

THE KNOWLEDGE TOOLBOX: A Review of the Tools Available To Measure and Manage Intangible Resources

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1999, European Management Journal, Vol. 17, No. 4, 391-402.

ABSTRACT

Given the increased talk regarding the development of metrics to manage intangible resources, there is a need for a review of the most important tools available to managers for this purpose. This article reviews four measurement systems currently popular among practitioners: i) human resource accounting; ii) economic value added; iii) the balanced scorecard; and iv) intellectual capital. The assumptions and details of each tool are discussed, as well as the operationalisation procedures to apply them correctly. Strengths and shortcomings of each system are also analysed in order to supply “knowledge managers” with the instruction sheet to the knowledge toolbox.

KEYWORDS: intellectual capital, knowledge management, balanced scorecard, economic value added, human resource accounting.

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The task of leadership is to create the environment for managing for knowledge. It requires less emphasis on what we own and more emphasis on what we know. It's not about managing hired hands, it's about setting context and energising hired minds. Our challenge is to manage the stage, so to speak, for the human spirit to thrive and create in the emerging knowledge society.

Mr. Paul Allaire, Chairman and CEO, Xerox Corporation
Keynote Address, November 7, 1997
Conference on *Knowledge in International Corporations*. Rome, Italy.

In the beginning of the eighties, steel mills were considered a relic of the past, together with most of the “hard industries”. New technological discoveries and increased efficiency had made the job extremely capital intensive. At the same time, the demand for new materials and alloys was reducing the demand for steel. The two factors combined to make the people employed by the steel industry a dwindling group. Thus steel mills drudged on, most of the time showing losses in their year-end accounts.

Then, something happened. Some of the big American steel companies, headed by Nucor and Chaparral Steel, converted their operations to a new production method, characterised by a smaller optimal batch size. The added flexibility that came from the reduced batch size was balanced, however, by a reduced quality, or, to be more precise, a less uniformly high quality. The solution was simple and genial at the same time: companies started to customise steel, so that each batch would perform its appointed task perfectly, but would not be suitable to different uses. To pull off the revolution in the rules of the game, steel mills had to put an enormous information processing system in place, and rely heavily on that (Webber, 1993). Thus, though a ton of steel still remained a ton of steel, it contained a lot more information. Now, fifteen years later, we cannot say that steel mills are flourishing; they have certainly improved their position, though, since the beginning of the eighties.

A NEW SET OF RULES

Welcome to the information age, where products and companies live and die on information and the most successful companies are the ones who use their intangible assets better and faster. Knowledge and information are nowadays the drivers of company life, much more so than land, capital or labour. What does this mean for managers? The increased importance of knowledge does not simply add an additional variable to the production process of goods: it changes substantially the rules of the game. The capacity to manage knowledge-based intellect is the critical skill of this era (Quinn, 1992). The wealth-creating capacity of the enterprise will be based on the knowledge and capabilities of its people (Savage, 1990). Firms that are thriving in the new strategic environment see themselves as learning organisations pursuing the objective of continuous improvement in their knowledge assets (Senge, 1990).

But there is more. Recent contributions have suggested that knowledge and information are actually subject to increasing returns, as opposed to the decreasing returns typical of the traditional resources. If this is true, then knowledge and information become even more attractive to companies than before. Having a good base of knowledge means that a company can in future years start leveraging that base to create even more knowledge thus increasing its advantage on the competitors (Arthur, 1996).

What is even more striking is that the market has long recognised the value of knowledge and other invisible factors in the value creating process. It is thus very common for companies to be valued more than their net assets would justify, precisely because of these invisible components. What has changed recently is the size of this “hidden value”. In 1986 Merck had the biggest gap: its net assets covered just 12.3% of its market value; in 1996, Coca-Cola’s assets were only 4% of its value, whereas the same figure for Microsoft was 6%. At the same time, some companies are trading below book value, which might be suggestive of the existence of “intellectual liabilities” (Harvey and Lusch, 1999).

Companies however were the first to realise that something was changing. In the last decade, the job title of Chief Knowledge Officer (CKO) has been showing up on annual reports and in job advertisements with ever-increasing frequency. Present and future success in competition will be based less on the strategic allocation of physical and financial resources and more on the strategic management of knowledge (Bontis, 1996), and these path-finding individuals have been given the unenviable task of channelling their organisation’s knowledge into corporate initiatives that become the essential source of competitive advantage. Unfortunately, knowledge is invisible and intangible, and thus it is not captured very well by any of the traditional measures, accounting or otherwise, that corporations master in their everyday operations. This means that managers run the risk of “forgetting” that knowledge and the other intangible assets are there, or underestimating their value and contribution, and thus take decision which in the long term might prove harmful precisely because they damage the “intangible asset stock” of the company. What is even worse, the attention of the company will be focused on improving the efficiency of its physical assets only, because that is what gets measured, appraised and evaluated by senior managers (Hauser and Katz, 1998).

