

The Emerald Research Register for this journal is available at
www.emeraldinsight.com/researchregister



The current issue and full text archive of this journal is available at
www.emeraldinsight.com/1469-1930.htm

JIC
5,2

Shaken, not stirred

Defining and connecting indicators for the measurement and valuation of intangibles

Karin Grasenick

*Joanneum Research, Institute of Technology and Regional Policy,
Graz, Austria, and*

Jonathan Low

Predictiv, Inc., West Palm Beach, Florida, USA

268

Keywords *Intangible assets, Measurement, Accounting valuations*

Abstract *The necessity and importance of measuring intangibles has become increasingly accepted in the business, financial and academic communities as a means for a better understanding of the value creation processes in private, public and not-for-profit enterprises. Intangible indicators are seen as idiosyncratic, unique to each enterprise and not standardised. Interpretation, dissemination and further research suffer from the lack of definition and measurement standards. This paper examines guidelines and suggestions for measurement instruments and discusses their limits. A framework for classifying intangibles and indicators through the utilisation of evaluation experience is derived in order to support the movement towards global agreement on terms, definitions, standards and measures. Further research is discussed concerning quality standards for measurement systems.*

Introduction

Financial statements have lost considerable meaning as the sources of wealth creation in the global economy have changed over time. A new set of metrics must be formulated and agreed on. The disclosure of intangibles or intellectual capital measurements derives its power from the fact that they are drivers of value that can be measured and evaluated by management. The adjective "intangible" usually accompanies different concepts such as assets, investments, and resources. There is not a unique nor unanimously accepted definition or classification of intangibles. One reason for this is that the boundaries, constituents and definitions of intangibles vary according to the perspectives of the different interest groups considering them, for example whether evaluating the potential impact of accounting concepts on a firm or national level, or analysing them from a managerial point of view in order to extract value from key business investments and assets. In the literature, numerous proposals on the definition of intangibles exist.

There seems to be no clear evolutionary path of intangible asset management as a discipline. Measurement instruments have been developed during the last decade with the purpose of reporting the contribution of human competencies, knowledge and skills to a firm's value and to foster their further expansion. Correlations between intangibles and other drivers of value show clear empirical evidence of their importance; it has been shown, however, that their interaction cannot be explained easily within a consistent theoretical framework.

Despite the limitations to theoretical foundations for the functioning of intangibles, practical managerial needs have to be acknowledged and addressed. Examining



Journal of Intellectual Capital
Vol. 5 No. 2, 2004
pp. 268-281
© Emerald Group Publishing Limited
1469-1930
DOI 10.1108/14691930410533696

المجلة
للإستشارات

practical measurement and reporting advice for managers throughout the literature shows that difficulties start with classification differences, usually developed according to differing viewpoints on how and for which purpose an organisation's assets are described.

If the managerial need to be supported by a monitoring system is interpreted as evaluation of a firm's activities, evaluation literature can be taken into account. This paper outlines a process to select, apply and relate indicators within a standardised framework for further development of intellectual capital statements. Explanatory power and relationships of indicators are discussed in detail, as information derived from measurement instruments is finally reported and interpreted – either for internal usage or external reporting thereby based on more or less common assumptions on the “theory of the firm”.

The meaning of intangibles: correlations and uncertainties

The acknowledgement of the importance of intangible assets for a firm's, an organization's or a region's economic success has led to efforts for integration in accounting standards. At the macroeconomic level OECD research has identified a number of business intangibles such as R&D, education and training of work force that correlate positively with GDP or productivity growth (according to Eustace, 2000). Evidence of a consistent relationship between the quality of human resources and the value of firms was found (Garcia-Ayuso *et al.*, 2000). In several recent studies (Bassi *et al.*, 2000), evidence on the profitability of training investments has been found. Furthermore, Lev and Sougiannis (1999) reported that there is a growing number of empirical studies revealing a substantial impact of R&D on productivity and shareholder value, and Deng *et al.* (1999) suggested that patent attributes are statistically associated with subsequent stock returns and market-to-book ratios.

However, further studies revealed that within these definitions important aspects of the formation and mode of functioning of intangibles remain undiscovered. Examples that have been studied carefully are investments in research and development (R&D) and information and communication technologies (ICT). Identical values of invested intangible assets have been shown to lead to different results.

