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Knowledge valuation analysis

Applications for organizational intellectual capital

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Abstract

Purpose – The purpose of this paper is to provide a review of an analytic methodology (knowledge valuation analysis, i.e. KVA), based on complexity and information theory, that is capable of quantifying value creation by corporate intellectual capital. It aims to use a real-world case to demonstrate this methodology within a consulting context.

Design/methodology/approach – The fundamental assumptions and theoretical constructs underlying KVA are summarized. The history of the concept, a case application, limitations, and implications for the methodology are presented.

Findings – Although well-known financial analytic tools were used to justify IT investment proposals, none provided a satisfying result because none offered an unambiguous way to tie IT performance to value creation. KVA provided a means to count the amount of corporate knowledge, in equivalent units, required to produce the outputs of client core processes. This enabled stakeholders to assign revenue streams to IT, develop IT ROIs, and decide with clarity where to invest.

Practical implications – When stakeholders can assign revenue streams to sub-corporate processes, they have a new context for making IC investment decisions. "Cost centers" and decisions based on cost containment can be replaced. Concepts such as a knowledge market, the knowledge asset pricing model, k-betas, and a sub-corporate equities market can be developed and applied. Some of the limitations related to real options analysis can be resolved.

Originality/value – This paper introduces an approach to measuring corporate intellectual capital that solves some long-standing IC valuation problems.

Keywords Intellectual capital, Knowledge management, Measurement

Paper type General review

Introduction

The fundamental building material and engine of wealth of the modern corporation is the creation and utilization of knowledge. The real challenge in the Information Age is to understand how to accelerate the conversion of knowledge into money through understanding how to measure knowledge assets (Kanevsky and Housel, 1998, p. 1). According to King and Zeithaml (2003, pp.1-2), current knowledge resource identification and measurement tools (such as patent or citation counts) are "crude and often inadequate." Yet, knowledge resources are a source of competitive advantage, i.e. valuable, rare, inimitable, and lacking substitutes (Barney, 1991). A knowledge based theory of the firm requires knowledge to be "defined precisely enough to let us see which firm has the more significant knowledge and explain how that leads to competitive advantage" (Spender, 1996a, p. 49).

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Sudarsanam *et al.* (2003, p. 1) define knowledge assets as the collection of intangible assets, as distinguished from physical or financial assets, that comprise the intellectual capital of the firm. We use the terms intellectual capital, intellectual capital assets, intellectual assets, IC assets, intangible assets, and knowledge assets interchangeably throughout this paper.

Sudarsanam, Sorwar, and Marr also state (Marr, 2005: 56) that:

> Relative to the other components of a firm's capital, such as physical and monetary capital, intellectual capital is more difficult to define, measure, manage, and value in the traditional sense. Yet, given the profound importance of such assets to a firm's competitive advantage and value creation capabilities, serious attempts need to be, and increasingly are, made to establish clear definitions, measurement rules, and valuation principles.

The burgeoning body of knowledge related to measuring and managing intellectual capital testifies acutely to this need (Housel and Bell, 2001).

In this paper, we introduce a set of definitions, measurement rules, and valuation principles that have guided our work for over a decade. We call them knowledge valuation analysis (KVA). KVA falls within the general parameters of the resource-based view (RBV) of the firm. However, since KVA is an analytic tautology rather than heuristical, it functions more like accounting in terms of the kinds of data it produces (i.e. data that can be described in common, universal units) and the way in which this data is gathered and analyzed (i.e. data that can be observed, counted, and utilized in traditional ways such as performance and profitability ratio analysis). Existing valuation models, including real options models, can be populated with KVA data, yielding useful results.

Since the KVA tool is pragmatic and useable at the level of accounting and finance, we propose its direct application to a broad range of consulting activities and problems. Although the case we present demonstrates a single application within the telecom industry, KVA has been tested and refined for for-profit, not-for-profit, and government organizations in over 100 consulting engagements and in-house corporate settings and in equal numbers of academic research papers. We suggest it as a tool to enable organizations to quantify the performance of IC assets and link it with value creation.