Knowledge managers may thus feel that they have been asked the impossible: how can they use accounting tools, developed five hundred years ago to help merchants in the feudal era, to make the key success factors of the information age visible? Once the need for new tools is recognised, how do you choose among the many alternatives suggested by different sources? How do they stop jumping on the bandwagon of the latest faddish instrument that promises success and competitive dominance?

We believe that answers to these three questions may come only from a deep understanding of all the most important tools available, of their premises and assumptions, their strengths and weaknesses. Therefore, this article aims at reviewing four of the most influential measurement systems diffused among practitioners: human resource accounting, economic value added, the balanced scorecard and intellectual capital. Our aim is not to suggest the “one best way”, simply because we do not believe that one exists: indeed, the different tools will be useful to different companies in different situations. What we hope to do, however, is to give managers the necessary information to choose the appropriate tools for their needs, as well as outlining the issues and the pitfalls the application of each tool entails. To use a metaphor, this article would like to be the instruction sheet of the managerial toolbox for measuring and managing knowledge. As such, each of the next four sections will be structured as follows:

- a short historical introduction, detailing the emergence of the measurement system and its diffusion;
- a description of the operationalisation of the system, i.e., what is measured and how, what do these measures mean, how can you compare with competitors, etc.
- a final section outlining the assumptions, advantages and disadvantages of the system as well as describing the appropriate context for its application.

HUMAN RESOURCE ACCOUNTING (HRA)

Human capital represents the human factor in the organisation; the combined intelligence, skills and expertise that gives the organisation its distinctive character. The human elements of the organisation are those that are capable of learning, changing, innovating and providing the creative thrust which if properly motivated can ensure the long run survival of the organisation. Since Hermanson's (1964) classic study several decades ago, the topic of how to and whether to value human assets has been debated by accountants and human resource theorists. Indeed, the arguments for and against Human Resource Accounting (HRA) are especially pertinent to the valuation of intellectual assets in the new economy since they involve essentially the same issues.

OPERATIONALISATION

According to Sackmann, Flamholtz and Bullen (1989, p. 235) the objective of HRA is to “quantify the economic value of people to the organisation” in order to provide input for managerial and financial decisions. Researchers have proposed three types of HRA measurement models:

- i) cost models which consider the historical, acquisition, replacement or opportunity cost of human assets;
- ii) HR value models which combine non-monetary behavioural with monetary economic value models; and

iii) monetary emphasis models which calculate discounted estimates of future earnings or wages. While none of the experiments in HRA have been long run successes, it is interesting to note that the majority of systems developed were in service organisations (i.e., accounting firms, banks, insurance companies and financial services firms) where human capital comprises a significant proportion of organisational value.

In their simplest form, HRA models attempt to calculate the contribution that human assets make to firms by capitalising salary expenditures. In other words, instead of typically classifying total wages as an expense on the income statement, a discounted cash flow of total wages is classified in the asset section of the balance sheet. For example, assume a firm has one thousand employees whose average annual salary is one thousand units per employee. The traditional income statement method of expensing wages would yield a one million currency unit expense (1,000 x 1,000) for the whole fiscal year. Using the HRA method requires a few more assumptions. First, HR managers would estimate the average length of tenure per employee as well as the average increase in wages per year. Therefore, the HRA measurement would consist of the one thousand employees; multiplied by the one thousand unit average salary; multiplied by the average length of tenure per employee; multiplied by the average increase in wages per year; all discounted back to year one. The remaining figure represents the human capital value of the firm in currency unit terms.

CRITICAL REVIEW

Anyone can see that there are too many assumptions that must be made when using HRA models. It is difficult to project what the size of a company will be in the next fiscal period let alone ten years from now. Furthermore, assumptions about tenure per employee, turnover and salary increases are all educated guesses at best. Some HRA models also include other assumptions which violate common sense, have been empirically disproven or are inconsistent with other tenets of the same model (Lindell, 1996).

HRA's problems have always been known. All of the models suffer from subjectivity and uncertainty and lack reliability in that their measures cannot be audited with any assurance. Both of these are measurement problems. Other criticisms of HRA include whether it is morally acceptable to treat people as assets and whether such measures are too easily manipulated. Although these arguments are salient comments on HRA, they beg the question of whether human assets in organisations do have value. The question thus arises: *are "auditable" valuations of human assets necessary in the conventional sense?* Extrapolating from the numerous HRA arguments, it appears that there are three basic uses to which HRA information can be put:

- i) as part of the official audited reporting of results to external users of the firm's financial data (e.g., creditors, investors, government, regulatory authorities);

- ii) as internal feedback to organisation members on the accomplishment of strategic goals; and
- iii) as a starting point to develop future plans and strategy by recognising the core competencies inherent in the unique intellectual capital resident in the organisation.

