sharing technology and knowledge assets beyond intellectual property, and reflecting its market value better (Fig. 1).

Edvinsson and Malone (1997) argue that IC represents such a fundamentally new way of looking at organizational value that it will never be confined to playing an adjunct role to traditional accounting. They also assert that the presence and value of intangible assets are capable of accounting for the significant widening gap between companies' valuing of

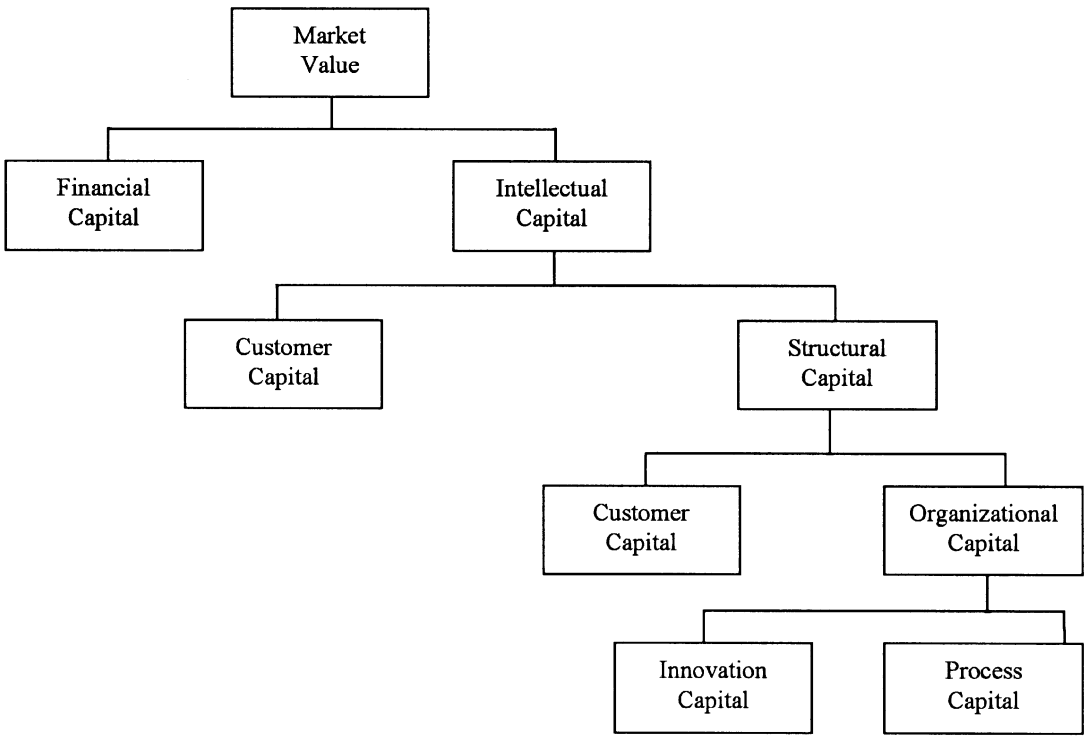


**Figure 1.** Skandia's value scheme.

enterprises stated in corporate balance sheets and investors' assessment of those values.

### *Operationalization*

The Skandia IC report uses up to 91 new IC metrics plus 73 traditional metrics to measure the five areas of focus making up the Navigator model. Edvinsson and Malone (1997) acknowledge that various indices may be redundant or of varying importance. Yet in trying to use their experience to create a *universal IC report*, they still recommend 112 metrics. Table 1 summarizes some of these metrics.

The 112 indices use direct counts, dollar amounts, percentages and even survey results. Edvinsson and Malone (1997) encourage direct counts to be compared with other direct counts to produce ratios or be transformed into money, leaving only two types of measurement. Monetary measures are combined using a pre-determined weighting to produce an overall IC value (*C*) for the organization. Percentages, that can be considered measures of incompleteness, can be combined to produce the coefficient of IC efficiency (*i*) that captures the organization's 'velocity, position, and direction' (p. 184). An organization's IC represents a multiplicative function of the two sums, *C* and *i*.

$$\text{organizational intellectual capital} = i\text{C}$$

When trying to come up with a monetary value of an organization's IC, Edvinsson and Malone (1997) recommend reducing the number of indices available to create a more parsimonious measure. They note that Navigator's five 'focuses' have 36 monetary measures that cross-reference each other. They also recommend multiplying out the denominators in those that are ratios, e.g. 'value added/employee', and excluding from a final list any redundancies and entries that are found on the traditional balance sheet Their examination leaves them with 21 indices which they believe can act as IC measurements for a fiscal year.