On a regional level, recent studies have shown that the impact of R&D investment leads to different levels of innovation activities and results, depending on institutional composition and cooperation in regions (OECD, 2001; Richiardi, 2000). As innovation is the result of complex processes, interactions, feedback loops and learning abilities it cannot be measured by single indicators (Edquist, 1997).

The importance of ICT as a driver of business performance has been recognised. However, direct relationship between ICT expenditure and firm performance cannot be easily demonstrated. ICT functions as an enabler of innovation and growth embedded in complex factors as, for example, the receptiveness of entrepreneurial culture. Learning abilities, organisational flows and work practices can all be measured by indicators but gaining broad acceptance of these measures has been challenging. Again, caution is necessary in inferring superior performance based on any single measure – or even a simple combination of measures (Brynjolfsson and Yang, 1997; Brynjolfsson and Hitt, 1998). The processes involved are complex and do not yield readily to analytical methods. OECD (2001) offers a comprehensive treatment of the

theoretical and statistical problems, together with comprehensive references to the on-going work of researchers.

One distinction that supports further development of more rigorous, therefore, more helpful definitions beyond the categories in use is presented by Eustace (2000). He and his colleagues divide assets into three categories: conventional assets (tangible assets) recognised in the contemporary balance sheet, "new" intellectual assets (intangible goods), e.g. brand value, and intangible competencies that foster innovation, structural, market and human resources (Eustace, 2000).

Although notoriously difficult to separate, the second group – intangible competencies – are valued by successful companies as vitally important in differentiating their market offer from those of their competitors (Porter, 1987; Hamel and Prahalad, 1994).

Classification efforts on a firm level

Non-monetary-oriented concepts that measure and manage intangibles usually concentrate on intangible competencies, based on a firm's strategy. Indicators are derived from identified key success factors. The most well-known representatives are the balanced scorecard (Kaplan and Norton, 1996), the intangible asset monitor (Sveiby, 1997), the intellectual capital approach (Edvinsson and Malone, 1997) and the IC-index (Roos *et al.*, 1997), the performance prism (Neely *et al.*, 2003), MERITUM guidelines (Cañibano *et al.*, 2002), Danish guidelines (Mouritsen *et al.*, 2003a).

Although the variety of concepts has been established while focussing on different measurement interests as, for example, strategy formulation, benchmarking or internal motivation (Marr *et al.*, 2002), a broad range of authors conceive of "intellectual capital" as composed of three categories (Edvinsson and Malone, 1997; Roos *et al.*, 1997; Sveiby, 1997):

- (1) Human capital is defined as the knowledge that employees bring and take with them when they join or leave the firm. It includes the knowledge, skills, experiences and abilities of people.
- (2) Structural capital is defined as the pool of knowledge that remains with the firm at the end of work, after employees have left (Stewart, 1997). It comprises the organisational routines, procedures, systems, cultures, databases, etc. Some of this may be intellectual property.
- (3) Relational capital is defined as all resources linked to the external relationships of the firm such as customers, suppliers or R&D partners. It comprises that part of human and structural capital affecting the firm's relations with stakeholders (investors, creditors, customers, suppliers, etc.) plus the perceptions that are held about the firm (brand, reputation, etc.).

Within those broad categories, however, further differentiation can be established to include customers and markets, networks and alliances, human resources, processes and innovation, leadership, adaptability, transparency, workplace organization and culture (Low *et al.*, 1997; Low and Kalafut, 2002). The recently published Danish guidelines for intellectual capital statements refer to four types of knowledge resources, namely employees, customers, processes and technologies. (Mouritsen *et al.*, 2003a). Hence this framework seems to leave alliances with suppliers, research partners etc. and strategy execution out of their recommendations. Strategy execution, however, is

also a fundamental dimension of managerial excellence and, in particular, of communicating information or perceptions about other intangibles.

Concepts for measuring intangible assets show a range of common objectives and grounds (Grasenick and Ploder, 2002), creating a set of generic and uniform metrics has so far been an elusive goal. Similar constructs and measures dedicated to a firm's intangible values are labelled differently. The concepts rely on different perspectives for controlling, reporting or planning, which can be of a strategic character or give a particular focus on knowledge creating processes. If intangibles are used as a component of the firm's rhetoric to mobilize change, there is no need for "getting things in order" by means of an exhaustive and exclusive classification scheme. However, if the task is to understand the importance of intangibles as part of the business model or production function, rigorous definitions are necessary.