Of these three, only the first has an external reporting focus that may require audit assurances. The other two potential uses of valuation pertain to the internal policy development and implementation of management planning and control systems. What's more, it is still possible to audit *the process* that leads to the creation of the HRA measurements.

Obviously, investors and financial markets attach value to the skills and expertise of CEOs and other top management. Investors value the people, their skills and their potential in such organizations. In fact, the criticisms of HRA arise largely from the fact that such valuations are *soft* measures rather than objective, auditable numbers. Accounting for salaries of managers and the costs of training are one thing, but putting a value on the growth and accumulation of their knowledge is much more difficult.

ECONOMIC VALUE ADDED (EVA™)

Traditional financial measures of performance, like Return on Assets (ROA) and Return on Equity (ROE) have long been criticised for their inadequacy in guiding strategic decisions. In particular, they do not consider the cost of capital incurred to fund the projects that generate these returns, and thus are severely lacking as instruments to guide managers in their quest for value-creating venues. They are also highly aggregated which means that they often confound the impact of different strategic factors, such as product differentiation leading to higher price recovery and productivity improvement providing a cost advantage (Stewart, 1994). In addition they often fail to shed light on underlying causes of high or low performance. For instance, a firm pursuing a cost leadership strategy may improve its productivity and lower its prices. The impact of these two managerial actions may be offsetting, and no change may be registered in the ratio to reflect these actions (Banker *et al.*, 1996).

Economic Value Added™ (hereafter referred to as EVA, a registered trademark) was introduced by Stern Stewart & Co., a New York-based consulting firm, in the late 1980s as a tool to assist corporations to pursue their prime financial directive by aiding in maximising the wealth of their shareholders (Stewart, 1994). In the broadest terms, EVA is a comprehensive financial management measurement system that can be used to tie together capital budgeting, financial planning, goal setting, performance measurement, shareholder communication and incentive compensation. The objective of EVA is to develop a performance measure that properly accounts for all ways in which corporate value could be added or lost. Building accountability into a measurement system, EVA encourages managers to take each and every decision following the overarching principle of

maximising shareholder value. Because of this, Stern Stewart & Co. purport EVA to be the only measure of performance that properly accounts for all the complex trade-offs involved in creating value.

The concept is certainly not an outright revolution. Alfred Sloan, the General Motors patriarch, knew EVA – though not by that name – by as early as the 1920s. In fact, accountants have long known a closely related acronym: RI, or residual income (McConville, 1994). Residual income is the value remaining after a company's stockholders and all other providers of capital have been compensated. The difference is that EVA has been taken a lot more seriously, and developed a lot more, by practitioners, consultants and researchers alike.

EVA provides a common language and benchmark for managers to discuss value creation: projects become easily comparable, and managers can respond to the pressure for performance accountability through the use of an appropriate metrics (Young, 1998). More than that, EVA is blessed with widespread acceptance in the financial community, and thus can increase the legitimacy of a company in the eyes of the financial markets, as a valuable measure of corporate value creation or destruction over a given period (CS First Boston, 1996).

OPERATIONALISATION

According to the EVA supporters, maximising the shareholders wealth is not the same as maximising the company's total market value. A company's total value can be maximised simply by investing as much capital in it as possible. Shareholder's wealth is on the other hand maximised only by maximising the difference between the firm's total value and the total capital that the investors have committed to it. This difference is called market value added (MVA). The spread represents the difference between the cash that the 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. Maximising this spread, corporate managers maximise the wealth of its shareholders relative to other uses of their capital.

It can therefore be argued that on an aggregate level a company's MVA communicates the market's present verdict on the net present value (NPV) of all its current and contemplated capital investment projects. MVA is thus a significant summary assessment of corporate performance - showing how successful a company has been in allocating, managing and redeploying scarce resources to maximise the NPV of the enterprise and hence the wealth of the shareholders.

The disadvantage with MVA is that gains and losses accruing from years-old activities are aggregated on a one-to-one basis with last years results and today's hope or despair as expressed in the share

price (Management Accounting, 1997). As a consequence, a company with a very successful history will keep on showing positive and high MVA even if current projects and future prospects are bleak, risky and unrewarding.

The solution to this is to concentrate only in the changes in MVA, that is the contribution from new projects to the spread between market value and total capital. EVA aims to do just that, emphasising the importance of maximising incremental earnings above capital costs. In order to have positive EVA, an organisation's rate of return on capital must exceed its required rate of return. The importance of maximising incremental earnings above capital costs seems intuitively simple. As we will show, however, the operationalisation is not as easy as it sounds.

EVA is the difference between net sales and the sum of operating expenses, taxes and capital charges. More formally:

$$\text{Net sales} - \text{Operating expenses} - \text{taxes} - \text{capital charges} = \text{EVA}$$

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.