Current activities in IC asset valuation

The valuation of intellectual capital assets has been the subject of extensive research and debate. Currently, IC valuation activities appear to be launched from three main trajectories: Accounting, finance, and the "qualitative metrics" camp. Each trajectory's activities offer potentially valuable insights and a number of carefully reasoned valuation approaches.

Accounting

The accounting profession has traditionally used the term intangible assets to describe IC assets. Lev *et al.* (Marr, 2005, p. 42) provide the following accounting definition of intangible assets as: " [T]he nonphysical value drivers in organizations that represent claims to future benefits." Most regulatory accounting bodies include in their definition of IC assets the lack of physical substance, the non-monetary nature of the asset, and the prospective rather than historical nature of associated benefit streams. (Marr, 2005, p. 45)

Since the objective of financial reporting is to provide useful information for making decisions based on the financial position and performance of the firm and since there is a high degree of uncertainty associated with future cash flows from intangible assets, the Financial Accounting Standards Board and the International Accounting Standards Board have ruled that intangible assets, especially those developed in-house, cannot be included on the balance sheet unless they meet the following criteria (Marr, 2005, p. 43):

- they are identifiable;
- they are controlled by the reporting firm;
- it is probable that their future benefits will flow to the reporting firm; and
- their cost can be reliably measured.

Whether IC assets are recognized on the balance sheet or not, accounting regulatory authorities require that the costs related to developing them must be expensed immediately. This ensures that in some reporting periods the profitability and financial condition of the company will be understated and, in other periods, overstated. The result is a possible loss of relevance of accounting information (Marr, 2005, p. 43).

When IC assets such as patents are acquired in a business combination, standard costing methods can easily be used to meet recognition and valuation rules. SFAS 141 and 142 allow for recognition of an acquired intangible asset at fair market value so long as it either can be identified separately from the acquired firm or has been created via contractual or legal rights. All non-identifiable IC assets are grouped under "goodwill", which can no longer be amortized over an indefinite life and must undergo annual impairment tests for possible value depletion. Marr (2005, pp. 46-48), Lev and Zarowin (1999) and Høegh-Krohn and Knivsflå (2000) support this "condition-based cost capitalization" approach (Marr, 2005, p. 50).

Lev and Zarowin (1999) also propose condition-based cost capitalization for the historical costs of developing intangibles that have clearly defined development phases but have not yet achieved technical feasibility. Their method includes the carefully regulated restatement of historical information, where the firm records an asset on its balance sheet once benefits start to flow from it and also reverses prior year expenditures related to it (Marr, 2005, p. 50).

To increase transparency and information flow, some enterprises have engaged in voluntary presentations of information about IC assets using methodologies such as book-to-market ratios, Tobin's Q (stock market value of firm ÷ replacement cost of assets), or a variety of qualitative measurement tools. However, firms in the USA and in Europe differ in the way information on IC is published, as do firms within industries and across reporting years. "[F]rom an investor's perspective, there is a serious drawback to these reports or any other voluntary information on intellectual capital: the lack of harmonization (comparability) among firms, industries, or different years for which the data are published. This significantly reduces the usefulness of the information" (Marr, 2005, p. 49).

The FASB project on intangibles is currently frozen, and the 2001 Securities Exchange Commission task force on intangibles states "the need for developing a disclosure framework for information on intangibles and other measures of operating performance" (Marr, 2005, p. 51).

Clearly, the accounting profession is considering various intangible assets valuation approaches seriously, but must, by its conservative role and nature, be guarded in what it accepts. It is also clear that the current inability to attribute a benefit stream (i.e.

revenue, income) to intangibles at the corporate or sub-corporate level, the continued reliance on historical cost as a measure of value, and the lack of comparability in proposed valuation approach results have created a barrier to further advances within the profession.