In order to achieve a general baseline to foster interpretability and comparability of intangibles, efforts to derive definitions should first concentrate on measurements that are easy to obtain. A possible approach for a common model is to follow Eustace's (2002) differentiations in his attempts to separate recognisable assets (as further enhancements of a firm's balance-sheet) from organisational competencies (see also above).

Intangible competencies are found in the relationships between human, organisational and customer related intangible assets that develop through interaction in collective performance. They are more than the sum of the human, structural and relational resources of the firm. Managing them is about how to let the knowledge of a firm work for it and have it create value (Roberts, 1999). This can be achieved by strengthening the connectivity between those resources through the appropriate intangible activities.

Measuring the impact of intangibles in this manner requires carefully differentiating framework conditions from the inexplicable residual aspects of intangibles that cannot be easily applied to standardised instruments. These are central to the uniqueness of a firm's success.

For separated framework conditions, definitions of intangibles and a set of rules should be defined. These rules must begin with an agreement on terms and a set of definitions for those terms. Once the intangibles' community of interest can agree to those, discussion can then begin on more complicated issues like how to measure the impact of those intangibles, what channels to employ for distributing the information collected and how best to monitor the veracity of that information.

Evaluation and measurement theory should be taken into account in order to discuss how to achieve a set of easy-to-handle indicators. The following paragraphs will derive and exemplify the development of a standardised framework for intangible indicators combining investments, processes and results based on a literature review.

Defining indicators, setting frameworks

Efforts to understand intangible assets start with classification differences, according to different viewpoints on how and for which purpose we need to describe an organisation.

Whenever a number of units is classified, measurement takes place. Deriving a measurement system for intangible assets is especially difficult as the knowledge of their mode of function is largely correlational rather than theoretical, as the paragraphs

above make clear. Important value drivers are usually different in nature and quality, hence no system of units can be derived that, at least in principle, relates all derived "variables" to a common set of logically simple qualities (as, for example, in physics or pure economics).

Indicators may represent complex, not directly measurable aspects of reality through metrics. A good indicator must provide simple information that can easily be communicated and understood. Like financial accounting data, indicators for intangible assets are not necessarily relevant as such. Classified and displayed indicators represent a selected base for interpretation of ongoing business activities of a firm. In terms of a firm's management, indicators should clearly be connected to the process of mobilizing resources for goal achievement leading to financial success. They should describe measurement points as a chain through the process of economic value creation.

If the managerial need to be supported by a monitoring system is interpreted as evaluation of a firm's activities, evaluation literature can be taken into account in order to achieve a standardising framework for further development of intellectual capital statements.

MEANS, a programme of the European Commission, elaborates a useful framework for classifying indicators for the evaluation of socio-economic programmes by their level of objectives (European Commission, 1999).

Socio-economic programmes mobilise resources (financial, human and institutional) in order to achieve a global objective. In order to evaluate a programme, a series of related objectives is identified and specific objective-dependent indicators are related to them in order to keep track and understand the process of goal achievement. The indicators are classified into five categories, namely resource, output, result, specific impact and global impact, as explained in Table I.

Additionally important for discussion of achieved results and managerial decision finding are indicators that foster further comparison by deriving effectiveness and efficiency measurements:

- Effectiveness can be obtained as the percentage of two values of the same output, result or impact indicator.
- Efficiency is measured by comparing what was obtained with the resources mobilised by relating two indicators, e.g. average time spent for acquisition related to actual contracts.

Referring to intangibles, indicators for inputs, outputs and results could be defined for the categories human, structural and external or customer capital. Inputs for a firm always have a financial baseline. Outputs and results turn through interaction of a firm's competencies to intellectual capital and finally to tangible goods.

For a model reducing itself to framework indicators, standards can be defined. They have to be pragmatic in order to guarantee comparison as well as connectivity to financial inputs and impacts that might be included in accounting statements.