CRITICAL REVIEW

Even though EVA does not explicitly relate to the management of intangible resources, the implicit argument here is that the effective management of knowledge assets will increase EVA. All the same, this origin implies that no specific measures are developed for the assessment of the potential contribution of investments in intangibles. Indeed, some strategy researchers support the idea of using EVA measures as a surrogate measure for the stock of intellectual capital and that EVA can be viewed as a measure for return on intellectual capital (Marchant and Barsky, 1997). The implication is that these investments should still be judged according to the standard criteria for assessing any long-term project: net present value, cost benefit analysis, etc. The complication, which we hinted in the introduction, comes from the ephemeral nature of intangible resources: how do you estimate the value of a training program? Or of the creation of a best practice database?

EVA pretends to do just that, through the innumerable adjustments to the value and the cost of capital that have been suggested. In defining the EVA measures, Stern Stewart & Co. has identified 164 different areas of performance adjustments, that are supposed to address shortcomings in conventional accounting practice, and thus solve problems like the accounting of intangibles and long-term investments with a high degree of uncertainty. Among these problematic areas we find: depreciation,

capitalisation and amortisation of R&D, market building, outlays, restructuring charges, acquisition premiums and other “strategic” investments with deferred pay off patterns.

Even ignoring the possible “accounting massage” that such a number of adjustment can allow unscrupulous managers to make, it is clear though that companies, when implementing EVA, face a trade-off between accuracy and complexity. As the number of adjustments increases, the precision of the EVA calculations may improve, but the system becomes more complicated and vulnerable to challenges by company managers, not to mention unwieldy and useless. To solve the trade-off, most companies that adopt EVA limit the number of adjustments they use to less than five. Some companies choose not to make adjustments at all, on the grounds that it will make the system too complicated.

Another limitation is that the calculation of EVA uses book values of (net) assets. These will in many instances be based on historic cost, which might give little indication of current market or replacement value. The argument for using historic cost is however that the market values would have to be updated on a regular basis, and that the volatility of the values, and possible estimation subjectivity, would impose large costs on a measurement system, and reduce the objectivity of the measures.

Although there is evidence to date showing that EVA and stock prices are correlated (Lehn and Makhija, 1996), can it be claimed that EVA is better at explaining stock price than alternative measures of performance? The evidence seems to suggest otherwise, as studies reveal no additional explanatory power over accounting profit in explaining stock price and only a relatively low correlation between variations in EVA and variations in stock prices (Dodd and Chen, 1997).

As a final comment, it is important to note that EVA assumes a definite governance perspective: the starting point for the EVA analysis is that companies should be run in the interest of shareholders exclusively. The corporate governance debate however is not so clear cut. Some organisation might thus resent this characterisation of their institutional goal, either because of their particular circumstances (for example, state-owned companies), on ideological grounds or simply because they believe that other perspectives on governance are more fruitful for their long-term development. It remains to be seen whether the EVA can be adapted to respond to these other governance viewpoints.

BALANCED SCORECARD (BSC)

After a multi-year, multi-company study sponsored by Harvard Business School, Kaplan and Norton (1996) suggested that managers need a multi-dimensional measurement system to guide their decisions: a Balanced Scorecard (BSC) including leading and lagging indicators and measurements

focusing on the outside and the inside of the company. It was not the first time that companies were encouraged to monitor non-financial measures (Eccles, 1991). By the early 1990s, many organisations were already measuring cycle times, quality rates, customer satisfaction, market shares: all of these measures are non-financial. The new idea however, was to encourage the *systematic* measurement of these quantities, and to link all these measures in a coherent system. A similar suggestion emerged in France in the 1950s and 1960s, and coalesced into a tool called Tableau de Bord; the literature on the Tableau however was never translated, and thus had little echo across the Ocean (Epstein and Manzoni, 1998).

OPERATIONALISATION

The BSC organises its measurement system in four perspectives. The *financial* perspective includes traditional accounting measures. The authors however suggest the adoption of different measures for different parts of the company, sacrificing comparability to fit with the SBU's strategy. The *customer perspective* groups measures relating to the identification of target groups for the company's products in addition to marketing-focused measures of customer satisfaction, retention, etc. The *internal business* process draws heavily from the concept of the value chain. Kaplan and Norton include all the processes relating to the realisation of products and services to satisfy the customers' needs. Finally, the *learning and growth* perspective includes all measures relating to employees and systems the company has in place to facilitate learning and knowledge diffusion.

A BSC however is, or should be, more than just a collection of measures. To this end, all measures should be linked through a cause and effect chain, that culminates in a relation to financial results. Thus, as time goes by, managers should monitor whether the strategy they chose is correctly implemented (which should be reflected in the single measures) and then check whether the assumptions they made about the cause and effect relations hold true. If financial results do not come, then either the causal chain is different from their hypothesis, or time lags are longer than forecasted.

