Knowledge management performance evaluation: a decade review from 1995 to 2004

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Abstract.

In this paper, the development of knowledge management (KM) was surveyed, using a literature review and classification of articles from 1995 to 2004. With a keyword index and article abstract, we explored how KM performance evaluation has developed during this period. Based on a scope of 108 articles from 80 academic KM journals (retrieved from six online databases), we surveyed and classified methods of KM measurement, using the following eight categories: qualitative analysis, quantitative analysis, financial indicator analysis, non-financial indicator analysis, internal performance analysis, external performance analysis, project-orientated analysis and organization-orientated analysis, together with their measurement matrices for different research and problem domains. Future development directions for KM performance evaluation are presented in our discussion. They include: (1) KM performance measurements have tended towards expertise orientation, while evaluation development is a problem-orientated domain; (2) different information technology methodologies, such as expert systems, knowledge-based systems and case-based reasoning may be able to evaluate KM as simply another methodology; (3) the ability to continually change and obtain new understanding is the driving power behind KM methodologies, and should be the basis of KM performance evaluations in the future.

Keywords: knowledge management; performance evaluation; literature survey

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1. Introduction

A knowledge-based economy is emerging, and knowledge management (KM) is being rapidly disseminated in academic circles, as well as in the business world. While an increasing number of companies have launched knowledge management initiatives, a large proportion of these initiatives retain a technical perspective. The problem with this type of focus is the exclusion and neglect of potential benefits that may be derived from knowledge management. The following types of question are proliferating: is it really worthwhile to invest in KM? Has our implementation of KM been a success? Is our KM system productive and effective?

Recent surveys indicate that issues such as 'measuring the value of KM' and 'evaluating KM performance' are of great importance to managers in places like Asia [1], the United States [2] and the United Kingdom [3]. Given the increasing role of KM in upgrading business competition, the interest of managers, in measuring and evaluating both KM performance and its benefits, is not surprising [4]. This brings up an important research issue: how do most firms that have initiated KM develop appropriate metrics to gauge the effectiveness of their initiative? In other words, there is

a need for metrics to justify KM initiatives. Our research objective was therefore to analyze a variety of evaluation perspectives, in order to estimate knowledge management performance.

This paper is focused on surveying knowledge management development through a literature review and classification of articles from 1995 to 2004, in order to explore KM performance evaluation during that period. This survey methodology is valuable for a number of reasons. First, it brings an issue into focus by defining and detailing its various characteristics. Second, the results of a survey are typically quantified and therefore amenable to statistical analysis. Third, statistical inference allows one to extend the results obtained from a sample of respondents to a large population, thereby permitting a wider application. Fourth, the survey methodology is fast and straightforward, compared to many other research methods. In addition, our goal was not only to examine the research trend in KM performance evaluation changes, but also to understand the gap between the academic and the business world. For this reason we used a questionnaire survey to investigate high-technology organizations and verify if there really exists a gap in academic research. As a result, the questionnaire survey had a significant relationship with the dependent variables. In other words, it was reasonable to use qualitative, quantitative, internal performance, external performance, project-orientated and organization-orientated analyses to evaluate KM performance. Hence, these six perspectives will be used in our literature survey methodology to classify and evaluate KM performance.

There are two reasons for choosing this period to survey knowledge management development. First, the knowledge spiral was proposed to corporations and organizations in 1995, and this model plays important roles, not only in conducting academic research studies, but also in creating, exploiting and recycling knowledge within the business environment. Second, there is no doubt that KM existed prior to 1995. KM has been rapidly disseminated in academic circles as well as in the business world because of Nonaka and Takeuchi's influential book. However, while an increasing number of companies launched knowledge management initiatives, KM still remained in the theory, model, and application development phases. Recently, the research trend has moved towards 'how to measure KM performance'. Therefore, our goal was to examine the research trend in KM performance evaluation changes, using two phases, distinguishing the first five years (1995–1999) from the second five years (2000–2004). Finally, we hope that the distinction between these two five-year periods will be evident. The history of KM evolution, over the past decade, can be seen in Figure 1.

This literature survey began in January 2005. It was based on a search for 'knowledge management' in the keyword index and article abstract within the ISI, Elsevier SDOS, IEEE Xplore, EBSCO, Ingenta and Wiley InterScience online databases, for the period from 1995 to 2004, in which 3699 articles were found. After topic filtering, there remained 108 articles, from 80 journals, related to the keyword 'knowledge management performance evaluation'. In addition, ISI Web of Knowledge, an integrated Web-based platform, provides high-quality content and the tools to access, analyze, and manage research information. We also used the 'keyword' and 'subject category' functions to analyze the selected articles. We found that the first five fields were Management (20%), Computer Science and Information Systems (19.2%), Information Science and Library Science (16.2%), Operations Research and Management Science (12.7%), and Computer Science and Artificial Intelligence (10.4%). Based on the scope of these 108 articles, from 80 academic KM journals, this paper surveyed and classified KM measurements into the following eight categories: qualitative analysis, quantitative analysis, financial indicator analysis, non-financial indicator analysis, internal performance analysis, external performance analysis, project-orientated analysis and organization-orientated analysis, together with their measurement matrices for different research and problem domains.

The basic underlying assumption is that knowledge may be viewed from a unified perspective; it circulates in the organization creating knowledge assets and influences the performance of the organization. It has multifaceted characteristics, such as: state of mind, object, having access to information, or the potential for influencing future action. We summarized the distinctions between these perspectives about knowledge in Table 1.

The remainder of the paper is organized as follows. Section 2 explains the methodology used to classify KM measurements into the above eight categories. Section 3 presents the survey results of KM performance evaluation, based on the above categories, respectively. In Section 4, a discussion offers suggestions for the future development of KM performance evaluation, while in Section 5 we present a brief conclusion.

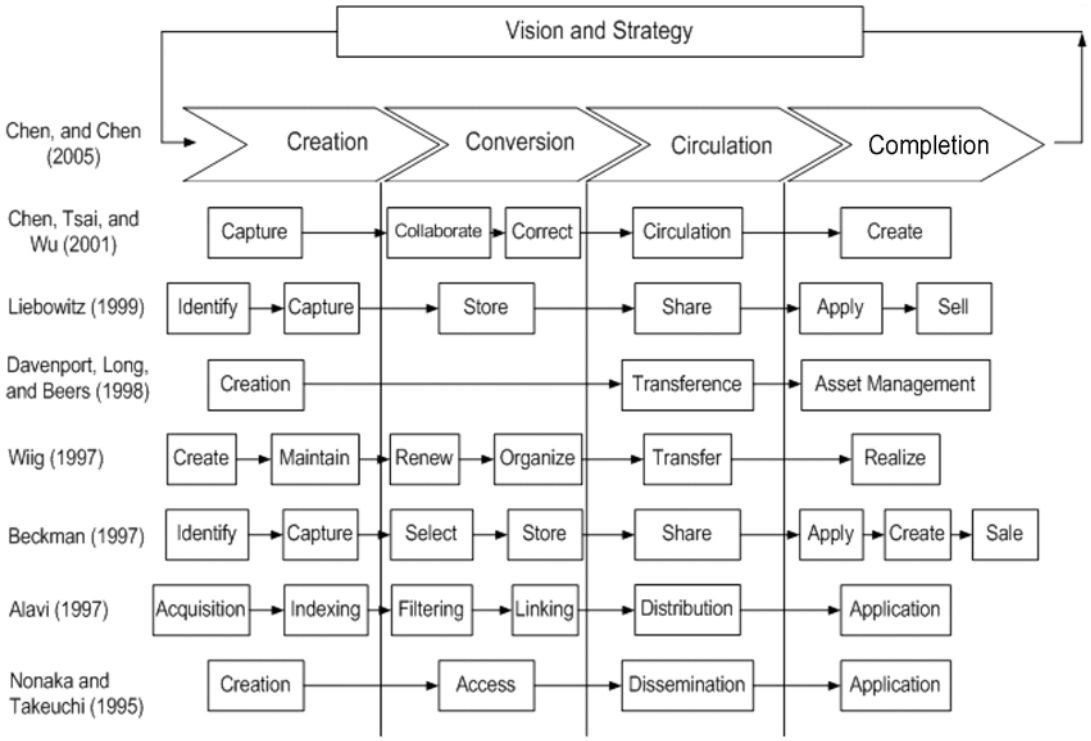

Fig. 1. The KM process [5–12].