The Danish guidelines for analysing intellectual capital statements follow, to a certain extent, evaluation principles when differentiating indicators along resources, activities and effects (Mouritsen *et al.*, 2003b). Resources thereby refer exclusively to "knowledge resources", whereas "activities" should subsume

Level of objective	Type of indicator	Definition	Example
	Resource (input)	Financial (human, material, organisational or regulatory) means	Money spend for training, search for new employees
Operational objective	Output (descriptor needed?)	Everything that is obtained by the input expenditures	Number of advertisements in newspapers, number of training days financed
Immediate specific objective	Result (immediate outcome/advantage as result of output)	Immediate effect for direct addressees or recipients	Number of new employees, number of trainees with new qualification, number of phone calls
Sustainable specific objective	Specific impact (sustainable outcome as consequence beyond its direct or immediate results)	Sustainable effect for direct addressees or recipients, referring directly to the aim of the input and intermediate outputs	Results of output, e.g. number of new customers through phone calls, increased throughput per employee
Strategic objective aim	Global impact (outreach)	Global effect for the entire population	Financial success of the firm

Table I.
Definition of indicators by level of objectives according to MEANS collection

Source: European Commission (1999, p. 29)

indicators related to a firm's activities to improve "knowledge resource". Examples for activity indicators are "course days per employee", "investment in education", "meetings with users" etc. Indicators stated for resources are, for example, "no. of employees", "no. of patent rights" or "percentage of turnover from civil projects".

An assessment of the evaluation principles described above shows a higher flexibility in assigning indicators to different levels of objectives, which might be helpful for certain analytical perspectives. Certainly an impact like turnover is a necessary requirement for new investments and activities and might therefore be seen as a resource. However, a more rigorous reorganisation of indicators would support standardization and readability of statements and their interpretation. Through this reorganisation an equivalent of the evaluation category "output" with "resources", "results" with "activities" and "specific impact" with "effects" can be defined. These definitions support the reflection and interpretation of collected indicators, by clarifying their limitations and preventing overestimation of achieved results (the number of training days per employee, for example, are *per se* no guarantee for higher motivation or efficiency, as will be exemplified below).

Outcomes can be determined by assessing their financial impact and monitoring the resources required to achieve them. Although indicator chains are loosely coupled and the complex correlations underlying a firm's success cannot be described, the search for problems and strategic discussion is only supported by awareness of their explanatory power and hence their applicability in relation to each other.

The retention of the terms "resources", "activities" and "results" might be helpful as they intuitively describe the framework needed to understand a firm's measurement needs. When complemented with the terms "investments" and "(financial) impact" a

perfect match with evaluation standards can be achieved as shown in Table II. In an organisational context the new terminology might be easier to understand intuitively and hence to follow.

Indicators used accordingly to the specific interests and planned activities should form a chain leading from inputs to intended impacts. Figure 1 exemplifies the standardisation procedure that could be undertaken.

Being able to connect investments to intangible assets and their financial output is crucial for a firm's need to determine profitability. Additionally, the combination of financial with intangible categories fosters better managerial decision making while facilitating the movement toward an integration of intellectual capital and financial statements that can provide the basis for better managerial analysis and execution in the future.

Mouritsen *et al.* (2003a, b) compare intellectual capital statements with financial statements and conclude that the process of analysis is similar for both (see Table III).

This comparison treats the statement as parallel, independent systems. However, financial statements mark the possible scope for strategic activities (no money, no training) and final aim of managing a firm's intangibles. Hence the relation of financial and intellectual analysis questions could be summarised as shown in Table IV.

Implementing intellectual capital statements still leaves considerable uncertainty as to the latent capabilities and embedded intangibles that could be examined further if activities and effects do not result in the targeted outcome. If correlations do not emerge, specific consultation of further (embedded) intangibles or external developments can be taken into consideration, as, for example, for motivational or cultural aspects or market developments and changes in customer behaviour.

Examining published indicator lists

The literature on intellectual capital statements provides categorical systems and processes on how to derive indicators according to the specific measurement needs of a firm. Usually, lists of possible indicators for each category are added. A short inspection of these lists shows many different kinds of indicators are collected and somehow rearranged with indices, instruments and umbrella terms. It is left to the user to find out which of them might make sense and how to interpret (or measure) them. Additionally, no relationships between resources, strategic financing and overall impacts are drawn.

Marr *et al.* (2002) with their collection of examples for "knowledge asset indicators" derived from different intellectual capital statements have clearly shown the need for further improvement and elaboration towards standards (see Table V).