The second coefficient of IC efficiency (*i*) is what Edvinsson and Malone call the 'truth detector' of their equation. While the absolute (*C*) variable 'emphasizes an organization's commitment to the future, the efficiency (*i*) variable grounds those claims in present performance' (p. 186). The two authors take from the general report only percentages and ratios, 'once more cull out redundancies and apply some subjective judgement' to arrive at nine indices of an organization's IC

Table 1. Sample of Skandia IC measures

| | |
|---|---|
| Financial Focus | • revenues/employee ($)<br>• revenues from new customers/total revenue ($)<br>• profits resulting from new business operations ($) |
| Customer Focus | • days spent visiting customers (#)<br>• ratio of sales contacts to sales closed (%)<br>• number of customers gained versus lost (%) |
| Process Focus | • PCs/employee (#)<br>• IT capacity – CPU (#)<br>• processing time (#) |
| Renewal and Development Focus | • satisfied employee index (#)<br>• training expense/administrative expense (%)<br>• average age of patents (#) |
| Human Focus | • managers with advanced degrees (%)<br>• annual turnover of staff (%)<br>• leadership index (%) |

efficiency. Edvinsson and Malone (1997) then choose to combine the nine percentage measures into a single percentage (i.e. determine the average of the indices in an effort to represent how effectively the organization is currently using its IC).

By giving equal weight to each index, the equation assumes that a complete breakdown of one part of the nine organization's operations would diminish the coefficient by just over 12%. Whether or not organizations decide to create a monetary value for their IC, the two authors are sufficiently confident in their 112 indices that they believe they can be used not only by for-profit businesses in many different sectors, but also non-profit organizations, including all levels of government, the military, charitable organizations, etc.

### *Strengths and Weaknesses*

Most researchers agree that Skandia's considerable efforts to create a taxonomy to measure a company's intangible assets has emboldened others to look beyond traditional assumptions of what creates value for organizations. Skandia's model is particularly impressive in recognizing the role of customer capital in creating value for an organization and how the very nature of customer relationships has changed. For example, Edvinsson and Malone (1997) offer five very specific indicators of customer capital – customer type, duration, role, support and success – as evidence of the important role played by customers in creating value for organizations. Skandia also provides a broad coverage of organizational structural and process factors, with its focus on process and renewal and development contributions to organizational value, that has not been attempted before.

Lynn (1998) points out that Skandia assigns no dollar value to its IC, but uses proxy measures of IC to track trends in the assumed value added. Roos *et al.* (1997) looked at the assumptions underlying three of Skandia's metrics and were able to offer plausible alternative interpretations about what each metric might represent for an organization. As a result, they concluded that every company would need to possess a unique understanding of which intangible assets were truly valuable for the organization to choose which assumption was most valid and identify appropriate metrics. Moreover, given the requirement to create unique standards for their metrics, Roos and his colleagues felt that generic standards for measuring IC among companies or across industries would be likely to be slow in coming. They also emphasized that, because Skandia follows a balance sheet approach when measuring its intangible assets, it offers only a snapshot in time and cannot represent the dynamic flows of an organization. Finally, Huseman and Goodman (1999) note that Skandia's inclusion of Structural Capital variables that include computers etc. as creators of true value can be criticized because it presumes that employees showing up for work and sitting in front of their computers end up investing knowledge into that computer that translates into the company's competitive advantage. Yet for that to occur, data given to the employee must be transformed into information, and that information converted into added-value knowledge, which is rarely automatic.

### IC-Index

The IC-Index is an example of 'second generation' practices that attempt to consolidate all the different individual indicators into a single index, and to correlate the changes in intellectual capital with changes in the market (Roos *et al.* 1997). According to the authors, second generation practices still seek

> to improve the visualization of the value-creating processes of the company so that they can be managed comprehensively [but] in effect create a bottom-line for IC. This synthesis allows managers to assess the IC situation of a company holistically, whereas the first generation practices give information only on the single components of intellectual capital. (p. 80)

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A summary index further provides an immediate improvement to having long lists of individual indicators, because it requires companies to understand the priorities and relationships that exist between their different measures.

### *Operationalization*

The notion of an IC-Index was first advanced by Goran Roos and his colleagues at Intellectual Capital Services Ltd. and was first used by Skandia in its 1997 IC supplement to the annual report. Since Skandia's adoption, the logic of an IC-Index has been endorsed and implemented by many other practitioners. According to Roos *et al*. (1997), the IC-Index has several distinct features:

- it is an idiosyncratic measure;
- it focuses on the monitoring of the dynamics of IC;
- it is capable of taking into account performance from prior periods;
- it sheds light on a company different from an external view typically based on an examination of physical assets;
- it is a self-correcting index in that if performance of the IC-Index does not reflect changes of the market value of the company, then the choice of capital forms, weights and/or indicators is flawed.

The IC-Index is context specific because it permits boundaries to be placed around the measurement of intellectual capital. While the concept of IC can include all intangible resources and their flows (i.e. any factor that contributes to the value generating process that do not come from a company's physical or monetary assets), Bontis *et al*. (1999) support restricting the IC conceptual definition used to create an IC-Index to those company intangible processes that are more or less under the control of the company itself. An idiosyncratic measure then also permits any IC metric to have maximum relevance for an organization.

Roos *et al*. (1997) propose that the specific measurement of company IC forms, weightings and indicators can be decided by knowing the company's strategy, characteristics of the particular business of the company and its day-to-day operations.

To give an example, Roos *et al*. (1997) suggest that company strategy and those IC forms which help the company achieve its strategic goals should be the guiding factor in deciding which IC structural or human capital form to emphasize in an index. Moreover, the main consideration for selecting weights assigned the IC forms should be the relative importance each capital form has in the particular business of the company. And finally, knowledge of a company's day-to-day operations should be known in order to know which specific indicators to choose.