The process of building a BSC starts with a reinterpretation of the vision, or long-term strategy through the lenses of the four perspectives. This yields key success factors for each perspective, which can be translated into critical measures. Top management as a team should perform the process outlined above: it is during this process that the essential commitment is created, and thus it is essential that the team performs it together. In particular, the BSC can help managers carry out four activities:

- i) communication and linking by achieving a strategic alignment of the objectives of the whole organisation;
- ii) business planing by managing targets, co-ordinating initiatives and planning the budget;
- iii) feedback and learning by updating plans, strategies and the BSC; and

- iv) translating the vision by clarifying the mission and long-term strategy to all constituencies inside the organisation.

These activities are recursive, and the company should describe a spiralling movement across them.

CRITICAL REVIEW

The main intuition behind the BSC is nothing short of genial: the creation of a system of measurement that would enable companies to keep track of many dimensions *in a systematic way* is an incredibly powerful concept. Moreover, we agree wholeheartedly with Kaplan and Norton, when they underscore the role of the BSC as a management system, and not just as a sophisticated measurement system. At the same time, we believe that the BSC has weaknesses that constrain its potential.

First of all, the BSC is relatively rigid. This rigidity appears in many aspects of the BSC. First, the perspectives drive the *identification of KSFs*. This is limiting, because some KSFs (indeed, probably most of them) will be cross-perspective, impacting simultaneously more than one dimension of the intangible resources of the company. Of course, this is not a big problem, if managers can identify all KSFs regardless. The danger, however is that their attention will be concentrated only on the perspectives, and they will miss some important KSFs just because it does not fall neatly into any of the categories. Also, the *perspectives* themselves can be fairly limiting. Kaplan and Norton mention that the four perspectives should not be a straitjacket, and companies should expand the number as they see fit, but then treat them like a comprehensive classification of all possible measures, which contradicts their earlier statement. Also, considerations on the *external environment* are limited to customers. Companies interact and leverage the relationship with other actors, like suppliers, alliance partners, local community, unions and final consumers.

Another problem the BSC has is its consideration of *employees* almost as an afterthought. Personnel is lumped together with IT systems into the learning and growth perspective. Not only that, innovation (the result of human learning and action) is actually part of the internal business process focus. It feels almost as if innovation is considered a routine, something the organisation can do without the people, or at least independently of them. As a consequence, the specific challenge of managing people and their knowledge is underestimated by the BSC. More than that, knowledge is reified, i.e. it is treated like a physical thing: this misconception might reinforce the mistake many companies make, to believe that the creation of an IT system is enough to automatically manage knowledge.

Finally, no external comparison is possible. In truth, the BSC is intended as an internal document, therefore this is not really a disadvantage as much as an assumption.

INTELLECTUAL CAPITAL (IC)

Intellectual Capital (IC) has enjoyed a very rapid diffusion in the last five years. Even though the term has been widely used in the literature before, the current wave of interest has been sparked by a few companies (mainly Skandia, Dow Chemicals and the Canadian Imperial Bank of Commerce) who started using it as a blanket denomination of all intangible resources. These companies realised that the existing frameworks (including some of the ones we reviewed above) could not address the issues they were facing, and tried to develop something new. Thus, IC is very much a practitioner-created concept, and only more recently did scholarly contributions appear to analyse its use and potential.

OPERATIONALISATION

Under the name of intellectual capital, we can classify all intangible resources (Bontis, 1996; Edvinsson and Malone, 1997; Roos and Roos, 1997), as well as their interconnections (Roos *et al.*, 1997; Bontis, 1998). Thus, for this tradition, intellectual capital is quite simply the collection of intangible resources and their flows. The problem is the definition of intangible resources: for the purposes of this paper, suffice it to say that we will call resources any factor that contributes to the value generating processes of the company and is, more or less directly, under the control of the company itself. Thus, the goodwill of the local community is an intangible resource (because the company can influence) and therefore a part of intellectual capital. The tax system, instead, is not, unless the company is so big that it can influence the tax system of the country it operates in, but this case would, hopefully, be an exception. It is clear that the definition is very vague, and purposely so. IC is something absolutely peculiar to each and every company: what the company can and cannot influence depends on many factors, which make one company include in IC something that another company would not. In other words, IC is context specific.

The value of a company then comes from its physical and monetary assets (which we will call financial capital), and from its collection of intangible resources (its IC, as we explained above). Once we try to get into the IC concept, however, the idiosyncratic situation of each company should take precedence, and guide the selection of specific categories. In general, we believe that this identification process should be guided by a purely managerial logic: if two intangible resources require different managerial actions, then they should belong to two different categories. As an example we present in Figure 1 an IC classification.