	Input	Operational objective	Immediate objective	Sustainable objective	Strategic aim
MEANS evaluation guidelines	Resource	Output	Result	Specific impact	Global impact
Danish guidelines		Resources	Activities	Effects	
Recommended principles	Investments	Resources	Activities	Effects	Financial impact

Table II.
Comparing evaluation and intellectual capital analysis practices

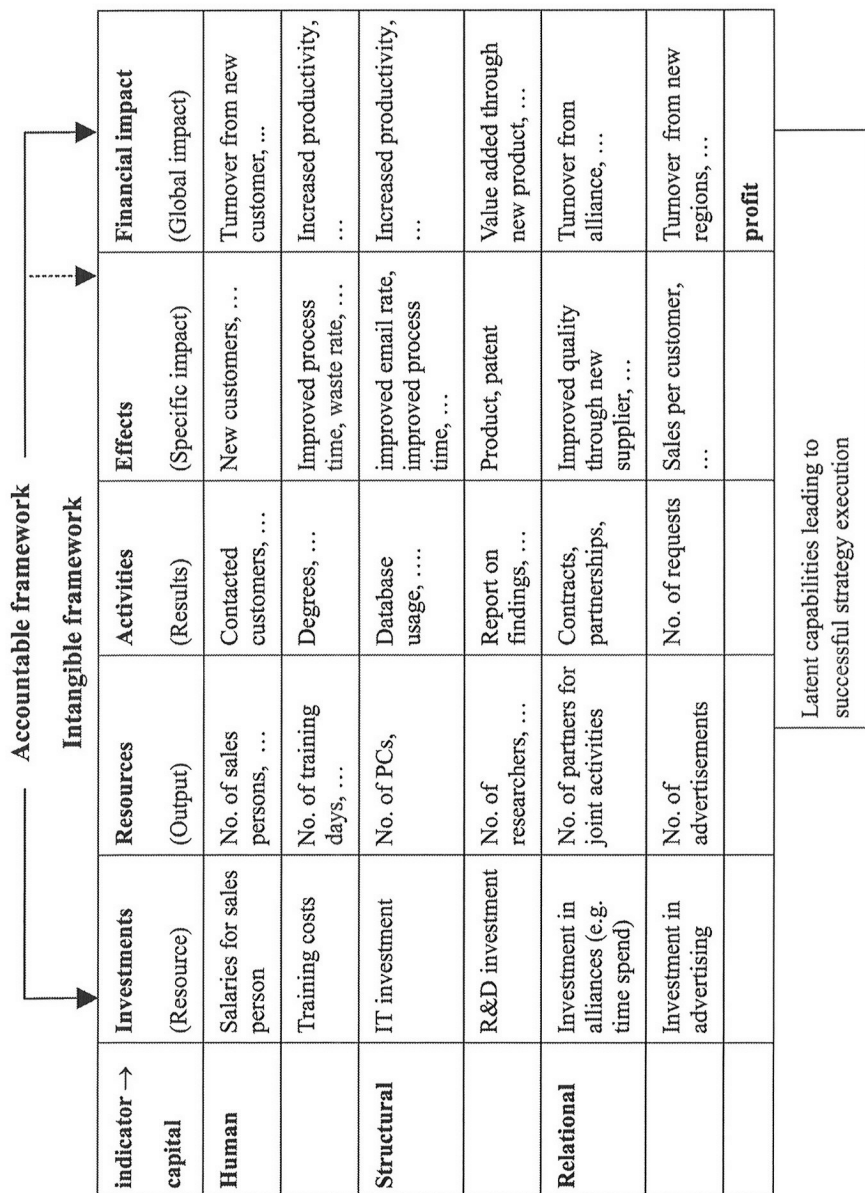


Figure 1. Deriving framework indicators for IC-statements

Examining the first category, stakeholder relationships, clearly shows this mixture of various kinds of indicators and instruments. This leads to three disadvantages:

- (1) Lists of indicators are not helpful in relating financial inputs for a specific category to intended effects.
- (2) Different kinds of measurements are mixed up. Some of the instruments try to capture enablers or embedded aspects of intangibles. Instruments for embedded residual aspects of a firm's activities are not clearly separated from indicators that could easily be standardised and regularly derived from a common database.
- (3) A baseline for standardization on which broad agreement is likely cannot be easily drawn, either for a specific firm's managerial interests nor for further research and development.

Other categories like "stakeholder relationships" include descriptions referring to variables, possible indices and instruments that should be discussed and restructured as examination shows (see also Table VI):

- Number of partners, distribution networks and licensing agreements are resource indicators. Their quality cannot necessarily be easily derived from a standardised indicator. Instruments for quality indices can be defined additionally.
- Length of relationship would be an activity indicator which can be easily recorded in standardised IC-framework statements.
- Partner satisfaction and customer retention index might vary in different companies, however instruments could be standardised.
- Market share can be defined as an important global impact indicator.