Table 1
Diverse perspectives of knowledge and implications for KM [7, 13]

	Perspectives	Implications for KM
State of mind	Knowledge is the state of knowing and understanding	KM involves enhancing an individual's learning and understanding through the provision of information
Object	Knowledge is an object to be stored and manipulated	Key KM issue is building and managing knowledge stocks
Process	Knowledge is a process of applying expertise	KM focus is on knowledge flows and the process of creation, conversion, circulation and carrying out
Access to information	Knowledge is a condition of access to information	KM focus is organized access to, and retrieval of, content
Capability	Knowledge is the potential to influence action	KM is about building core competencies and understanding strategic know-how

2. Methodology of the literature review

2.1. Measures

In this study, we have examined various KM performance evaluation perspectives, using path analysis with structural equation modeling (SEM). A survey, conducted among existing KM project members, who were corporate employees, was analyzed using LISREL software. Path analysis is an extension of the regression model, used to test the fit of the correlation matrix against two or more causal models, which are being

compared by the researcher. A regression is done for each variable in the model that is dependent on others, which the model indicates as causes. The regression weights, predicted by the model, are compared with the observed correlation matrix for the variables, and a goodness-of-fit statistic is calculated. The best fitting, of two or more models, is selected by the researcher as the best model for the advancement of the theory. Path analysis, in the main, has two models: 'Path Analysis with Observed variables' (PA-OV) and 'Path Analysis with Latent Variables' (PA-LV). In this study, we adopted the PA-OV model to observe each performance evaluation perspective, because there were no latent variables in the PA-OV model; all variables in this model were manifest variables.

Our research has emphasized the evaluation of knowledge management performance. We reviewed the literature on the following categories: qualitative analysis, quantitative analysis, internal performance analysis, external performance analysis, project-orientated analysis and organization-orientated analysis. Moreover, we obtained 21 items representing various dimensions underlying KM performance evaluation, and these were used to form the initial item pool for the scale in the questionnaire. To make sure that important aspects of KM performance were not omitted, we conducted experience surveys and personal interviews with two professionals, four college teachers, and two CKOs (chief knowledge officers). They were asked to review the initial item list of the scale, and approved the items. Consequently, the 21-item list was considered to constitute a complete domain for KM performance measurement.

In addition, we designed a mediation variable – Knowledge Management Evaluation (KME), which presented the total score from the previous six main items. The higher the KME score, the better it expresses the knowledge management evaluation. Although it is important to understand the score of the KME, our aim is to analyze the KM performance in the business. In other words, KME is just an evaluation tool to present the KM performance. As a result, the variable – Knowledge Management Performance (KMP) – is dependent on the KME status, which uses a 10-point scale, scored by the administrator. Again, the higher the score, the more successful the knowledge management performance. Finally, we also designed a moderator – 'Time' – to prove that there was a significant relationship between KME and KMP through *T*-value analysis. Therefore, there was a total of nine observation variables in our model.

For that reason, our exploratory instrument involving 24 items (as shown in the Appendix), with the one variable – KMP – perceived overall performance and given the success of the knowledge management criterion, the instrument was developed using a 10-point Likert-type scale, with anchors ranging from 'strongly unimportant' to 'strongly important'. For each question, respondents were asked to circle the response which best described their level of agreement. The KMP can be used to analyze the criterion-related validity of the instrument and to measure overall significant relationships prior to detailed analysis. After careful examination of the result of experience surveys and interviews, the statements were further adjusted to make their wording as precise as possible.

2.2. Subjects

The data used to test the research model was obtained mainly from five international organizations: the Taiwan Semiconductor Manufacturing Corporation (TSMC), the United Microelectronics Corporation (UMC), the Coretronic Corporation, the Trea Autotech Corporation, and IBM Taiwan. Each company already had KM implemented, and each respondent had experience involving KM projects or in using a KM system. The respondents completed a self-administered, 24-item questionnaire. For each question, respondents were asked to circle the response which best described their level of agreement with the statements. Of the 300 surveyed, 269 useful responses were returned, and thus the response rate was 89.6%. The respondents averaged 34 years of age and had an average of five years experience in KM; the male-to-female ratio was approximately 1.8 to 1. Thirty-nine percent had completed a college or university degree only, while 45 percent had obtained postgraduate degrees. Table 2 gives the detailed information for the questionnaire survey.

2.3. Model assumptions

The KME and KMP in our model were dependent variables. When the KME is a dependent variable, the 'Qualitative (X_1)', 'Quantitative (X_2)', 'Internal Performance (X_3)', 'External Performance (X_4)', 'Project-Oriented (X_5)', 'Organization-oriented (X_6)', and 'Time (X_7)' are all independent variables. When the KMP is a dependent variable, the 'Time (X_7)' and 'KME (X_8)' are independent variables. The regression equation is shown as follows:

Table 2
Details of the questionnaire survey

		TSMC	UMC	Coretronic	Trea Autotech	IBM, Taiwan
Industry		IC Manuf.	IC Manuf.	LCD-TFT	Automation	IT
Survey		60	60	60	60	60
Respondent	Deptartment	KM	KM	KM	IT	KM
	Position	CKO and Members	CKO and Members	CKO and Members	Manager and Members	Consultants
	Average experience	6	4	4	6	5
	Average age	38	36	31	31	34

$$Y_1 = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + a_1 \quad (1)$$
$$Y_2 = b_7X_7 + b_8X_8 + a_2$$

Where a is the intercept, and b is the regression coefficient.

Because path analysis is an SEM application, the SEM equation is shown below:

$$y = \alpha + \beta y + \Gamma_X + \zeta \quad (2)$$

where α = intercept, β = regression coefficient, and Γ = regression coefficient between dependent and independent variable.

The model, shown in Figure 2, has four assumptions, which are described below:

(1) The variables can all be observed.
(2) Each dependent variable has two explained disturbances (ζ_1, ζ_2).
(3) y_1 has seven structural parameters, from γ_1 to γ_7.
(4) y_2 has two structural parameters, from β_1 to β_2.