Bontis *et al*. (1999) suggest that a process model can help create an IC measurement system and especially the selection of the right indicators. To do this, they refer to the 'value scheme' (see section on Skandia Navigator), which describes the sources of company value coming from intellectual capital.

Bontis and his colleagues believe that, once a company has a clear idea about its identity and strategy, it should use its long-term goals to identify two sets of variables: one set comprising its value-creating path (i.e. those IC categories that really drive company value creation); and the other set that can act as performance measurements. This second set is made up of key success factors (KSF) that can describe more than one company, and indicators which reflect a company's characteristics more closely. Information from the two steps are then to be joined, leading to the creation of an IC system. Unfortunately, although the authors state that information from the two sets should be joined together to create the IC measurement system, they do not explain whether each category has its own measurement, and how such measures duplicate or offer unique variance from that contributed by the second set of KSF and indicators.

### *Strengths and Weaknesses*

An IC-Index is very much context specific and is therefore is limited in its universality among companies. Definitions, strategic prioritizing, choice of indicators, etc. all make comparisons of any absolute IC-Index summary value calculated for different companies or over time by one company meaningless. In addition, because only proxy measures are taken of IC stock, all metrics are dimensionless, ordinal numbers (Roos *et al*. 1997). As a result, the value of an IC-Index continues to lie in its measurement of changes in IC stocks, i.e. IC flow. This stockflow perspective is quite powerful for researchers, since they can examine firms as organizational learning systems which try to minimize stockflow misalignment (Bontis *et al.* 2001). Bontis *et al.* (1999) suggest that changes in an IC-Index reflect changes in the underlying IC elements, that in turn signal changes in the underlying drivers of future earnings potential. They conclude:

> A company that improved its IC-Index by 50 per cent is invariably doing better than another that improved the same measure 'only' by 25 per cent. The nature of IC and its increasing returns also eliminate any concern about the starting point of the two companies. In fact, companies with higher starting IC levels would probably increase their IC performance more easily, contrary to common logic. (p. 399)

Like most other measures of tangible assets, an IC-Index does depend on value judgements, in the choice of weights, indicators, and even the assumption that IC is present and important in company operations. Although this charge of subjectivity can also be made of certain traditional accounting methods and assumptions, Roos *et al*. (1997) argue that at least IC measurement and especially a consolidated measure such as the IC-Index makes a larger part of the organization visible and open to valuation. On a final note, because the IC-Index takes past performance into account, it is subject to 'one-off special events' which can have a strong influence on moving the index up or down for some years after the event. On the other hand, the IC-Index allows mangers to 'finally understand the effects a particular strategy has on the IC of a company and compare two alternatives to understand which one is preferable from an IC point of view' (p. 92).

## Technology Broker

Annie Brooking (1996) makes a practical contribution to IC measurement by offering three measurement models to help calculate the dollar value of IC as identified through the Technology Broker's IC audit.

Brooking defines IC as the combined amalgam of these four components: market assets, human-centred assets, intellectual property assets and infrastructure assets. Market assets equal the potential an organization has due to market-related intangibles such as brands, customers, repeat business, backlog, distribution channels, contracts and agreements such as licensing and franchises. Human-centred assets are the collective expertise, creative and problem-solving capability, leadership, entrepreneurial and managerial skills embodied by employees of the organization. Intellectual property assets contain the legal mechanism for protecting many corporate assets and infrastructure assets including know-how, trade secrets, copyright, patent and various design rights, trade and service marks. Finally, infrastructure assets equal those technologies, methodologies and processes which enable the organization to function, including corporate culture, methodologies for assessing risk, methods of managing a sales force, financial structure, databases of information on the market or customers and communication systems.

### *Operationalization*

Brooking begins the diagnostic process by having the organization answer 20 questions that make up the IC indicator. The results of

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this test suggest that the less a company is able to answer in the affirmative the 20 questions, the more it needs to focus on strengthening its intellectual capital.

The following are five sample IC indicator questions:

- In my company every employee knows his job and how it contributes to corporate goals.
- In my company we evaluate ROI on R&D.
- In my company we know the value of our brands.
- In my company there is a mechanism to capture employees' recommendations to improve any aspect of the business.
- In my company we understand the innovation process and encourage all employees to participate within it.

Each component of Brooking's IC model is then examined via a number of specific audit questionnaires that ask questions specific to those variables thought to contribute to that asset category. For example, to identify the hidden value due to *Market-related* intangibles, Brooking asks 15 *Brand* audit, 14 *Customer* audit, 7 *Name* audit, 5 *Backlog* audit and 6 *Collaboration* audit questions. *Intellectual Property* intangible assets are identified by 9 *Patent* audit, 6 *Copyright* audit, 3 *Design* audit and 4 *Trade-Secret* audit questions. *Human-centred* hidden assets are identified by 5 audit questions about *Employee Education*, 5 *Vocational* audit, 12 *Work-related Knowledge* audit, 8 *Occupational Assessment* audit, 8 *Work-related Competency* audit, 10 *Corporate Learning* audit and 3 *Human-centred Asset Management* audit questions. Lastly, *Infrastructure* hidden assets are evaluated by 6 *Management Philosophy* audit, 4 *Corporate Culture* audit, 31 *Corporate Culture Collaboration* audit, 7 *Information Technology Systems* audit, 6 *Database* audit and 4 *IT Manager* audit questions. In total, the Technology Broker IC Audit comprises 178 questions.