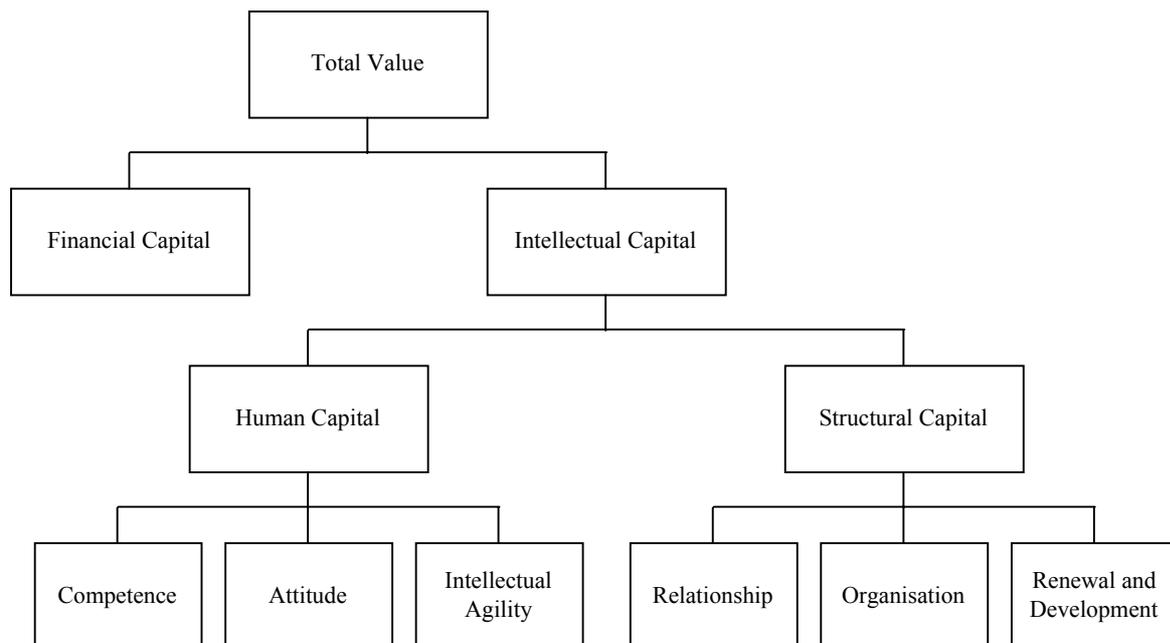


Figure 1: The value distinction tree

Source: Roos *et al.* (1997)

Very briefly, human capital is the collection of intangible resources that are embedded in the members of the organisation. These resources can be of three main types: competencies (including skills and know-how), attitude (motivation, leadership qualities of the top management) and intellectual agility (the ability of organisational members to be “quick on their intellectual feet”: innovation and entrepreneurship, the ability to adapt and cross-fertilise, etc.).

Structural capital instead is “everything that remains in the company after 5 o’clock”, according to a definition by Leif Edvinsson, Vice President and Corporate Director of Intellectual Capital for Skandia. The essence of structural capital is the knowledge embedded within the routines of an organisation. Its scope lies internal to the firm but external to the human capital nodes. It comprises all the intangible resources which are the property of the company: thus in most cases there is a market, albeit a limited one, for structural capital, where the company can buy or sell intangible resources, and the dynamics of this market are quite similar to the ones governing the market for more traditional resources (though there are obvious complications due to the problem of evaluating these intangible resources correctly). The market for human resources instead, while existing, presents totally different characteristics, given that what is “bought” and “sold” are human people, and thus nobody can claim ownership on them. Structural capital can be divided into relationships (with any type of external actors: suppliers, customers, allies, local communities, government, shareholders, etc.), organisation (including structure, culture, routines and processes) and renewal and development (all the projects for the future: R&D, new plants, new products, BPR, etc.).

Identifying the different types of intellectual capital can be likened to the identification of stocks of intangible resources: this however is not enough. It is essential to measure, and thus manage, also the flows of intellectual capital, that is the changes in the stocks of intangible resources (Roos and Roos, 1997). Dierickx and Cool (1989) make a fundamental distinction between stocks and flows of knowledge by using the bathtub metaphor:

At any point in time, the stock of water is indicated by the level of water in the tub; it is the cumulative result of flows of water into the tub (through the tap) and out of it (through the leak). In the example of R&D the amount of water in the tub represents the stock of know-how at a particular moment in time, whereas the current R&D spending is represented by the water flowing in through the tap; the fact that know-how depreciates over time is represented by the flow of water leaking through the hole in the tub (Dierickx and Cool, 1989, p. 1506).