2.4. *Path and T-value analysis*

The relationships related to the performance evaluation perspectives were tested using LISREL path

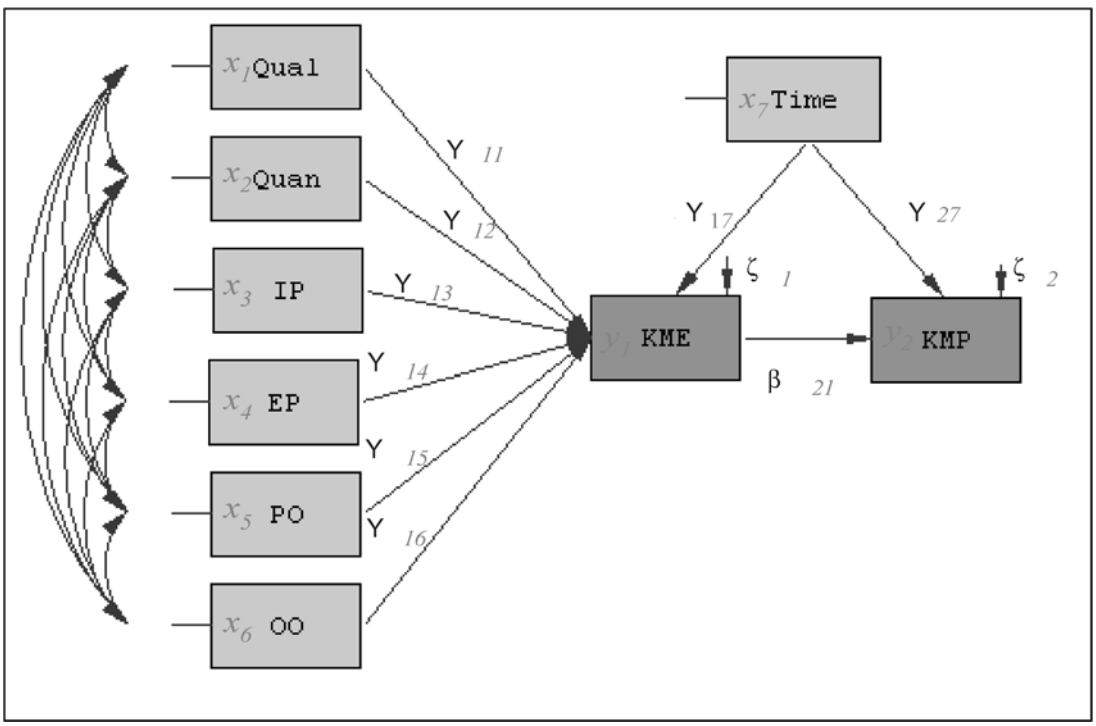

Fig. 2. Path analysis model.

analysis. This provided estimates of the parameters and tests of fit for the linear structural equation model; Figure 3 shows these model relationships as well as the fit measures for the model. The chi-square statistics tested the hypothesis that the proposed model could generate the observed data. What this means is that when the chi-square values are statistically significant, the observed data can be closely patterned by the hypothesized model. Figure 4 shows the *T*-value analysis between the six performance evaluation perspectives and KME and KMP. The main findings are described as follows:

(1) Qualitative analysis and quantitative analysis are important in evaluating KM. This is because γ_{11} and γ_{12} are 0.25 and 0.21, respectively and similarly, γ_{11} (t = 4.38) and γ_{12} (t = 3.70) are significant at the 0.001 level, showing that both the qualitative and quantitative analyses are observable indicators for KM evaluation. In addition, the γ_{15} (t = 3.01) and γ_{16} (t = 2.20) are also significant at the 0.01 and 0.05 levels, respectively.

(2) None of the independent variables had a direct effect on KMP. However, these independent variables may influence the KMP through the mediation variable – KME. As shown in Figure 2, all independent variables had significance in the chi-square statistic tests, especially for X_1, X_2, X_5 and X_6.

(3) Time (X_7) had a high 'total effects' value in this questionnaire analysis. The γ_{17} and γ_{27} were 0.13 and 0.2, respectively. In the meantime, X_7 had an indirect effect, with KMP (Y_2), of 0.06. Therefore, the total effect was 0.26 between Time (X_7) and KMP (Y_2). The γ_{27} (t = 4.52) also had significance at the 0.001 level, showing Time as a critical observable indicator for KM evaluation and performance.

2.5. Results

The detailed questionnaire analyses are summarized in Table 3. From these statistics, some interesting facts may be noted:

(1) Qualitative and quantitative analyses had the most significant relationships with KME and KMP. The aim of the quantitative analysis was to present the extent of the impact on both decision making and task performance, using historical data that is easily available, relevant, accurate and timely. This type of evaluation may avoid the drawbacks of qualitative analysis, especially in the subjective judgments of empirical results. Therefore, KM performance was measured by two quantitative methods: financial and non-financial indicators. Using two indicators to analyze the data was more effective than using quantitative analysis alone.

(2) Project-orientated and organization-orientated analyses had the second most significant relationships with KME and KMP.

(3) Internal and external performance analyses had relationships with the lowest significance to KME and KMP. However, we found that γ_{13} (t = 0.61) and γ_{14} (t = 0.78) still had positive relationships with KME and KMP.

(4) In this research, we used interview by questionnaire methodology in five famous international organizations. Each company had already implemented KM, and each respondent had experience involving KM projects or in using a KM system. Our questionnaire survey included six independent variables: qualitative analysis, quantitative analysis, internal performance analysis, external performance analysis, project-orientated analysis and organization-orientated analysis. In addition, we designed a mediation variable – Knowledge Management Evaluation (KME), since it presented the total score from the previous six independent variables. As shown in Table 3, the independent variables had a significant relationship with the KME in the chi-square statistic tests. In other words, it was suitable and reasonable to use qualitative, quantitative, internal performance, external performance, project-orientated and organization-orientated analyses to evaluate KM performance. Hence, these six perspectives to classify and evaluate KM performance, were used in our research. Most important of all, we use the results from path analysis to ensure our classification of KM performance evaluation is compatible with our literature survey. In this way, the gap between the academic and business worlds has been reduced.

3. Knowledge management evaluation perspective

3.1. Qualitative analysis

A universally accepted definition of KM does not yet exist. While there is debate as to whether knowledge itself is a cognitive state, a process or an object, the

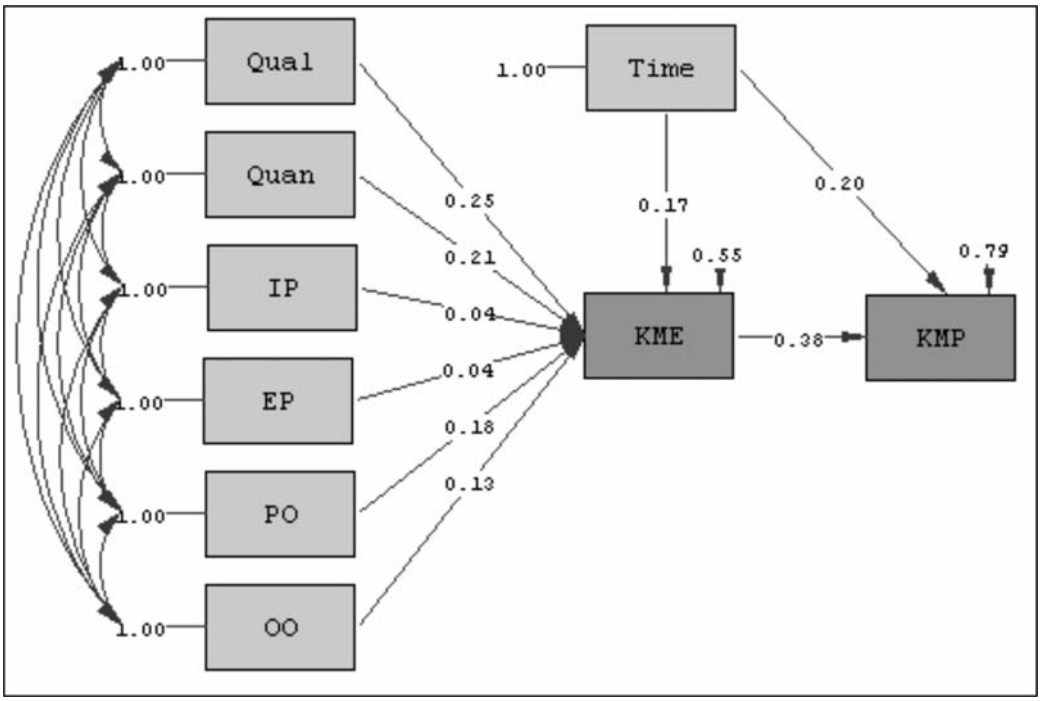

Fig. 3. LISREL path diagram for KM performance evaluation.
(Qual: qualitative; Quan: quantitative; IP: internal performance; EP: external performance; PO: project-orientated; and OO: organization-orientated.)