The following are 20 samples of IC audit questions

- What is the annual cost of protecting this brand?
- What is the potential for repeat business with our customers?
- What does your company name mean to the financial community and investors?
- What is the optimum backlog for your company?
- How does your company track and identify opportunities to collaborate with partners?
- To what extent are the patents owned by your company optimally exploited?
- What copyrights owned by your company are of value?
- Would a design right give your company a competitive advantage in some area?
- Where are trade secret agreements kept in your company?
- Does your company give any advice or counselling to employees on educational issues?
- How do your employees know when it is time to learn new vocational skills?
- On what special knowledge does your company depend to operate?
- How is information generated from personality tests used in your company?
- How are work-related competencies planned for the future?
- What is the average length of time that knowledge in your company is current and useful?
- Is the management philosophy an asset or a liability?
- Is the culture conducive to achieving corporate goals?
- What is the ratio of employee to PCs in your company?
- Are databases able to be queried to satisfy the user's need?
- What use is made of e-mail, Internet and the WWW in your company?

Brooking proposes that the value an organization place on its IC is wholly dependent upon the goals of the organization and the state of the market as such; any valuation is organization-specific and limited in time (Lynn 1998).

Once an organization completes its IC Technology Broker audit, Brooking offers three methods of calculating a dollar value for the IC identified by the audit:

- the cost approach, which is based on assessment of replacement cost of the asset;
- the market approach, which uses market comparables to assess value; and
- the income approach, which assesses the income-producing capability of the asset (i.e. the NPV of its net cash benefits)

### *Strengths and Weaknesses*

The Technology Broker approach has been lauded for offering a *toolbox* for organizations to assign value to IC. Lynn (1998) suggests that Brooking has created an IC audit that itself represents an intellectual asset for organizations. Moreover, her active marketing of the instrument and its conceptual basis has served to help others identify, value and leverage the IC in their organizations.

The main weakness in these items is that there is a considerable leap that must be made from the qualitative results of the questionnaire to actual dollar values for these assets. For example, using replacement cost implies that a cost figure actually represents value and that, notwithstanding their unique value in creating competitive advantage, a 'replacement' value can actually be determined for such intangible items as management systems or brands. A market-based valuation suffers from a lack of efficient market-based prices for many elements of IC. Finally, the income-based model suffers from subjectivity of estimations and uncertainties inherent in the cash-flow model.

Almost all of the items in the IC audit can be converted into Likert-type scales, which may help organizations assign quantitative values to qualitative questions. For example, the second sample question above can be reworded as follows: 'We are confident in the potential for repeat business with our customers.' Multiple respondents in the organization can now answer this question on a scale from 1 (strongly disagree) to 7 (strongly agree). The results will yield a richer (quantitative) description of this item.

There are also many similarities between the Technology Broker IC audit questions, which are subjective in nature, and Skandia's IC measures, which are objective in measure. For example, both models look at the number of PCs per employee as a proxy for structural capital or infrastructure assets.

## Intangible Asset Monitor

Sveiby (1997) believes that difficulties in measuring intangible assets can be overcome. He foresees an intangible model as clearly understood as that of an organization's *book value* equal to tangible assets minus visible debt. Sveiby asserts that key to such a system is having a coherent conceptual framework. But Sveiby argues that, to do this, money must no longer be used as a proxy for human effort. A 500-year-old system of accounting must make way for a system of non-financial knowledge flows and intangible assets that use new proxies.

Sveiby proposes a conceptual framework based on three families of intangible assets: external structure (brands, customer and supplier relations); internal structure (the organization: management, legal structure, manual systems, attitudes, R&D, software); and individual competence (education, experience). While efficiency of the internal structure or 'operational efficiency' of an organization has historically been part of most traditional accounting measurement, the other two intangible assets in his model are not. Sveiby believes that the problem with using measures of these two assets is not that they are difficult to design, rather their outcomes seem difficult to interpret as they correlate with changes in business performance.

First, Sveiby recommends replacing the traditional accounting framework with a new framework that contains a *knowledge*

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**Table 2.** Seeing intangible assets

| Visible equity (book value) | | Intangible assets (stock price premium) | |
|---|---|---|---|
| Tangible assets minus visible debt | External structure (brands, customer and supplier relations) | Internal structure (management, legal structure, manual systems, R&D, software) | Individual competence (education, experience) |

perspective. Within this framework, he argues that both *non-financial* measures to measure intangible assets and *financial* measures to measure visible equity can be jointly used to provide a complete indication of financial success and shareholder value (Table 2).