Finance

As with the accounting definition already provided, the finance definition of intellectual assets indicates that: they have no immediate, measurable, or certain payoffs (income streams); and due to their embedded nature, are not susceptible to the development of a secondary market by which they could be valued. In addition, the finance definition states that intellectual assets embody the firm's growth opportunities, "contributing to both their evolution over time and their realization in the future" (Marr, 2005, p. 56). So, firm value from a finance perspective can be viewed as: value of assets in place + value of future growth opportunities from assets in place + value of future growth opportunities from new assets. The second and third elements of this value proposition are "largely path dependent and derive from the firm's accumulation of resources and capabilities from past investments" (Marr, 2005, pp. 57, 60).

Sudarsanam *et al.* (2003) (in Marr, 2005, pp. 58-62) suggest that financial valuation models can be divided into two groups: static (historically based) and dynamic (prospectively based). They provide the following discussion of both groups.

Static models develop an estimate of value as of a specified valuation date. The assets being valued are generally aggregated at the firm level, although intellectual property (IP) such as patents and brands are often valued alone. Static model valuation approaches include:

- *Lev's (2001) Residual Income Model*. Subtract the after-tax earnings attributable to financial and physical assets from the firm's after-tax earnings to arrive at a residual, the knowledge earnings that can be capitalized at an appropriate discount rate. This model is a variant of the traditional financial valuation "Excess Earnings Approach."
- *Brooking's (1996) Technology Broker Model*. Use an audit questionnaire to identify the firm's intellectual asset categories. Then apply traditional valuation approaches (market, income, or cost) to each category. The market approach uses market comparables as a benchmark for asset value. The income approach estimates the income-producing capability of the asset. The cost approach estimates value based on the asset's replacement cost.
- *Market- or value-based approach*. Take the difference between the stock market value of the firm and the net market value of its assets.
- *Tobin's Q*: Take the difference between the market value of the firm and the replacement cost of its tangible assets.

Dynamic valuation models include:

- *The Discounted Cash Flow Model*. Estimate future asset cash flows and discount them using a market-determined discount rate. This model requires relatively stable, predictable cash flows and the ability to estimate an appropriate discount rate.

- *Real Options Models*. Use financial option pricing models to value intellectual assets, since intellectual assets are, in effect, real options created by the firm through such activities, investments, or acquisitions as: Investments in IT and human resources, customer relationship arrangements, intellectual property (IP), R&D, and practices and routines.

A review of the literature indicates that all financial valuation models have the same limitations in one form or another:

- IC assets must be valued as an aggregate with no ability to separately value individual assets (other than certain types of IP);
- differences in the national, industry, and firm accounting standards and policies that govern the recording of the IC assets create a lack of comparability of value estimates;
- an inability to define either exactly how much IC assets contribute to firm value or the process by which they do so;
- difficulty in estimating the replacement cost of IC assets, their future cash flows, or the risk (volatility) and uncertainty (probabilities) associated with these cash flows;
- difficulty in capturing path dependencies and asset synergies in value estimates; and
- lack of historical data to use for benchmarking and forecasting.

Many or most of these problems could be addressed by a method to estimate sub-corporate cash flows, i.e. cash flows for IC assets such as people, processes, and information technology.

Qualitative metrics

There is a large universe of qualitative metric approaches: Kaplan and Norton's Balanced Scorecard, Edvisson and Malone's Skandia Reporting Model, Prusak and Davenport's Knowledge Outputs model, and newer models such as those proposed by King and Zeithaml (2003) and Chen *et al.* (2004). However, since KVA fits within the accounting and finance disciplines, rather than the qualitative metric discipline, we will not provide a review of qualitative metrics approaches in this paper.

Methodology

The problem we sought to address was seemingly straightforward. "To value any asset, we need to specify an income stream clearly identified with that asset" (Marr, 2005, p. 58). In 1991, while at Pacific Bell, we were asked to make business cases for investments in IT, specifically expert systems. We needed to be able to assign a benefit stream (i.e. revenue) to IT in order to justify IT investment proposals because, without a benefit stream, the IT value equation had no numerator and valuation was impossible.