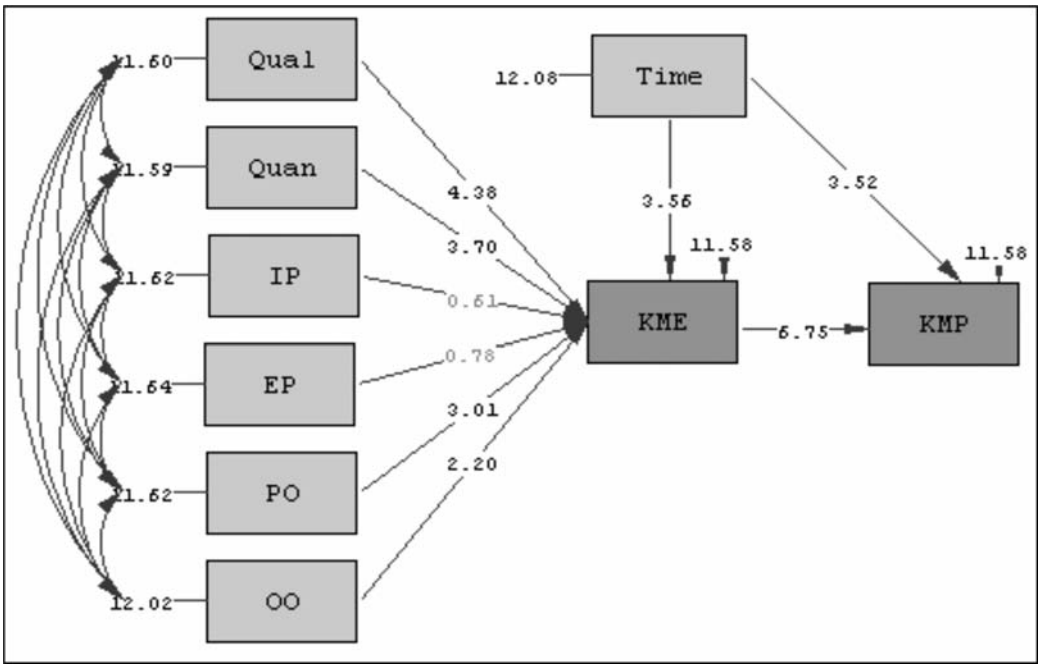

Fig. 4. *T*-value analysis.

Table 3
Summary of path analysis

Independent variables	Dependent variables			
	Knowledge management evaluation (Y_1)		Knowledge management performance (Y_2)	
	Standardized	*t*-values	Standardized	*t*-values
Qualitative (X_1)				
Direct effects	0.25	4.38***	–	–
Indirect effects	–	–	0.09	3.29***
Total effects	0.25	4.38***	0.09	3.29***
Quantitative (X_2)				
Direct effects	0.21	3.70***	–	–
Indirect effects	–	–	0.08	3.24**
Total effects	0.21	3.70***	0.08	3.24**
Internal performance (X_3)				
Direct effects	0.04	0.61	–	–
Indirect effects	–	–	0.01	0.60
Total effects	0.04	0.61	0.01	0.60
External performance (X_4)				
Direct effects	0.04	0.78	–	–
Indirect effects	–	–	0.02	0.77
Total effects	0.04	0.78	0.02	0.77
Project-orientated (X_5)				
Direct effects	0.18	3.01**	–	–
Indirect effects	–	–	0.07	2.75**
Total effects	0.18	3.01**	0.07	2.75**
Organization-orientated (X_6)				
Direct effects	0.13	2.20*	–	–
Indirect effects	–	–	0.05	2.09*
Total effects	0.13	2.20*	0.05	2.09*
Time (X_7)				
Direct effects	0.17	3.56***	0.2	1.37
Indirect effects	–	–	0.06	3.15**
Total effects	0.17	3.56***	0.26	4.52***
Knowledge management evaluation (X_8)				
Direct effects			0.38	6.75***
Indirect effects			–	–
Total effects			0.38	6.75***

*t-value > 1.96, $p < 0.05$.
**t-value > 2.58, $p < 0.01$.
***t-value > 3.29, $p < 0.001$.

description of KM as a process is based on understanding an organization as a knowledge system [14]. As Polanyi observed, 'we can know more than we can tell' [15]. The notion of tacit knowledge was introduced by Polanyi, a philosopher made known to a larger audience by being quoted in the writings of Kuhn in 1962 [16]; this notion has since had a renaissance, due to the writings of Nonaka [17] and Nonaka and Takeuchi [11].

While referring to and building on the arguments of Polanyi, different scholars have arrived at contradictory conclusions. Cook and Brown argue, in what they claim is agreement with Polanyi, that 'explicit and tacit are two distinct forms of knowledge, and that one form

cannot be made out of, or changed into, the other' [18]. In contrast, Tsoukas, also building on Polanyi, claims that tacit and explicit knowledge are mutually constituted and should not be viewed as two separate types of knowledge [19]. In a critique of Nonaka, Tsoukas further argues that tacit knowledge is not explicit knowledge internalized. In fact, tacit knowledge is inseparable from explicit knowledge since 'tacit knowledge is the necessary component of all knowledge'. It seems that most scholars share the opinion of Cook and Brown, that it is useful to treat tacit knowledge as separate from explicit knowledge.

Consequently, because of the methodology, qualitative means are suitable to measure tacit knowledge. Qualitative research includes an array of approaches that share some non-quantitative methods. Several have a well-established and widely respected place in the social sciences and social work. The qualitative research approach has been refined by using the outcomes of pilot studies and reviews by researchers in organizational learning. For example, the success of knowledge sharing in organizational culture is not only technological but also related to behavioral factors [20–22]. Besides, expert interviews, critical success factors (CSFs) and questionnaires are used to implement qualitative methods in exploring specific human problems.

From the organizational perspective, attention to an organization's internal controls has increased significantly since the 1990s. Although management is ultimately responsible for ensuring that internal controls are adequate, managers often lack knowledge of internal control concepts. Changchit et al. used a questionnaire in examining an expert system which could facilitate the transfer of internal control knowledge to management [23]. The results indicated that expert systems are viable aids for transferring internal control knowledge to managers, whose work experience is outside the field of accounting and control systems. Longbottom and Chourides reported on interviews with key staff within organizations, at various stages of approaching and deploying KM programs [24, 25]. In a follow-up paper, the research investigated issues concerning the CSFs and measurements of KM, establishing practical and key factors likely to enhance successful implementation. It accessed a range of critical factors and identified appropriate measures over five organizational perspectives: strategy; human resource management; information technology; quality; and marketing [26]. Furthermore, ASSESS is a prototype decision support system for managing tacit assessment knowledge, which uses knowledge management system techniques [27]. These techniques include databases, internet architecture and artificial intelligence. The qualitative analysis framework methodology is categorized in Table 4.

3.2. Quantitative analysis

Returning to the literature, we learn that Nonaka and Takeuchi defined explicit knowledge or codified knowledge as knowledge that can be articulated through formal language, including grammatical statements, mathematical expressions, specifications and manuals [11]. Such explicit knowledge, they concluded, can be transmitted easily and formally between individuals. Choo suggested that explicit knowledge is knowledge made manifest through language, symbols, objects and artifacts [28].