Table III.
Main questions for financial and intellectual capital statements

Financial statement	Intellectual capital statement
What are the firm's assets and liabilities? What has the firm invested?	How is the firm's knowledge resource comprised? What has the firm done to strengthen its knowledge resources?
What is the firm's return on investment?	What are the effects of the firm's knowledge work?

Source: Mouritsen *et al.* (2003b, p. 5)

Table IV.
Connecting financial and intellectual capital statements with main questions

Financial statement	Intellectual capital statement
What are the firm's assets and liabilities? How are the firm's knowledge resources comprised? What has the firm invested?	What are the firm's assets and liabilities? How are the firm's knowledge resources comprised? What has the firm invested? What has the firm done to strengthen its knowledge resources? What are the effects of the firm's knowledge work?
What is the firm's return on investment?	What is the firm's return on investment?

Stakeholder relationships	Number/quality of partnering agreements; number/quality of distribution agreements; number/quality of licensing agreements; public opinion survey; market share; length of relationship; partner satisfaction index; customer retention
Human resources	Demographics indicators, for example: number of employees; number of employees in alliances; average years of service with firm; average age of employees; full-time permanent employees; as percentage of total employment; employees working at home/total employees; number of women managers Competence indicators, for example: employees with high qualifications; people with PhD and/or masters degree/total employees; average years of service with the firm; number of years in specific professions; definition of a competence map Attitude indicators, for example: average level of happiness (measured with Likert-type scale); savings from implemented suggestions from employees; number of new solutions, products and processes suggested; qualitative descriptions of employees (commitment, loyalty, entrepreneurial spirit, enthusiasm); motivation and behaviour indicators Human resource management practices indicators, for example: training expenses/employees employee turnover; time in training; expenses for employee-development activities (social and personal); indicators about activities to motivate employees; indicators about recruitment practices
Physical infrastructure	Scalability/capacity measures; facilities/equipment versus plan; time to execute server updates; system integration; use of knowledge-sharing facilities
Culture	Management philosophy; number of internal disputes and complaints; qualitative measures about employee satisfaction; feedback; values; behaviour; motivation; commitment; loyalty; opinion survey
Practices and routines	Process quality; number of codified processes; networking practices; norms; database availability; intranet use
Intellectual property	Revenues from patents; number of patents and registered designs; value of copyrights; value of patents versus R&D spend; trademarks; brand recognition survey

Source: Marr *et al.* (2002)

Table V.
Knowledge assets indicators

Indicator → capital	Investments	Resources	Activities	Effects	Financial impact
Stakeholder relationships		Number of partnering, licensing agreements	Length of relationship		Market share
Special Recommendations		Descriptions of quality of partnering, licensing agreements	Partner satisfaction index (measured by ...)		
	(Investment in) public opinion survey			Customer retention (measured by ...)	

Table VI.
Suggestions on reframing collections of stakeholder relationships related instruments and indicators

Working towards standardisation means being able to concentrate on measurable and comparable indicators. For these indicators a list of definitions and procedures for deriving (relative) values can be defined. Standardisation should thereby start with indicators that can be linked to the financial framework.

Measurement of a person's motivation can change in different firms, teams, departments, with different management etc. Such factors are related to culture and unfold with interaction and therefore should be included in a standard framework only cautiously. For the evaluation of a firm's activities to improve, motivation of a specific indicator chain could be added according to actual requirements. However, even if a new chain of indicators can be helpful in producing economic decisions, the cost of classification change and data retrieval can be higher than the marginal benefits. Here the issue involves choosing between possible proxies rather than constructing new indicators.

Other types of data, like demographic information, could be restructured according to the intangible framework matrix illustrated above. Competence indicators like degrees and overall years in profession relate to demographic information. Further subdivision into different scopes of functions (e.g. research, sales, administration, depending on a firm's activities) would be useful. As shown above, indicators like "number of years in service" etc. should be treated as resources already connected to the latent capabilities of a firm, e.g. its culture, management style etc. The category "culture" itself, however, is not suitable to be part of a common instrument. Recommendations and toolboxes for specific needs measuring and changing culture should be provided instead.

Setting the collected instruments and indicators for human resources in the recommended evaluation framework helps to clarify the missing links and demonstrates the necessity for further discussion and completion (see Table VII).