We attempted to use the discounted cash flow model, NPV, IRR, activity-based costing models, and other approaches to develop a proxy for revenue so we could focus on value creation at a sub-corporate level. However, none of these provided a satisfying answer because there was no unambiguous, verifiable way to tie revenue to IT at the sub-corporate level. We wanted more than another approach to cost containment.

KVA theory was developed from the complexity theoretic concept of the fundamental unit of change, i.e. unit of complexity. The information bit was theoretically the best way to describe a unit of Kolmogorov complexity. However, to make the operationalization of the KVA more practical, we used a knowledge-based metaphor as a means to describe units of change in terms of the knowledge required to make the changes. We sought to meet a single goal: to provide a means to count the amount of corporate knowledge, in equivalent units, that is required to produce the outputs of the organization. Our underlying assumptions (represented in Figure 1) were that: humans and technology in organizations take inputs and change them into outputs through core processes; and by describing all process outputs in common units, i.e. the knowledge required to produce the outputs, it would be possible to assign revenue, as well as cost, to those units at any given point in time.

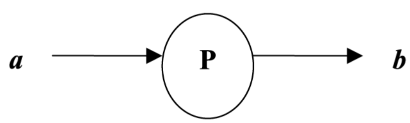
Our notion of intellectual capital started with a practical need and was formulated around direct observation of IC asset performance within the core processes of the organization by describing process outputs in units of learning time. Over time, we came to define intellectual assets as one category of organizational assets, all of which can be quantified and valued in terms of a common unit of measure we called the Knowledge Unit (K_μ).

A brief overview of KVA theory

We have built KVA theory from a somewhat ad hoc language of description to a highly formalized methodology. The following is abstracted from the most current version of the theory (see Housel and Nelson, 2004).

The amount of change caused by a process can be described in terms of the time required by an "average" learner to learn how to produce process outputs. These units of learning time we define as K_μ's. The Ku unit is proportionate to an information bit which is proportionate to a unit of Kolmogorov complexity which is proportionate to a unit of change. It is the descriptive language for change within the knowledge metaphor.

No measurement is possible without observation, and observation is meaningless without using a descriptive language to record it. Within the KVA theory, change measurement can be discussed in any descriptive language so long as the language



Process ***P*** is a business process.

If input ***a*** is equal to output ***b***, no value has been added by process ***P***.

If input ***a*** is changed by process ***P*** into output ***b***, value has been added and is ≈ change.

Change can be measured by the amount of knowledge required to make the change.

This knowledge ≈ the amount of time it takes for an average learner to acquire the knowledge.

So, value added by process ≈ change ≈ knowledge required to produce the outputs ≈ $\mathbf{K}_\mu$

Source: Housel and Kanevsky (1995)

Figure 1.

will provide reliable estimates of value stated in common (equivalent) units. For this reason, there have been many languages used within the KVA theory to describe units of change, e.g. tasks, process instructions, Haye knowledge points, Shannon bits, Jackson structural diagram decision points, units of knowledge.

We have chosen to discuss units of change (complexity) in terms of the knowledge required to reproduce them, because the operational metaphor, "knowledge," is easy to understand and rapidly apply to generate estimates of change. Although the term "bits" describes units of complexity (i.e. change) at the most granular level, it is currently impractical to count them. The knowledge metaphor, however, allows us to describe change in terms of the amount of knowledge required to make changes and to discuss intangible activity (i.e. activity that is not directly observable, as is the case with many IC activities) more satisfactorily. Knowledge units are less precise (rougher cut) than bits, but more practical to estimate.

The outputs of all processes can be standardized by describing them in terms of the number of units of change (complexity) required to produce them, given the existing technology. Outputs, such as products and services, have value derived from their inherent characteristics. These characteristics have been predetermined by the products' designers and are embodied in the corporate knowledge needed to produce the products.