According to Sveiby, the purpose of measuring these three indicators of intangible assets is to provide management control. To do this, the first preliminary step is to identify who will be interested in the results. In an *external presentation*, a company needs to describe itself as accurately as possible to stakeholders, customers, creditors and shareholders, so that these external agents can assess the quality of its management and whether the company is likely to be a reliable supplier or a dependable creditor. External parties are usually interested in a company's position versus changes and flows, given that external accounts are provided only at relatively lengthy intervals. They also need to assess risk. Finally, the presentation's form is important, given their lesser familiarity with how the business works. As a result, Sveiby recommends that management information given to external parties about a company's intangible assets should include key indicators and explanatory text, given that it is not possible to compile a full balance sheet that expresses in monetary terms every intangible asset. Moreover, in the process of redefining what it is to be measured, new contributors of data are likely to include these outside parties. Sveiby believes that companies should be prepared to pay for this assistance.

*Internal measurement* on the other hand is undertaken for management, which needs to know as much as possible about the company so that it can monitor its progress and take corrective action when needed. It in fact becomes a management information system. With business today in a constant state of flux, Sveiby suggests that management information should emphasize flow, trends, change and control figures. He believes that managers are more likely to be concerned with the speed with which intangible assets are measured than with accuracy. Notwithstanding this acknowledgement that business cycles have shortened, it is interesting that Sveiby recommends that the measurement of intangible assets should include at least three measurement cycles in order evaluate results, and be repeated yearly.

### *Operationalization*

In his conceptual model, Sveiby identifies three measurement indicators: *growth and renewal* (i.e. change), *efficiency* and *stability* for each of the three intangible assets. He recommends managers select one or two variables indicative of each indicator similar to those developed in the example of his Intangible Assets Monitor model shown in Table 3.

In essence, the Intangible Assets Monitor is 'a presentation format that displays a number of relevant indicators in a simple fashion' (Sveiby 1997, 197). The choice of indicators depends on the company's strategy but should include only a few of the measurement indicators for each intangible asset, with the most important areas needing to be covered those of growth and renewal, efficiency and stability. The IAM can be integrated into the management information system. And lastly, it should not exceed one page in length but should be accompanied by a number of comments.

**Table 3.** Sample measures for intangible assets

| | External structure | Internal structure | Competence of people |
|---|---|---|---|
| Growth and renewal | • organic volume growth<br>• growth in market share<br>• satisfied customers<br>• quality index | • investments in IT<br>• time devoted to R&D<br>• attitude index of personnel<br>• toward managers, culture, customers | • share of sales from competence-enhancing customers<br>• growth in average professional experience<br>• competence turnover |
| Efficiency | • profit per customer<br>• sales per employee | • proportion of support staff<br>• sales per support staff | • change in added value per employee<br>• change in proportion of employee |

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The second step in designing a measurement system for intangible assets is to classify all employee groups within one of the two categories: professional and support staff. Professionals are those who plan, produce, process or present the product or solutions, and who are all directly involved in client work. They are the only employees considered when assessing the third intangible asset: competence of personnel. All other employees whose work seeks to preserve, maintain and develop the internal rather than external structure, e.g. those who work in accounting, administration, reception, etc., while essential to a firm's long-term viability, contribute to an organization's internal structure and should be measured under that category. Where employees perform a variety of duties, the time spent working for clients is assigned professional, with the rest charged to the internal structure. As such, time is an important variable to record in knowledge organizations. Outside experts and suppliers, although essential contributors to production in many companies, are not classed as employees, i.e. professionals in Sveiby's model. Rather, they are considered under the external structure as an important element in the external networks that a knowledge company builds to support the process of knowledge conversion; indeed, where independent contractors may be so important to an organization that the organization becomes virtual; i.e. 'it ceases to be possible to see where the competence of the organization ends and that of its suppliers begin' (Sveiby 1997, 166).

Sveiby lists specific indices for each of his three growth and renewal, efficiency and stability measurement indicators used to assess each category of intangible assets of a knowledge organization. To measure *professional competence* intangible assets, the indices include:

- *growth/renewal*: number of years in the profession, education level, training and education costs, grading of executives, professional turnover, competence-enhancing customers;
- *efficiency*: proportion of professionals in the company, the leverage effect of professionals, value-added per professional;
- *stability*: average age, seniority, relative pay position, professional turnover rate.

To measure *internal structure* intangible assets, the indices include:

- *growth/renewal*: investment in the internal structure, investment in information processing systems, customers contributing to internal structure;
- *efficiency*: proportion of support staff, sales per support person, values and attitude measurements;
- *stability*: age of the organization, support staff turnover, the rookie ratio.

To measure *external structure* intangible assets, the indices include:

- *growth/renewal*: profitability per customer, organic growth;
- *efficiency*: the satisfied customer index, win/loss index, sales per customer;
- *stability*: proportion of big customers, age structure, devoted customers ratio, frequency of repeat orders.

### *Strengths and Weaknesses*

Celemi, a Swedish company selling software and consulting services, has been measuring and monitoring its knowledge assets for several years by following IC growth through non-financial models and non-financial indicators.

Although Celemi endeavours to measure the growth of its intellectual network, it does not assign a financial value to it. However, in the same 1998 Celemi report, there is an attempt to provide a *Value-added Statement* outlining key indicators that they measured, including: value added % of sales; profit capacity % sales; return on equity capacity after tax; value added per employee and value added per expert.