Conclusions and further research

Firms are generally unique in the prioritisation of the importance of their intangibles and use that uniqueness to create competitive advantage. Companies typically try to identify, measure and manage primarily those intangibles they have assessed as the most important for their long-term value creation. However, the cause-effect relation is not easy to establish and to demonstrate to the satisfaction of constituencies that must be convinced. At this stage in the evolution of the field it is the perception of the firm, and not a generally accepted "fact" that establishes value at a particular level. The interest in the intangible resources of future value has led to various systems for measuring intellectual capital. Still no clear definitions of intangibles and no theory explaining their mode of function can be provided.

In order to support theoretical research as well as practical managerial interests, standardisations of terminology and guidelines for the definition, usage and interpretation of indicators would be an important further step towards a common baseline. Due to the very nature of intangibles, standardisation efforts have to concentrate on a framework, leaving many firm-specific residuals aside.

Within this framework efforts should revise chains of clearly defined indicators according to empirical evidence and categories agreed as common dominators. Choosing indicators could be improved significantly by reflecting their explanatory

Indicator → capital	Investments	Resources	Activities	Effects	Financial impact
Human		Number of employees (with PhD) Average age of employees Full-time employees, etc.	Average years of service with firm, employees working at home/total employees, etc.		
	Training expenses/employees	Time in training		Number of new solutions, products and processes suggested	Savings from implemented suggestions
Special recommendations	Description of recruitment practices		Number of women managers		
	Expenses for employee-development activities (social and personal)	Definition of a competence map, qualitative descriptions of employees (commitment) Questionnaires on happiness motivation and behaviour, derived indices			

Table VII.
Suggestions on reframing collections of human resource related instruments and indicators

power: limited by definition and metric but expanded through relationships to others as outlined in the paragraphs above.

The framework of standard indicators might be combined with specific instruments to keep track of unique competencies according to a model that best suits a firm's specific needs.

However, an inadequate amount of information is currently available on how category classification, indicators and temporary interests (e.g. cultural change efforts or activities to improve employees' motivation) should be composed to reliable management systems. Again, a baseline is needed for research and practice. Without theoretical foundations and different motivations, quality criteria for firm-specific measurement needs should be defined as an early, co-evolutionary step in the process of determining standardizable intangible value drivers. These quality criteria could integrate the exemplified processes for reliable indicators and support selection and further development of measurement instruments.

References

- Bassi, L., Lev, B., Low, J., McMurrer, D. and Siesfeld, G. (2000), "Measuring corporate investments in human capital", in Blair, M. and Kochan, T. (Eds), *The New Relationship: Human Capital in the American Corporation*, Brookings Institution Press, Washington, DC, pp. 334-82.
- Brynjolfsson, E. and Hitt, L. (1998), "Beyond the productivity paradox", *Communications of the ACM*, Vol. 41 No. 8, pp. 49-55.
- Brynjolfsson, E. and Yang, S. (1997), "The intangible costs and benefits of computer investments: evidence from the financial markets", *Proceedings of the International Conference on Information Systems*, Atlanta, GA.
- Cañibano, L., Sánchez, P., García-Ayuso, M. and Chaminade, C. (2002), *Guidelines for Managing and Reporting on Intangibles*, Meritum, Madrid.
- Deng, Z., Lev, B. and Narin, F. (1999), "Science and technology as predictors of stock performance", *Financial Analysts Journal*, Vol. 55 No. 3, pp. 20-32.
- Edquist, C. (1997), *Systems of Innovation: Technologies, Institutions and Organizations*, London.
- Edvinsson, L. and Malone, M.S. (1997), *Intellectual Capital*, HarperCollins Publishers, New York, NY.
- European Commission (1999), *Evaluating Socio-economic Programmes: Selection and Use of Indicators for Monitoring and Evaluation*, European Commission, Luxembourg.
- Eustace, C. (Ed.) (2000), *The Intangible Economy: Impact and Policy Issues. Report of the European High Level Expert Group on the Intangible Economy*, European Commission, Luxembourg.
- Eustace, C. (2002), "A new perspective on the knowledge value chain", PRISM working paper, London.
- Garcia-Ayuso, M., Moreno, I. and Molina, G. (2000), "Fundamental analysis and human capital: empirical evidence on the relationship between the quality of human resources and fundamental accounting variables", *Journal of Human Resources, Costing and Accounting*, Vol. 5 No. 1, pp. 45-57.
- Grasenick, K. and Ploder, M. (2002), "Intangible asset measurement and organisational learning: the integration of intangible asset monitors in management processes", in Neely, A., Walters, A. and Austin, R. (Eds), *Performance Measurement and Management: Research and Action*, Cranfield School of Management, Cranfield, pp. 235-42.
- Hamel, G. and Prahalad, C. (1994), *Competing for the Future*, Harvard Business School Press, Cambridge, MA.
- Kaplan, R.S. and Norton, D.P. (1996), *The Balanced Scorecard: Translating Strategy into Action*, Harvard Business School Press, Boston, MA.
- Lev, B. and Sougiannis, T. (1999), "Penetrating the book-to-market blackbox: the R&D effect", *Journal of Business, Finance and Accounting*, Vol. 26 No. 3/4, pp. 419-45.
- Low, J. and Kalafut, P. (2002), *Invisible Advantage: How Intangibles Are Driving Business Performance*, Perseus Publishing, Cambridge.
- Low, J., Kalafut, P. and Robinson, J. (1997), *Measures That Matter*, Ernst & Young LLP, Cambridge.
- Marr, B., Schiuma, G. and Neely, A. (2002), "Assessing strategic knowledge assets in e-business", *International Journal of Business Performance Management*, Vol. 4 No. 2-4, pp. 279-95.