The aim of quantitative analysis is to present the extent of the impact on both decision making and task performance, using historical data that is easily available, relevant, accurate and timely. This evaluation can avoid the drawbacks of qualitative analysis, especially in the subjective judgment of empirical results. Therefore, a quantitative research approach is designed to represent a tangible, visible and comparable 'ratio'. In other words, quantitative analysis can be used to measure the explicit knowledge of an organization or an individual, with both financial and non-financial indicators; this is discussed below. Table 5 shows the benefits and classes of KM, with qualitative and quantitative indicators.

3.2.1. Financial indicator analysis. Traditional quantitative methods focus on well-known financial measures, such as analyses of financial statements, payback periods, return on investment (ROI), net present value (NPV), return of knowledge (ROK), and Tobin's *q*. These methods are best suited to measure daily transaction processing system values.

Table 4
Qualitative analysis

Research methodology	Authors
Questionnaire	Changchit et al. (2001)
Expert Interviews	Longbottom and Chourides (2001) Longbottom and Chourides (2002)
Critical Success Factors	Chourides et al. (2003)
Decision Support System	Mitri (2003)

See References [23–27].

Table 5
benefits of qualitative and quantitative indicators

Knowledge management benefits	
Qualitative index	Quantitative index
• Improving employees' skills • Improving quality strategies • Improving core business processes • Developing customer relationships • Developing supplier relationships	• Decreasing operation costs • Decreasing product cycle time • Increasing productivity • Increasing market share • Increasing shareholder equity • Increasing patent income

The goal is to expand business leaders' knowledge of the key drivers of customer satisfaction and business process excellence, strengthening their skills to develop profitable growth strategies, based on customer value added (CVA) [29]. Laitamaki and Korduplesk used an ROI index to evaluate KM projects and performance in CVA. From the managerial perspective, Stein et al. deployed a knowledge-based system, which was designed to automate tasks previously performed manually, train new staff members, and capture knowledge, to enable a university organization to improve services. Performance evaluation used NPV to diagnose the project outcome. Finally, the system could be viewed as an estimation tool, giving a competitive advantage to the organization [30]. From an empirical point of view, it is well known that Tobin's q ignores replacement costs for intangible assets, because of the accounting treatment of intangibles [31]. Tangible assets are capitalized and reported on firms' balance sheets. In contrast, intangibles are expensed, i.e. written off on the income statement, along with regular expenses such as wages, rents and interest. As a result, the book value of assets does not reflect the stock of intangibles, resulting from cumulative investments; market value does, however. In fact, it is a fairly common practice, in studies using Tobin's q as a measure of corporate performance, to 'correct' the denominator of q for the presence of such intangibles. Examples include knowledge capital [31, 32], or customer assets [33]. Villalonga also used Tobin's q to test empirically the hypothesis that the greater the intangibility of a firm's resources, the greater the sustainability of its competitive advantage [34]. The results suggest that intangibles can help firms to maintain a persistent advantage. Stein et al. also presented a knowledge-based system, to assist furnace production staff in diagnosing and correcting faults in electron beam guns, which are used to melt titanium [35]. This project used payback period analysis to measure future cash flows over a three year period. In financial strategy, bank failure prediction is an important issue for the regulators of the banking industry. Very often, bank failures are due to financial distress. Early Warning Systems (EWS) may be able to identify the inherent traits of financial distress, based on financial covariates derived from publicly available financial statements. An EWS is a knowledge management system, which uses a knowledge base to aid in bank regulation. [36]

Unfortunately, evaluation methods which rely on financial measures are not as well-suited for complicated IT applications. These systems typically seek to provide a wide range of benefits, including many that are intangible in nature. For example, it is difficult to quantify the full value of a point-of-sales (POS) system [37] or an enterprise resource planning (ERP) system [38].

A number of researchers have written about the use of option models in IT investment decision making. The pioneering work of Dos Santos [39] employed Margrabe's exchange option model [40] to value an IS project, using a novel technology for testing. He argued that the option model would be better than NPV to evaluate the new IT project. Similarly, Kambil et al. [41] used the Cox–Rubinstein binomial option pricing model [42], to determine whether or not a pilot project should be undertaken.

For a software platform, several options may be relevant. In an analogy to Kester's 'growth options' for firms [43], Taudes investigated options for evaluating 'software growth options' [44], which could bring valuable software platform benefits.

Benaroch and Kauffman [37] investigated the problem of investment timing, using the Black–Scholes model in a real-world case study dealing with the development of point-of-sale (POS) debit service. Their contribution did not ask whether an investment should be undertaken, but when to exercise the option held, i.e. when to implement a particular IT solution. In a follow-up paper [45], they used sensitivity analysis to probe Black–Scholes valuation for IT investment opportunities. Taudes et al. [38] also compared NPV with the Black–Scholes valuation method, which they used to employ SAP R/2 and to switch to SAP R/3. Their results also indicated that, in the absence of a formal evaluation of the time option, traditional

Table 6
Financial indicator analysis

Research methodology	Authors
Return on investment	Laitamaki and Kordupleski (1997)
Net present value	Stein et al. (2001)
Tobin's *q*	Ittner and Larcker (1998) Hall et al. (2000) Lev (2001) Villalonga (2004)
Payback period	Stein et al. (2003)
Financial statements	Tung et al. (2004)
Options	Benaroch and Kauffman (2000) Taudes et al. (2000)

See References [29–38].

approaches to evaluating information technology investments would have produced the wrong recommendations. The methodology of financial index analysis is categorized in Table 6.

3.2.2. Non-financial indicator analysis. Measurement requires a medium- to long-term commitment from both senior management and the entire staff, and potentially offers little impact on financial performance, in the short-term. The drivers underpinning knowledge performance measures, such as teamwork, learning, communication, knowledge processes, tools and techniques, etc., require non-financial performance measures to ensure that progress is being made, as well as to determine where and when to take corrective action. In fact, non-financial methods are quite different from traditional financial statement analysis, using non-financial indexes, such as the 'frequency' of employee logins to the knowledge base, how many 'times' each employee comes up with a proposal, how many 'topic numbers' are on the KMS discussion board, the level of customer 'satisfaction', the depth of 'loyalty' of employees, and the 'number' of communities of practice (CoP) within the company. These indexes are all related to behavioral factors and system usage. Moreover, non-financial indexes are as important as financial indexes, and belong to quantitative analysis.

One good thing about KM is that a company can retain the knowledge it has acquired, even after the source of the knowledge (the employee) has moved on. In terms of human resource training, focus must be placed on developing people who are capable of turning internal knowledge into organizational knowledge. Performance appraisal aims at bringing organizational improvement through effectively directing employee behavior. Yahya and Goh investigated performance appraisal characteristics and their respective association with KM [46]. The feedback generated was then used for the purpose of promoting or encouraging better KM practices, especially from the knowledge transfer phase to the knowledge application phase.

Communities of practice have begun to play an increasingly important role in modern, knowledge-intensive organizations. CoPs foster knowledge development and creative interaction among highly specialized experts, helping to channel their efforts towards areas of most need. Smits and Moor presented a Knowledge Governance Framework, which focused on how to define, measure, and use performance indicators for KM in a CoP. The results were successful and offer useful guidelines for KM procedures [47].