If the output will always be the same, given the same input, then we describe the output as predetermined. Another definition of a predetermined output is that, once it is produced, it does not vary within reasonably well-defined boundaries. Its inherent characteristics are fixed.

Due to the growth of knowledge-based industries, the professional services, and "customized" manufacturing, there are a sizeable and growing number of core processes that produce outputs which belong to predetermined categories but whose inherent characteristics may differ (be customized) from each other within the category. For these processes, we vary our estimation techniques somewhat to properly measure output K_μ.

Processes with predetermined outputs are more or less isomorphic with computer algorithms. Therefore, process changes are virtually identical to computing. This fundamental parallelism between the structural change of substances (inputs into outputs) and information processing allows us to describe the amount of knowledge required to produce process outputs and determine the value added by the process (Kanevsky and Housel, 1998).

Knowledge is embedded in process assets such as IT, employees, training manuals, etc. and all processes can be described in terms of knowledge units. A process must execute once to produce a single unit of output, represented by a given number of knowledge units. Additional levels of detail in process descriptions provide additional levels of accuracy in the estimation of the number of knowledge units comprising those processes.

Foundation for KVA methodology

King and Zeithaml (2003) provide the following formal summary of the academic research undergirding the actual KVA methodology:

- Organizational knowledge is enacted through the perspective of multiple "knowers" in a firm (Tsoukas, 1996; Glazer, 1998; Orlikowski, 2002). Therefore, it is not appropriate to attempt to measure knowledge from one individual's viewpoint.

- Knowledge is acquired in two stages (e.g., Anderson, 1976, Singley and Anderson, 1989), the declarative and the procedural. The declarative stage involves conscious, general knowledge that can be verbalized. The procedural stage involves practice, growing recognition of patterns, improved abilities, and lower requirements for cognitive involvement (Newell and Simon, 1972; Simon, 1974; Anderson, 1995; Gobet and Simon, 1996). Procedural knowledge is rich, embedded, specific, and embodied in actions and skills (Singley and Anderson, 1989, p. 31).
- Organizational knowledge resources are predominantly procedural (Nelson and Winter, 1982). However, to measure organizational knowledge requires declarative knowledge.
- "Managers routinely are required to communicate and transform procedural knowledge into declarative knowledge as they negotiate organizational priorities and make strategic decisions. Although it is impossible to articulate all that one knows about organizational knowledge (Leonard and Sensiperm, 1998), we suggest that experienced top- and middle-level managers are particularly adept at recognizing and articulating organizational knowledge. Tapping their knowledge about the organization.. can provide a new and valuable way to measure organizational knowledge" (King and Zeithaml, 2003, pp. 2-3).

KVA makes extensive use of top and middle manager, as well as subject matter expert, knowledge about the organization.

Components of KVA methodology

There are at least three measures that can be used to estimate the amount of knowledge required to produce process outputs (Housel and Nelson, 2004). They each assume process efficiency maximization as a baseline, that is, the shortest learning time per average "learner," the least number of process instructions, or the shortest sequence of binary questions required to obtain the predetermined outputs.

We consult with the top and middle-level managers of the organization, as well as subject matter experts, to obtain estimates of these measures. Ideally, at least two estimation approaches should be used during any given process analysis to provide a reliability check, provided that both estimates reflect the same underlying construct, i.e. common units of change.

- *The time required to learn the process*. Learning time can be described as the amount of time necessary for an average person (i.e. a common reference point, "learner") to learn how to complete a process correctly.
- *The number of process instructions*. The number of process instructions required to generate the process output successfully can serve as the proxy for the amount of change produced by a given process. Process instructions must be made roughly equivalent in terms of the amount of knowledge required to execute them.
- *The length of the sequence of binary questions (i.e. bits) required to complete the process*. Computer code is a reasonable proxy for amount of change and thus can serve as a proxy for the amount of knowledge required to produce process outputs.