Both Sveiby and Celemi assume that financial outcomes are somehow related, and by leveraging IC correctly, financial outcomes will follow suit. According to Lynn (1998), this idea of 'innate value creation' has been argued before with just-in-time inventory (JIT), diversity management, etc., but only when organization culture supports it, such as in case of Celemi. It has not worked for many North American companies when they have tried to institute JIT, quality circles, etc. without the appropriate support of financial feedback systems. Lynn argues for most organizations, making a business case means creating ties to financial results. And she suspects that only those companies which can emulate Celemi's culture will also be able to emulate its highly successful reporting system on IC. Finally, Sveiby has developed an executive training module called the TANGO Simulation, which is intended to help senior managers understand how to account for IC using similar measures that he has developed in his IAM model (Bontis and Girardi 2000).

## MVA and EVA

Economic Value Added (EVA$^{TM}$) was introduced by Stern Stewart as a comprehensive performance measure that uses the variables of capital budgeting, financial planning, goal setting, performance measurement, shareholder communication and incentive compensation to account properly for all ways in which corporate value can be added or lost (Bontis *et al.* 1999). Bontis *et al*. describe EVA as providing 'a common language and benchmark for managers to discuss value-creation [and because] it is blessed with widespread acceptance in the financial community, can increase the legitimacy of a company in the eyes of financial markets, as a valuable measure of corporate value-creation or destruction over a given period' (p. 394). According to Strassman (1999), economic value added is the net result of all managerial activities.

EVA is intended to offer improvements to the market value added (MVA$^{TM}$) calculation. MVA represents the spread between the cash that a firm's investors have put into the business since the start up of the company and the present value of the cash that they could get out of it by selling their shares. By maximizing this spread, corporate managers maximize the wealth of the company's shareholders relative to other uses of capital (Bontis *et al*. 1999).

According to Bontis *et al*. (1999), MVA can represent the market's assessment of the net present value of a company's current and contemplated capital investment projects. As such, MVA is a 'significant summary assessment of corporate performance' (p. 395). However, a key disadvantage with MVA is that gains and losses accruing from historic activities are aggregated on a one-to-one basis with last year's results plus today's moods as they are shown in market price. As a result, a company with a successful history will keep on showing positive and high MVA even

when current or future prospects are bleak and unrewarding.

### *Operationalization*

EVA only concentrates on changes in MVA occurring from new projects to account for the spread between market value and total capital. It accomplishes this by emphasizing maximizing incremental earnings over capital costs. To have a positive EVA, therefore, a company's rate of return on capital must exceed its required rate of return.

Bontis *et al*. (1999) define EVA as 'the difference between net sales and the sum of operating expenses, taxes and capital charges where capital charges are calculated as the weighted average cost of capital multiplied by the total capital invested. In practice, EVA is increased if the weighted average cost of capital is less than the return on net assets, and vice versa' (p. 395). Its equation is given below:

net sales − operating expenses − taxes − capital charges = EVA

Bontis *et al*. (1999) further liken EVA to an accounting concept introduced much earlier, that of residual income (RI). RI represents the value remaining after a company's stockholders and all other providers of capital have been compensated. The sole distinction the authors make between EVA and RI is that EVA has simply been paid more attention. Given its positive reception, some writers have suggested that EVA can be used as a surrogate measure for the stock of intellectual capital if it can be assumed that effective management of knowledge assets increases EVA.

### *Strengths and Weaknesses*

EVA is a financial measurement system that seeks to account properly for many important factors and their trade-offs involved when creating value. Yet in terms of its use as a surrogate measure of IC, Bontis *et al.* (1999) note that if EVA is used, it implies that no specific measures of intangible assets are needed. Moreover, managers are no better off understanding exactly what are the company's intangible resources or their specific contribution. Such a 'black box' approach to accounting blocks any real effort to validate the value of or manage a company's IC.

Strassman (1999) does say that EVA represents something that defies the laws of conservation energy, which state that output of any system can never be greater than its input. Delivering a positive EVA therefore comes from an act of creativity that is coming from an intangible. Put another way, Strassman (1999) believes that 'if EVA is the interest earned from an accumulation of knowledge residing within the firm, then the value of this principal can be calculated by dividing the EVA by the price one pays for such capital' (p. 4).

Bontis *et al*. (1999) state that EVA uses 164 different areas of performance adjustment to solve problems such as trying to account for these intangibles and long-term investments that lack a high degree of certainty. However, the very fact that the model contains 164 adjustments suggests that managers will have to engage in a trade-off between complexity, accuracy and ease. Given the very great likelihood that managers are likely to pick and choose from this larger list, it runs the risk of making comparisons of EVA values difficult if not meaningless between companies or over time.

Three other limitations in the calculations used to create EVA include: (i) the use of book assets relies on historical costs which give little indication of current market or replacement value; (ii) empirical research has not shown conclusively that EVA is a better predictor of stock price or its variation; and (iii) the starting point for EVA analysis assumes that companies should be run in the interest of shareholders exclusively. In sum, the EVA performance measure may not be appropriate when applied to quantifying the value of intangible assets.

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### Citation-weighted Patents

According to Bontis (1996), Dow Chemical has been at the forefront in using patents as proxies for practical IC measurement. Former Director of Intellectual Asset Management at Dow, Gordon Petrash, implemented a six-step process for managing intellectual assets that includes:

- defining the role of knowledge in the business;
- assessing the competition's strategies and knowledge assets;
- classifying the company's portfolio of knowledge assets;
- evaluating the value of those assets to keep, develop, sell or abandon;
- investing in areas where gaps have been found; and
- assembling the new knowledge portfolio and repeat *ad infinitum*.