To manage knowledge successfully, it must be measured. It is not always clear how this can be done, however, as proper measurements may not exist and, indeed, knowledge may be immeasurable. To address this issue, Ahn and Chang assessed the contribution of knowledge to business performance, rather than trying to measure the value of knowledge directly [1]. They provided a way to assess the contribution of knowledge to business performance, by employing products and processes as intermediaries. Product knowledge is directly related to a company's specific product. Process knowledge is associated with the activities performed at each stage in a value chain, from inbound logistics to customer care. In the same way, Holt et al. used four metrics to access organizational knowledge, including individual, context, content and process knowledge measures [48]. These approaches enable us to relate knowledge to business performance more explicitly, and provide valuable insight into how knowledge may be strategically managed.

Organizational performance must usually be defined using non-monetary metrics, making it relatively difficult to measure. Though it can be measured indirectly, using 'intermediate' measures, such as the number of new ideas, the number of new products, job satisfaction levels, and the contribution of knowledge management activities to organizational performance, these are difficult to translate into tangible benefits. Organizational performance is as important as financial performance; organizational quality can indirectly influence financial performance, serving as a moderating factor. The methodology of non-financial index analysis is categorized in Table 7.

Table 7
Non-financial indicator analysis

Research methodology	Authors
Human resource training	Yahya and Goh (2002)
Communities of practice	Smits and Moor (2004)
Product and process knowledge assessment	Ahn and Chang (2004)
Individual, context, content and process knowledge assessment	Holt et al. (2004)

See References [46–48].

3.3. Internal performance analysis

Internal performance measurement methods focus on process efficiency and goal achievement efficiency. These methods evaluate KM performance through the gap between target and current value. Well-known methods include ROI, NPV, balanced scorecard (BSC), performance-based evaluation, activity-based evaluation and other models.

Underlying Kaplan and Norton's concept of BSC was that all aspects of measurement have their drawbacks; however, if companies offset some of the drawbacks of one measure with the advantages of another, the net effect can lead to decisions resulting in both short-term profitability and long-term success [49–51]. As a result, they suggested that financial measures be supplemented with additional ones, reflecting customer satisfaction, internal business processes and the ability to learn and grow. Many scholars have discussed the use of a Balanced Scorecard approach in determining a business-orientated relationship between strategic KM usage and IT strategy and implementation [52–54]. They have applied an IT investment to KM, by creating a KM scorecard focusing on both the current financial impact of intellectual capital on core processes, and future earnings capabilities in structural or human capital.

Most research on KM has been limited to individual levels or knowledge transfer within organizations. However, firm innovation capability is the most important determinant of product performance and competitive ability. Competitive advantage has a significant positive economic value for a firm, and the main purpose of KM is to retain sustainability. Cavusgil et al. used three items to measure innovation performance [55]. They measured whether the innovation project had succeeded in achieving its main objectives: financial and ROI. The contribution lay in its performance-based measures and the values of inter-firm relationships in tacit knowledge transfer, as well as innovation capability.

As mentioned earlier, valuable knowledge resides within individual employees and is critical to an organization's ability to solve problems and create new knowledge. In a sense, KM can be viewed as an activity which acts as a constituent of a community, performing one's task by using tools or technology [56, 57]. Some KM studies have taken an IT perspective, where enterprise information portals (EIPs) are gateways that streamline access to information, thereby easing the task of transforming data into knowledge, thus increasing KM efficiency. Kim et al. stressed the importance of activity theory, by using it to evaluate EIP systems in the context of knowledge integration or application [58]. The analysis revealed that EIP functions, from a KM activity perspective, remain underdeveloped.

Many measurement systems have failed to be effective, because they are disparate, often measuring activities that are of local or individual interest to a manager, rather than a key activity for the business. Pervaiz et al. proposed a model founded upon a continuous improvement methodology. This model utilized a Deming type PDCA (Plan-Do-Check-Act) cycle [59]. The proposed measurement framework enabled the effective and efficient leveraging of knowledge assets. The methodology of internal performance analysis is categorized in Table 8.

3.4. External performance analysis

External performance measurement methods always compare a firm with benchmark companies, primary

Table 8
Internal performance analysis

Research methodology	Authors
Balanced scorecard	Van Grembergen and Vander Borght (1997) Martinsons et al. (1999) Fairchild (2002)
Performance-based evaluation	Cavusgil et al. (2003)
Activity-based evaluation	Kuutti (1996) Hasan and Gould (2001) Kim et al. (2002)
Plan-do-check-act (PDCA) cycle	Pervaiz et al. (1999)

See References [52–59].

competitors or the industry average. For example, benchmarking is the process of determining who is the very best, who sets the standard, and what that standard is. When we apply the benchmarking concept to business, the following types of questions are asked: 'Which company has the best manufacturing operation?' and 'How do we quantify that standard?' With benchmarking or best practice methodologies, firms can understand their KM performance by comparison with competitors. Thus, firms can retain a competition advantage and expand the gap between themselves and competitors.

Traditionally, benchmarking has been described as a practice that promotes imitation. However, according to a more recent approach, benchmarking has looked outside a firm's boundaries, to enable comparison with others, in terms of both practice and performance, in order to acquire both explicit and tacit knowledge [60–62]. Such newly acquired knowledge, once integrated with a firm's prior internal knowledge, may create new knowledge that can give rise to improvements and innovations. Benchmarking is also seen as a tool for identifying, understanding and adopting best practices, in order to increase the operational performance of intellectual capital (IC) [63, 64]. From an organizational learning perspective, benchmarking is concerned with enhancing organizational performance, by establishing standards against which processes, products and performance can be compared and consequently improved [65]. Furthermore, all the organizational factors examined in both sectors proved to be statistically significant, when comparing world-class and potentially winning companies with their competitors; this adds weight to the argument that the existence of organizational learning, within a company, is an essential ingredient in the quest for superior performance.

In the endlessly hyped knowledge age of the new millennium, evaluators are being asked to generate lessons learned and best practices. Lessons learned (local knowledge about what works) can be converted to best practices (universal knowledge about what works, at least by implication of being best). Lessons learned represent principles extrapolated from multiple sources, and increase transferability in the form of cumulative knowledge that can be adapted and applied to new situations. The internal validity of any single source of knowledge must be judged by the criteria appropriate for that type of knowledge. Thus, practitioner wisdom and evaluation studies may be internally validated in different ways [66]. On the other hand, the 'Best Practice' approach is an essential component of KM. It provides an opportunity to retain and use knowledge, even when an expert has left the organization. Asoh et al. investigated how governments could deliver more innovative services to a demanding public [67]. They felt that governments must be involved in the deployment of new services, such as e-Government and e-Commerce. Active management of knowledge assets is mandatory for success. A suggested implementation approach highlights leadership, culture, technology and best practice measurements as critical success factors. The methodology of external performance analysis is categorized in Table 9.

3.5. Project-orientated analysis

Since projects characteristically involve the development of new products and new processes, obvious opportunities may present themselves for novel ideas to emerge and for cross-functional learning to occur, thereby enhancing the organization's innovative capacity and potential. On the other hand, recent studies of knowledge management and organizational learning, in project environments, have emphasized instead the difficulties of learning from projects – not only within individual projects, but also across and between projects [68].

Some articles have set out to examine the significance of social factors in enhancing knowledge management capabilities in the construction industry [69, 70]. Bresnen et al. revealed that processes of the capture, transfer and learning of knowledge, in project settings, rely very heavily upon social patterns, practices and processes, in ways which emphasize the value and importance of adopting a community-based approach to managing knowledge [69]. Bresnen et al.'s paper made a contribution to the development of knowledge management theory, within project environments.

Table 9
External performance analysis

Research methodology	Authors
Benchmarking	Pemberton et al. (2001) Chai et al. (2003) Leung et al. (2004) Massa and Testa (2004) Carrillo (2004) Marr (2004)
Best practices	Patton (2001) Asoh et al. (2002)

See References [60–67].