Case study

To illustrate the KVA methodology, we have selected a case study taken from a consulting engagement performed on behalf of SBC Telecom. We chose this case because it was rich in detail, had large-scale implications for SBC, and its success created several further opportunities for follow-on consulting. The full details of the case can be found in Cook and Housel (2005).

Statement of SBC case problem

The President of SBC Telecom was faced with a critical deadline. His new Tier One subsidiary had to write at least three sales orders and provide service to the customers in three separate market areas on October 8, 2000 or face a $10.1 million fine from the FCC. Given the short time frame for making the company operational, management decided that it would be necessary to use the company's billing, network provisioning, and network maintenance legacy systems. However, top management invited the management team to make the case for new information systems to support sales, marketing, finance-accounting, and/or corporate management.

Top management did not want to use standard company procedures to justify such investments based on how much downsizing the IS would enable. Instead, they wanted to focus on how much value new systems would provide, and on growth accompanied by low marginal costs. They wanted to know where investments in information technology would pay off, what the optimal resource allocation would be for IT. Many of these benefits had already been projected by a variety of consulting firms and integrators. However, top management wanted a sanity check on their projections.

The cultural context surrounding SBC decision processes included a low tolerance for failure, consistent with SBC history as a long product cycle, monopolistic company. In addition, SBC decision makers were deeply rooted in cost-accounting based approaches and methods. Based on our experience in the telecommunications industry, and with SBC in particular, we knew that if we did not provide the company decision makers with what they viewed as credible data within this highly constrained decision context, they simply would not use it.

Conducting the KVA

Our team met with subject matter experts and top management over a period of three months, although we only consumed a total of about two weeks of actual work time. We primarily used audio conferences and email to gather and verify KVA data. We developed learning time data estimates based on the relative amount of time it would take for one average learner to learn eight core processes (marketing, ordering, provisioning, maintenance, billing, customer care, corporate management, and sales) within a normalized 100 months. Since we could not observe the actual executions of each process, we assumed that they executed only once per person per sample period. This meant that we could use employee head count as our proxy for number of process executions.

Using the product of the number of process K_μ generated per employee and the number of employees executing each process, we estimated the total K_μ generated per process. From this data and the total annual revenues for the firm, we were able to assign revenues to each process. The next step was to develop return on knowledge ratios (i.e. ROKs, our KVA productivity ratio) for each process. KVA results are shown in Table I. ROKs are shown in Table II.

Table I. KVA data

Process	RLT[a]	HC[b]	Automation (percent)[c]	LT for IS	Total LT including IS	Revenue assigned to non-IS ($)	Revenue assigned to IS ($)	Cost assigned to non-IS ($)	Cost assigned to IS ($)
Marketing	6	28	30	50	218	2,350,450	540,180	2,700,000	600,000
Ordering	12	25	75	225	525	5,650,119	2,411,517	2,875,000	1,000,000
Provisioning	36	120	60	2,592	6,912	74,387,858	27,780,672	12,583,721	3,583,720
Maintenance	20	120	60	1,440	3,840	41,326,588	15,433,707	10,162,791	1,016,279
Billing	7	15	80	84	189	2,034,043	900,300	4,025,000	2,900,000
Customer care	11	37	70	285	692	7,446,319	3,053,516	4,775,000	2,000,000
Management	4	75	60	180	480	5,165,823	1,929,213	6,425,000	800,000
Sales	4	240	70	672	1,632	17,563,800	7,202,396	20,000,000	2,000,000
Totals	100	660		5,528	14,888	155,925,000	59,251,500	63,400,000	13,900,000

Notes: [a]RLT is employee relative learning time within the framework of a normalized 100 months; [b]HC is employee head count, used as a proxy for number of executions of processes: [c] percent automation is the percent of IS contribution to processes over and above the human contribution

Table II.
Returns on knowledge (ROKs)