In a way, the identification of stocks creates a series of still photos of the company's intangible resources, whereas the flows provide the animation. Adding a flow perspective to the stock perspective is akin to adding a profit and loss statement to a balance sheet in accounting. The two perspectives combined (or the two reporting tools, in the case of accounting) provide much more information than any single one alone. At the same time, intellectual capital flow reporting presents some additional challenges in terms of complexity. Unlike accounting and cash flows, in fact, intellectual capital flows do not necessarily add up to zero: in other words, intellectual capital management is not necessarily a zero-sum game (Roos and Roos, 1997). We are all familiar with stories of investments in IT, brand building and training that did not pay off, and turned out to be pure money drains. In these cases, the money invested in these activities did not convert into value for the company. Equally renowned, fortunately enough, are other cases where small ad campaigns, marginal improvements in quality or processes and short training courses paid back their cost manifold, turning into great assets for the company in question. Incidentally, it might be worth noting that the very nature of intangible resources might contribute to this non-zero-sum effect. In fact, research has shown that knowledge and information are governed by increasing returns, as opposed to the decreasing returns which characterise the traditional resources (land, labour and capital) (Arthur, 1996).

How should the indicators of IC be chosen? The choice should be guided by the long-term strategy of the company, its vision or mission. Once the company has clear ideas on its identity and its long-term goal, it should use these goals to identify two sets of variables: one is the "value creating path", that is the categories, or focus areas, of IC that really drive value creation; the other is the set of key success factors (KSF) and indicators that are appropriate as performance measurements. The information from the two separate steps should be joined, and an IC system created (Figure 2).

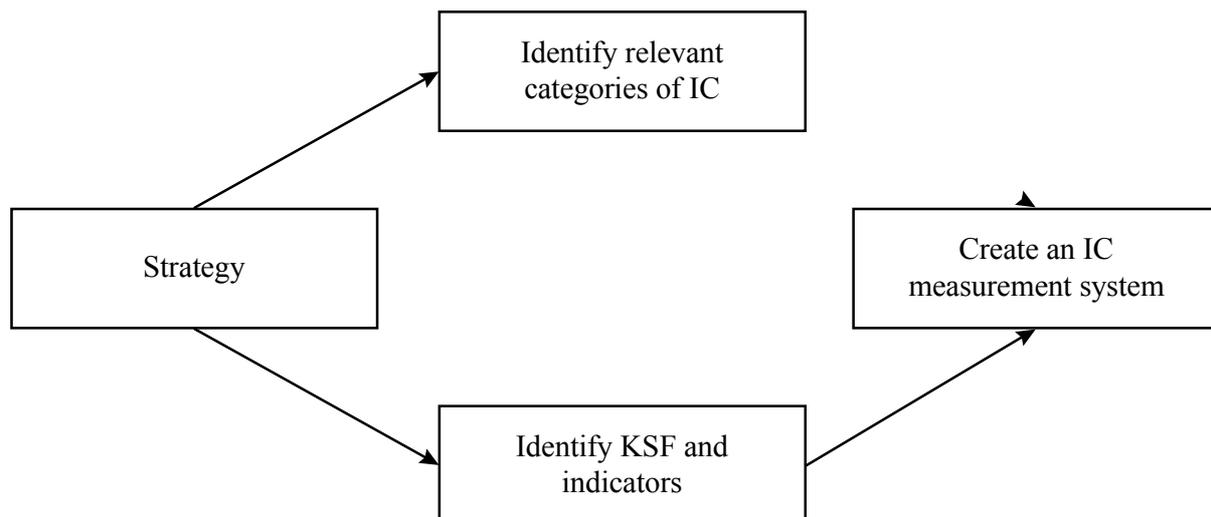


Figure 2: The simplified process model

The creation of an intellectual capital measurement system is fundamentally a top-down process. The initial start of the idea, as well as the initial framework (that is, the top part of figure two), must come from the topmost layers of the organisation. All the same, top management can only supply the language and the framework. The filling of the framework, the real juicy part (the bottom part of figure 2), can only be created at a local level, by the people that know the reality of the business because they are immersed in it every day, 250 days a year. The added familiarity with the business operations is an absolute requirement. Key success factors are quite general, and in most cases refer to most companies. We are not diminishing the importance of the KSF identification step, but KSF are necessarily general, and thus applicable to more than one company, if not to entire segments or industries. The choice of indicators instead reflects the characteristics of the company more closely: in other words, it is more specific (Hauser and Katz, 1998). Finally, indicators should be put together and organised according to the particular outlook of the company on intangible resources.

The joint examination of intellectual capital stocks and flows still leave some issues unsolved. It is still impossible to judge the overall IC situation of companies: if, for example, its culture has improved (judged by whatever criteria top management chose as appropriate), but its process efficiency has deteriorated, what is the final effect on structural capital? Has it gone up, down or remained stable? An answer can only be reached through the consolidation of the different IC indicators into a single, summary measure¹. The consolidation implies the identification of weights for all the indicators, to ensure that the most important factors be adequately represented in the consolidated IC index. It also requires a re-examination and transformation of the indicators, to make

¹ The concept of consolidation of IC indicators has been introduced by Intellectual Capital Services, Ltd., under the name of IC-Index™ approach

them dimension-less and more robust. Once however this index is obtained, it can be used to monitor the evolution of the company's IC situation very easily and effectively.