In recent years, after the term was proposed, numerous individuals and organizations have been trying to put more 'science' behind the 'art' of 'knowledge management'. Rubenstein-Montano et al. found that current project management frameworks did not typically employ a systems approach [71]. For this reason, they suggested that frameworks should be developed within a systems context. With this in mind, Liebowitz provided some useful frameworks to help project managers and others to conceptualize and implement knowledge management initiatives [72]. In the strategy approach, Kamara et al. described a framework for selecting a KM strategy that is appropriate to the organizational and cultural context in KM projects [73]. This approach underscores the fact that knowledge management is not an end in itself, but a means towards the solution of business problems that mitigate inefficiencies and improve the innovative capacity of a company.

Nevertheless, project organizations require particularly systematic and effective knowledge management, if they are to avoid knowledge fragmentation and loss of organizational learning [74]. Kasvi et al. dealt with knowledge management and knowledge competence in project organizations, particularly from a programmer's perspective [75]. Finally, they made a contribution by presenting the Learning Programme Model. In order to systematically manage the knowledge created within a project, the project itself must be systematically managed by the model. The methodology of project-orientated analysis is categorized in Table 10.

3.6. Organization-orientated analysis

With the increasing importance of effective knowledge management in organizations, it has become increasingly important for organizations to be able to measure their 'state of the art' on this subject. Organization-orientated analysis is focused on the entire organization, on the multi-dimensional and multi-layering aspects of the firm. In the horizontal perspectives, KM performance evaluation is focused on leadership, and cultural and technological as well as process dimensions. In the vertical perspectives, KM performance evaluation is focused on strategy, management, and implementation layers. The primary objective is to estimate the level of KM performance from the perspective of the whole organization. KM performance evaluation is carried out using the Skandia AFS (Assurance and Financial Services) model, technology tools and all four perspectives in BSC.

Most organizations have only a vague understanding of how much they have invested in intellectual capital (IC), let alone what they may receive from those investments. Standard financial accounting systems do not allow for the easy estimation of intellectual capital investments. Without methods to measure intellectual capital, many firms are ignorant of its full potential. Among the most widely used approaches for IC management and reporting are the so-called Intangible Asset Monitor by Sveiby and the IC approach by Edvinsson and Van Buren, originally introduced by the insurance company Skandia [76–78]. These models are designed to measure human, innovation, process, and customer capital, and represent a major step toward providing precisely the information that firms and their stakeholders need to foresee the future. Thus, these IC models can help visualize the knowledge-production process of research organizations [79]. In addition, some firms have also used BSC – originally developed for strategic management, control, and performance measurement – for IC management and reporting [80–82].

Knowledge management tools can support the performance of applications, activities or actions, such as knowledge generation, codification or transfer, and also promote and enable the knowledge process, in order to improve decision making. Ruggles claimed that Knowledge Codification is the capture and representation of knowledge, so that it can be accessed, reused and transferred, either by an individual or by an organization [83]. Jackson investigated 59 Knowledge Management tools and examined both the software and technology approaches for knowledge management [84]. Wensley simply discounted any tool that was not web-based, believing that KM tools would only be utilized in an internet environment [85]. Tyndale also evaluated a wide variety of such tools, by examining the literature

Table 10
Project-orientated analysis

Research methodology	Authors
Social patterns	Edelman et al. (2001) Bresnena et al. (2003)
KM project management framework	Rubenstein-Montano et al. (2001) Kamara et al. (2002) Liebowitz and Megbolugbe (2003)
KM project management model	Vartiainen et al. (1999) Kasvi et al. (2003)

See References [70–75].

related to the selection and evaluation of the KM tools available in the software market [86].

Van Den Hooff et al. presented the Knowledge Management Scan, which is an adequate instrument for diagnosing organizations, with the results providing sufficient insight into the organization's knowledge processes [87]. In practice, the scan is repeatedly translated into concrete activities, which improves such processes. The methodological reflection, which is important in the execution of the scan, will lead to an instrument that is practically and scientifically valid; moreover, it will give much valuable insight into the subject of knowledge management. The methodology of organization-orientated analysis is categorized in Table 11.

4. Discussion, limitations and suggestions

4.1. Discussion

KPMG reported that the reasons for the creation of knowledge management initiatives, cited by most companies, are to facilitate better decision making, increase profits and reduce costs [88]. However, KM suffers from the same challenges as many other management issues: it assumes that knowledge is a 'thing', which is amenable to being 'managed' by a 'manager'. It must first be determined which KM process is key to achieving a competitive advantage, and second, which measurement method is the most appropriate to appraise KM performance.

KM performance measurement methods comprise broad categories of research issues. Method development has been diverse, due to researchers' backgrounds, expertise and problem domains [89]. On the other hand, some means of analysis have common measurement concepts and methodologies. For example, the NPV measurement method is used in both financial and internal performance analysis. In addition, the BSC measurement method is used in internal performance and organization-orientated analysis. This indicates that the development trend in evaluation methods is also diverse, due to the author's research interests and ability in the methodology and problem domains. This directs the development of KM performance measurement towards an expertise orientation.

Furthermore, some evaluation methodologies overlap, to a high degree. For example, financial statement analysis, ROI, ROK, payback period and option evaluation methods are all quantitative methods, with different concepts and methodologies, which evaluate KM within a common problem domain. This indicates that these evaluation methods are the major trend for KM development, and that many methodologies are focused on these problems. This can direct the development of KM evaluation towards a problem domain orientation.

As shown in Table 12, we gathered statistics for this KM performance evaluation survey research from 1995 to 2004. We divided this data into eight categories of KM performance evaluation methodologies. Our goal

Table 11
Organizational-orientated analysis

Research methodology	Authors
Technology	Ruggles (1997)
	Jackson (1999)
	Wensley (2000)
	Tyndale (2002)
Process	Van Den Hooff et al. (2003)
intellectual capital	Edvinsson (1997)
	Sveiby (1998)
	Van Buren (1999)
	Leitner and Warden (2004)
BSC	De Gooijer (2000)
	Johanson et al. (2001)
	Bukh et al. (2002)

See References [76–87].

Table 12
A review of articles evaluating KM performance: 1995–2004

Approach	Paper amount	1995–1999	2000–2004
Qualitative	14	4	10
Quantitative	26	10	16
Internal performance	16	6	10
External performance	15	4	11
Project-orientated	17	5	12
Organization-orientated	20	9	11
Total	108	38	70

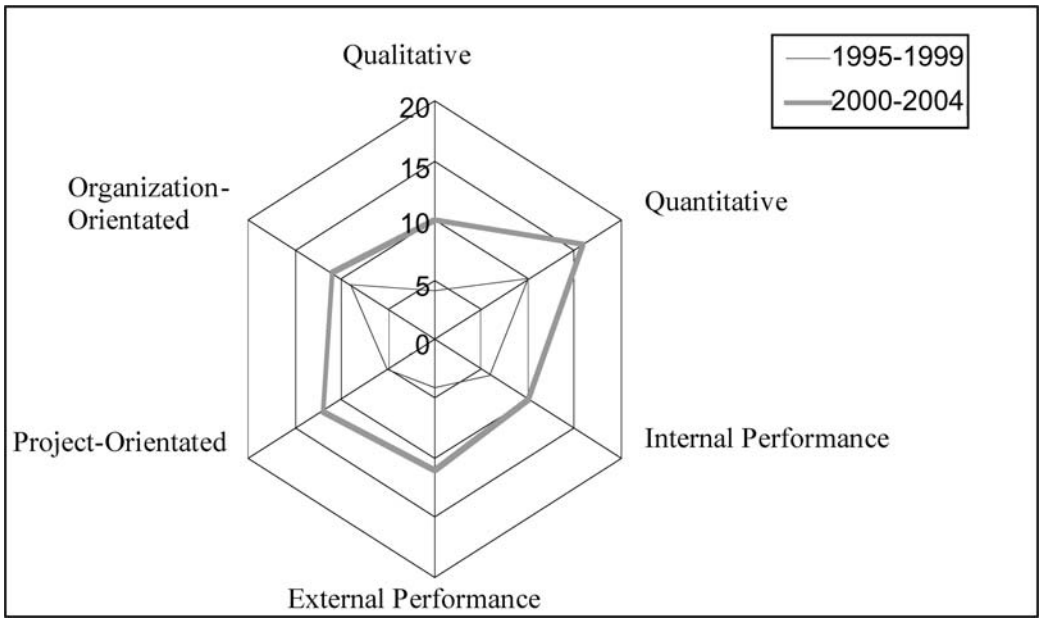

Fig. 5. KM development trend analysis.