Dow Chemical instituted this IC initiative at the same time as it was reorganizing and delayering its organization to facilitate critical communication links. According to Lynn (1998), these organizational changes and concern for knowledge sharing and teamwork represented a cultural revolution for an oversized Dow that had developed knowledge silos and minimal exchanges of knowledge between various parts of its organization. Worse, 'the idea of selling ideas discovered at Dow or developing ideas not invented at Dow (the not-invented-here syndrome) or even collaborating to develop in-house or outside ideas were foreign concepts' (p. 31).

A significant component of Dow's initial management of intellectual assets has been its review of patent maintenance within R&D to create objective, major cost savings for the firm (Lynn 1998). The Dow model estimates a 'technology factor' to identify the impact of R&D efforts that lead to the creation of intellectual property and uses indicators such as R&D expense per sales dollar, number of patents, income per R&D expense, cost of patent maintenance per sales dollar and project lie-cycle cost per sales dollar. The 'patent evaluation process' is a team-based effort, where members from R&D and marketing interact directly with production to decide on the viability of undertaking and/or continuing the research process. The team may review one indicator or sets of indicators *for longer than a year* in order to decide whether the intellectual property is valuable. It also triggers management action to investigate whether the intellectual property might have value for someone else, i.e. sell the idea, or whether it should be abandoned and written off, like other unproductive assets.

Dow started with patents as an obvious and important example of intellectual assets in order to make IC visible to the organization. Patents can be readily understood to be indicators of intellectual property. Traditional accounting methods assign value to patents, but only in terms of the cost to obtain the patent, and not the cost of the R&D leading to the patent, nor the potential for marketability if put into production, nor any legal considerations about the patent. Objectively measuring and monitoring patents using multiple indicators within Dow's 'technology factor', has made this intangible asset become meaningful. It also has the benefit of more thoroughly incorporating the bottom-line impact of R&D efforts. In addition, the Dow patent evaluation process can measure the internal operations that created the intellectual property, and can be benchmarked against other companies in the industry or compared with industry averages. In 1996, Dow produced its first public IC report as a supplement to its annual report, comparable with Skandia's.

In a separate work, Hall *et al.* (1999) make the distinction between patents and their citations as evidence of technological output and information flow. Using the financial market valuation of firms that own the patents, they found higher market valuations due mainly to firms with highly cited patents per R&D dollar spent. Hall *et al.* interpret their findings to suggest that citation-weighted

patents can act as a better measure of innovative output than pure patent counts.

Citation-weighted patents also did as good a job as R&D in explaining the market-valued firms relative to their book value, mostly because the explanatory power of R&D declined when patent citations were included in the regression. Hall *et al*. interpreted the unique variance added by citations as success in innovative activity or success in appropriating returns to such activity. Indeed, using a firm's average citations per patent revealed that citation rate had a substantial effect on market value beyond that due to R&D or patenting behaviour. That is, an increase of one citation per market was associated with a 34% increase in market value at the firm level.

## Research Agenda

It would be useful to emphasize what we have learned so far in this field. Early research on IC primarily focused on definitions and classification. Interestingly, many IC models have similar constructs and measures that are merely labelled differently. For example, human capital (Skandia Navigator) is also called human-centred assets (Technology Broker) and competence of personnel (Intangible Asset Monitor). This re-labelling of similar conceptualizations can be construed as both positive and negative for the field of IC measurement. On a positive note, it shows that researchers are narrowing their frameworks and focusing on important concepts that are consistent across perspectives. However, since the field is still in its embryonic stage, no one is willing to give up their own nomenclature and build off each other's work. Perhaps, a change for the better will occur as this field develops further and the desire for more valid and generalizable measures emerges. It is important for the development of this field in the near term to build on each researcher's work so that a common set of definitions can be used.

It should be noted that this review is by no means exhaustive. There are numerous other models that have been presented at many conferences that were not mentioned here. In addition, there exist dozens of customized models that are designed to service only one organization – typically the one that designed it. Other models that were not reviewed in this paper that are nevertheless worth examining include Standfield's (1999) Knowcorp Audit, the Tobin's Q ratio, the Balanced Score Card (Kaplan and Norton 1992) and a popular stream of research from the 1960s called Human Resource Accounting (Bontis *et al.* 1999; Brummet *et al.* 1968).

Another challenge with IC research thus far has been that it has been primarily of the anecdotal variety. Most researchers have conducted case-based reviews of organizations who have established intellectual capital initiatives already. Other researchers have merely documented the metrics that have been developed by Skandia and others without advancing or testing them. A way to overcome this challenge is for researchers to pursue more empirical research. Using survey data, Bontis (1998) has already shown a very strong and positive relationship between Likert-type measures of intellectual capital and business performance in a pilot study. The explanatory power of the final specified model was highly significant and substantive ($R^2 = 56.0\%$, $p$-value $<0.001$). In order to make any significant claims, IC researchers must now move from perceptual measures in isolated cases to large-scale studies with objective measures. This task is daunting, since the challenges are enormous but the potential benefits are far-reaching across many management disciplines including accounting, human resources, finance, training and development and strategy, to name a few.