Process	ROK for non-IS[a] (percent)	ROK for IS[a] (percent)
Marketing	87	90
Ordering	197	241
Provisioning	591	775
Maintenance	413	1,519
Billing	51	31
Customer care	156	153
Management	80	241
Sales	88	360
Aggregate	246	426

Note: [a]ROK is calculated as revenue/process ÷ cost/process

Findings

These results allowed us to concentrate in depth on estimating the value of using web-based IS to enhance the productivity of the current low-automation sales process. We used KVA to build a comparison between the current non-web-based sales process and a competitor's existing web-based sales process. The ROK for the web-based sales process was over 432 percent higher than that of the non-web-based process. We were able to demonstrate that by implementing a sales automation tool (e.g., Siebel CRM system), SBC would increase the ROK of the sales process by at least 30 percent.

We also were able to demonstrate that the ROKs on provisioning and maintenance (traditionally considered pure "cost centers" by management) were substantially higher than on other processes, in spite of their relatively high costs. KVA made it clear that some supporting IS provided better returns than others, and that higher returns on IS appeared to be associated with processes that had been intentionally optimized to take advantage of legacy IS (i.e. provisioning and maintenance, but not billing). This supported the notion that process design, rather than type of IS, might be the most crucial issue in predicting and maintaining the highest ROK on IS.

All in all, during the three years following the initial KVA analyses, there was a 20-30 percent reduction in operating costs and a 20-30 percent improvement in revenues. "We have moved from a stand alone entity that competed out of the [SBC] region to one that has a nationwide footprint. This allows SBC to take care of our customers telecommunications needs end-to-end" (Tim Harden, October 3, 2002). SBC has implemented several other KVA initiatives since 2002.

Limitations

Since incipience, there have been a number of limitations to KVA theory and practice, all of which have been or are currently being addressed. They are:

(1) We have been primarily focused on developing and implementing a practical, observation-based methodology for real-world use and only secondarily focused on standardizing KVA theory or migrating it into the languages of accounting and finance where it could be adopted more widely and easily.

(2) Our data-gathering methods have not been fully standardized. So, although much data has been collected, we do not yet have a database of comparable historical KVA information from which to begin to benchmark future work or provide broader-scale insights for current work.
(3) Due to the non-observable nature of "meta" knowledge, "meta" processes, and management/creative staff processes, KVA theory, until recently, has simply added the cost of these components of value into the total cost of overhead.
(4) Finally, we have needed to embed KVA in a solid, useable, flexible software product that would provide the analytic power and storage capacity to undertake large-scale, complex KVA research and practical applications.

Latest developments and future possibilities

KVA theory has been tested in a wide variety of practical and academic settings since its creation, including in collaboration with several leading management consulting firms such as Deloitte & Touche, KPMG, and Ernst & Young. We continue to refine and use it as an analytic tool for major IT projects and other organizational initiatives where intellectual capital is the focus of concern. Since early 2004, we have focused heavily on revisiting and addressing the limitations discussed above. By mid-2005, KVA will finally be embedded in software capable of unleashing its full potential. Once KVA becomes more universally utilized and larger pools of KVA data have been gathered across time and industries, it will supply valuable benchmarking information that is both consistent over time within the organization and comparable among organizations and industries. At that time, some of the IC asset transparency and comparability issues that plague accounting and finance can be addressed more successfully.

Currently, we are in the process of exploring and publishing the implications of KVA theory for fundamental financial theory and for the practice of real options analysis. We have developed and introduced such concepts as an endogenous knowledge market, the knowledge asset pricing model, k-betas, and an exogenous sub-corporate equities market. We are also using KVA data and knowledge market theory to resolve some of the long-standing limitations faced by practitioners of real options analysis (Nelson and Housel, 2005).

Finally, we hope that KVA theory will evoke new avenues of research and application within the consulting sector regarding the measurement and management of IC assets. Perhaps it may provide this sector with one additional key to further unlocking Information Age wealth creation on behalf of client companies world-wide.

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