Unfortunately, the fact that different companies will use different indicators to create their IC index makes comparisons of the absolute value meaningless, in most cases: to be more precise, the more two companies use different indicators, and the more they operate in different contexts (thus the more their weights differ), the less their IC indices will be comparable. Still, it is possible to compare companies through the relative changes in the index. Changes in this measure would reflect changes in the underlying components, which in turn would be a sign of changes at the deeper level of the drivers of future earning potential. Thus, a company that improved its IC index by 50% is invariably doing better than another that improved the same measure "only" by 25%. 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.

CRITICAL REVIEW

Although an exciting perspective to most managers, IC still remains elusive and restrictive. The tremendous growth of contributions and applications over the last decade has not addressed all the limitations yet. This field typically looks at knowledge as a static asset in an organisation – what above we called stock. The different categories of stock have been identified fairly accurately, and described quite extensively. Unfortunately, the description of these constructs is limiting to managers who are more interested in how to measure and leverage intellectual capital. Accountants and financial analysts continue to battle with metric development but these are typically too firm-specific, have difficulty in conforming to generally accepted accounting principles and lack the generalisability necessary for interested boards such as national associations of accountants or stock exchange watchdogs to adopt. Like HRA, IC systems can, at the present state of development, be audited only as far as the process goes: external institutions can therefore certify that the process of developing the system is correct and follows all prescriptions. Nothing however can be said about the measurements themselves.

To move forward intellectual capital researchers must converge on certain measures and indicators. Although Bontis (1998; 1999) has started this research program with a survey design, more metric development is required. Moreover, there is a concern among many people that flows of IC are being left too much in the background. As we tried to point out in our description, consideration of flows is really critical to a correct management of IC.

On a more general level, IC suffers from the downside of its own greatest advantage. If it is true that IC as a concept is extremely flexible, it is also true that it is extremely complicated for anybody to make sense out of the very different contributions, all suggesting slightly different variations of the same idea. Equally worrying is the fact that this same diversity and context specificity hinder any possible comparison. While it is true that the consolidation is a step forward towards inter-company comparisons, even in this case IC performance (i.e. changes in IC levels) is the only element that can be compared, and then only if the two companies under consideration used similar IC systems. IC stocks (i.e. the accumulated performance over time) remain as elusive and resistant to comparison as ever.

CONCLUSION

So, which is the best tool? Sadly, we cannot answer that question: in truth, we believe that any answer would be pretentious and harmful. There is no universally best tool: there are only tools that are more or less appropriate to specific situations and companies. All of the tools we examined above have success stories they can rightfully take credit for. We should never forget however that those same tools applied to the wrong situation would damage companies, or at the very least generate some undesired side effects.

The aim of this paper was therefore to arm managers with a clear understanding of what each tool aims to accomplish, and the conditions under which these accomplishments can happen. We also tried to highlight the shortcomings of each tool, to avoid creating undue expectations. Table 1 summarises our reflections on the various tools, and highlights the differences amongst them. Hopefully managers will be in a better position now to choose how to manage their intangible resources using their knowledge toolbox.

*** Table 1 approximately here ****

TABLE 1: SUMMARY OF THE KNOWLEDGE TOOLBOX

| TOOL | PRIMARY RATIONALE | ADVANTAGES | DISADVANTAGES |
|-------------|---|---|--|
| HRA | The value of human capital as expressed in financial terms should be capitalised on the balance sheet instead of expensed on the income statement. | <ul style="list-style-type: none"> · calculated in financial terms; · extensive internal use in certain service industries. | <ul style="list-style-type: none"> · too many assumptions, some of which cannot hold; · subjective. |
| EVA | The purpose of a company is to maximise shareholder value, and maximise the effective use of capital. This should be reflected in every decision, at all levels of the company. | <ul style="list-style-type: none"> · correlates well with stock price; · ties budgeting, financial planning, goal setting, and incentive compensation together. | <ul style="list-style-type: none"> · complicated adjustment procedures; · net assets vs. market value of assets · weak additional explanatory power; · assumes governance structure in the interest of shareholders only |
| BSC | Companies need a system of leading and lagging, internal and external indicators. | <ul style="list-style-type: none"> · powerful logic; · clear correlation between indicators and financial performance; · well-developed and consistent literature. | <ul style="list-style-type: none"> · rigid; · inappropriate consideration of human assets and knowledge creation processes; · static: no consideration of dynamics; · no external comparison possible |
| IC | A good part of the value generated by a company comes from intangible resources, and therefore these resources need to be monitored like the physical ones are. | <ul style="list-style-type: none"> · flexible; · dynamic model; · partial external comparison possible; · applicable also to not-for-profit organisations | <ul style="list-style-type: none"> · confusing literature; · metric development is still at early stages; · too much concentration on stocks, at the expense of flows. |

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