- Mouritsen, J., Bukh, N., Rosenkrands, M., Larsen, H.T., Nielsen, C., Haisler, J. and Stakemann, B. (2003a), *Intellectual Capital Statements: The New Guideline*, Danish Ministry of Science Technology and Innovation, Copenhagen.
- Mouritsen, J., Bukh, N., Rosenkrands, M., Larsen, H., Nielsen, C., Haisler, J. and Stakemann, B. (2003b), *Analysing Intellectual Capital Statements*, Danish Ministry of Science, Technology and Innovation, Copenhagen.
- Neely, A., Adams, C. and Kennerly, M. (2003), *Performance Prism: The Scorecard for Measuring and Managing Stakeholder Relationships*, Prentice-Hall, Indianapolis, IN.
- OECD (2001), *Cities and Regions in the New Learning Economy*, OECD, Paris.
- Porter, M. (1987), "From competitive advantage to corporate strategy", *Harvard Business Review*, Vol. 65 No. 5/6, pp. 43-59.
- Richiardi, M. (2000), "CIS-2: toward an identification of regional systems of innovation. STEP economics", working paper.
- Roberts, H. (1999), "Classification of intellectual capital", Meritum Project Meeting, Stockholm.
- Roos, J., Roos, G., Edvinssons, L. and Dragonetti, L. (1997), *Intellectual Capital: Navigating in the New Business Landscape*, Macmillan, London.
- Stewart, T.A. (1997), *Intellectual Capital*, Doubleday/Currency Publishers, New York, NY.
- Sveiby, E. (1997), *The New Organizational Wealth: Managing and Measurement Knowledge Based Assets*, Berrett Koehler, San Francisco, CA.

Further reading

- Bassanini, A., Scarpetta, S. and Visco, I. (2000), "Knowledge, technology and economic growth: recent evidence from OECD countries", paper presented at the 150th Anniversary Conference at the National Bank of Belgium, Brussels.
- Cañibano, L., García-Ayuso, M. and Sánchez, P. (2000), "Accounting for intangibles: a literature review", *Journal of Accounting Literature*, Vol. 19, pp. 102-30.
- Johanson, U., Martensson, M. and Skoog, M. (2001), "Mobilizing change through the management control of intangibles", *Accounting, Organizations and Society*, Vol. 26, pp. 715-33.
- Kaufmann, S. (1993), *Origins of Order: Self Organization and Selection in Evolution*, Oxford University Press, Oxford.
- Lev, B. (2001), *Intangibles: Management, Measurement, and Reporting*, Brookings Institute, Washington, DC.
- Marr, B., Gray, D. and Neely, A. (2003), "Why do firms measure their intellectual capital?", *Journal of Intellectual Capital*, Vol. 4 No. 4, pp. 441-64.
- Mouritsen, J., Larsen, H.T. and Bukh, P.N. (2001), "Valuing the future: intellectual capital supplements at Skandia", *Accounting, Auditing & Accountability Journal*, Vol. 14 No. 4, pp. 399-422.