Such a grand vision for IC research requires some realistic goals. Unfortunately, the pursuit of measuring IC assets objectively is a noble but difficult one. Top executives in large US and Canadian businesses agree that new intellectual capital measures are required to help manage knowledge assets. Covin and Stivers (1998) surveyed 253 companies

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among the US Fortune 500 and Canadian Post 300 in their study of non-financial measure usage. Results showed that, even though 63% of the sample felt that measuring innovation was important, only 14% were actually measuring it, and only 10% were actually using the measures for strategy development. Covin and Stivers argue that these results show a significant measurement–use gap. However, the evidence presented at many conferences on the topic show that this gap is decreasing. What was once a small club of practitioners has grown into a community of thousands and thousands of organizations around the world who are developing and experimenting with new IC measurement techniques [see Brennan and Connell (2000) for a nice summary of other empirical research in the IC field]. A realistic goal for this field is to continue to document such activity and to share measurement practices across industries in order to take full advantage of the innovation that is already taking place.

Given the challenges of (i) trying to measure an intangible construct, (ii) putting forth nascent efforts to conceptualize an IC domain, (iii) establishing bi-directional cause–effect relationships, and (iv) maintaining a reliance on the use of proxy variables, it should not be surprising that different companies' IC management systems contain any number of unconnected and unproved individual indicators. Göran Roos and his colleagues also note that, in their search for individual proxies of IC, companies tend to produce long lists of multiple indicators. Typically, the indicators are weighted equally. Put together, companies can end up with a measurement system that is awkward and complex, and may contain invalid measures. Moreover, these indicators are likely to be expressed in qualitative and quantitative units that attempt to represent any number of diverse elements of an organization's functioning, range in their degree of specificity and focus, i.e. from the individual employee to macro-organization relationships, and potentially represent either linear or non-linear relationships. To complicate matters further, IC measurement may attempt to capture not only forms of individual IC resources using a balance-sheet approach, but also changes in these stocks of capital, i.e. the flows or transformation of intellectual capital into financial capital and vice versa (Roos *et al.* 1997).

Another realistic goal for IC researchers is to pursue international research settings so as to remove oneself from the anglophonic bias of the field's initial growth. The goal of international research would be to show that the relationship between intellectual capital and performance can be generalized to other countries and industries. In a recent study of Malaysian managers, Bontis *et al.* (2000) showed that many of the hypotheses tested in previously anglophonic settings of intellectual capital also held true. This speaks well for the generalizability of intellectual capital research across a variety of national and industry settings. Professor Ante Pulic and his colleagues in Austria are also finding evidence of generalizable results across Eastern Europe (Pulic 2000). The lesson here is that a growing amount of IC research exists that is not necessarily published in English. We are also indebted to the *Journal of Intellectual Capital*, which has positioned itself as one of the leading academic outlets for research in this area.

Furthermore, an intellectual capital training tool that is gaining widespread use by senior managers and CKOs alike (Bontis 2001; Mitchell and Bontis 2000) is the *TANGO Simulation* developed by Karl-Erik Sveiby. Research has shown that this simulation game significantly improves the perceived importance of developing intellectual capital metrics among its participants (Bontis and Girardi 2000) and could prove to be quite useful in further enhancing the intellectual capital management skills of knowledge managers. The advent of the Internet has also provided us with ample opportunities to trade our intellectual capital in a virtual marketplace. *Knexa.com* is touted as the world's first

knowledge and exchange auction and has attracted international attention for its intellectual capital exchange platform.

## Conclusion

Intangible assets have a substantial implication for financing a knowledge organization's vision. While visible financing, consisting of equity, short-term and a few long-term loans, is usually simple to calculate, it is more difficult for knowledge organizations because of a lack of tangible collateral. Attempts to measure intangible assets have included treating employees as balance-sheet items and measured in dollars, and using financial variables, e.g. discounting a person's output during a lifetime, costing out sick leaves or personnel turnover to create personnel accounting calculations for managers' use. Unfortunately, these efforts to create human resources costing and accounting systems have not considered the full range of intangible assets that can exist, nor have they been particularly useful as management information systems monitoring the daily progress of business. They have tended to adopt a manufacturing or industrial perspective. Yet service companies now account for two-thirds of the employment in the industrialized world. Even more compelling, the wealth of knowledge-intensive organizations is now surpassing the manufacturing sector in most global economies.

The International Accounting Standards Committee and its national counterparts face a challenge in setting standards for IC disclosure. The measurement examples thus far have been too firm-specific and no set of indicators could hope to be general enough to encompass the needs of a variety of international and industry settings. Auditing all of the different frameworks at this point would be pointless. In fact, pursuing standards at this point might be more harmful, given the nascent stage of research development. Voluntary disclosure is the only solution in the short term. In the long term, it will be up to the demands of the capital markets. If shareholders and analysts agree that IC disclosure is beneficial in explaining business performance, than companies will have no choice but to appease their audience. In the meantime, academic researchers must continue to push the envelope on empirically based studies so as to support the growing numbers of early adopters.


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