was to examine the research trend in KM performance evaluation changes, using two phases, to distinguish the first five years (1995–99) from the second five years (2000–2004). In Figure 5, we can see the change between these first and second five-year periods. The main findings can be described as follows:

(1) KM performance evaluation is becoming more important. Articles published over the last five years are almost double the five years previous to that. This shows that research topics have changed from KM creation, transformation and implementation to the evaluation of KM performance.

(2) Quantitative analysis is the primary methodology used to evaluate KM performance; indeed, most research articles, in the last five years, have involved quantitative analysis. Traditionally, most scholars have suggested financial indicators to display the value of KM; now, more and more scholars are insisting on evaluating KM performance using non-financial indicators, in a social and behavioral sciences approach.

(3) Firms are now highlighting the KM performance of competitors, through benchmarking or best practices, rather than internally auditing KM performance via BSC. In Table 12, we can see that articles outlining the external performance approach have grown quite substantially. These results allow us to infer that, in the future, firms will carefully consider their own KM performance, as well as that of their competitors. For this reason, firms are now using an external performance approach to replace the original BSC framework, using benchmarking or best practices to integrate the four perspectives of BSC activities. It is now evident that past, present and future KM performance can be measured by an external performance approach.

(4) Firms may begin to focus more on project management measurement, than on the entire organization. In Table 12, it can be seen that project-orientated articles have grown considerably, showing that measurement and control of the achieved percentage of scheduled progress in KM project management is becoming a major focus. Measurement of the entire organization's KM performance is very difficult from process, leadership, culture or technology perspectives; it is obvious that better efficiency and effectiveness in KM performance can be reached through a project-orientated approach.

In this paper, most of the articles discussed came from management science and social science journals, found on the five online databases, while a few came from computer and information science journals. It is hoped that different research fields will begin to

publish KM performance evaluation articles, in order to broaden the horizon of academic and practical KM studies.

4.2. Limitations

This analysis and research into KM performance evaluation has several limitations. First, a literature review of this broad category is difficult, due to the extensive background knowledge required to study, classify and compare these articles. Although limited in background knowledge, this paper has presented a brief literature review of KM from 1995 to 2004, in order to explore how KM performance evaluations developed throughout this period. Thus, the first limitation of this article is its scope, in that surveys that focused solely on a specialty domain, or which were proprietary, and therefore inaccessible, were excluded.

Second, the scope of our investigation was further diminished by utilizing only surveys for which we were able to obtain the original documents. Some academic journals listed in the science citation index (SCI) and the social science citation index (SSCI), as well as other practical reports, were not included in this survey. This weakens our conclusions, somewhat, and notably our proposition that the epistemological foundation of survey research in KM performance evaluation turns around eight categories.

A third constraint, constituting possible limitations in the analysis of these eight categories, may require submission to other researchers for further validation.

Fourth, non-English publications were not considered in this survey, so the effects of different cultures on the development of KM performance evaluations were not determined. Many other KM performance evaluations have been published and developed, in addition to those discussed in this article.

4.3. Suggestions

(1) Integration of cultural perspective. In this survey, we obtained questionnaire data from five international high-technology organizations. As such we infer that KM performance evaluation development is closer to that of the information technologies. However, confusion between knowledge and information underlies many of the problems caused by information technology. As Brown and Duguid note, knowledge entails a 'knower', but people treat information as independent and self-sufficient [90]. They argue it is difficult to separate knowledge from information. In addition, Nardi and O'Day define information ecology as 'a system of people, practices, values, and technologies in a particular local environment' [91]. Their goal is to change the way people look at information technology. A key to thoughtful action is to ask more 'know-why' questions, before jumping to the more straightforward 'know-how' questions. Since we are heading into a totally technology-dominated world, it is very important that we not only know 'how' to use a certain technology, but 'why' we use a certain technology. Therefore, by trying to understand technology this way, we will then be able to communicate our thoughts to others and find ways to use technology much more effectively.

(2) Integration of information technologies. KM is an interdisciplinary research issue. Thus, future KM performance evaluation developments will be integrated with information technologies, especially for high-technology organizations; cross- or inter-disciplinary research may offer more methodologies to investigate the challenges of KM performance evaluation.

(3) Integration of options. A major challenge lies in designing models and theories to evaluate the performance and value of KM. Traditional financial analysis indicators have long relied on NPV, simple cost–benefit analysis, critical success factors and other less-structured techniques, to make their assessments. Thus, our literature survey has critically reviewed the case for using option pricing as a basis for KM performance analysis, evaluating its merits in a real-word business setting.

(4) Other computer science methodologies. The definition of KM performance evaluation is not complete in this survey, because other methodologies, such as artificial intelligence, were not included. Data mining and soft computing methods are other research technologies that may be used to solve problems in social studies. Thus, computer science methodologies may include a KM performance evaluation category in future.

(5) Evolution as a source of development. Social and technical evolution may empower the development of KM performance evaluation. To continue creating, converting, circulating and implementing KM processes may be the factors necessary for the successful development of KM. Most importantly, the more KM development is encouraged, the better KM performance evaluation will be.

5. Conclusions

This paper was based on a literature review of Knowledge Management performance evaluation from 1995 to 2004, using a keyword index search. Development of KM performance measurements have tended towards expert orientation, while KM evaluation development is a problem-orientated domain. Different information technology methodologies, such as artificial intelligence, may be another way of implementing KM performance evaluation. Integration of knowledge-based systems, expert systems and data mining technologies may also increase our understanding of this subject. The ability to continually change, and gain new insights into the power of effective KM performance evaluation, will be the core of future KM research.

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Appendix: Questionnaire

	1	2	3	4	5	6	7	8	9	10
I. Qualitative of Method										
Questionnaire	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Expert Interviews	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Critical Success Factors	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Decision Support System	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
II. Quantitative of Method										
Financial Indicator Analysis of Revenue	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Financial Indicator Analysis of Cost	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Non-Financial Indicator Analysis of Human	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Non-Financial Indicator Analysis of Process	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
III. Internal Performance of Method										
Balanced Scorecard (Internal Business Perspective)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Performance-based Evaluation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Activity-based Evaluation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Plan-Do-Check-Act Cycle	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
IV. External Performance of Method										
Benchmarking	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Best Practices	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
V. Project-Oriented Method										
Social Patterns	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
KM Project Management Framework	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
KM Project Management Model	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
VI. Organizational-Oriented Method										
Technology	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Process	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Intellectual Capital	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
BSC	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7	8	9	10
VII. Knowledge Management Performance										
Knowledge Management Evaluation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knowledge Management Evaluation of Method	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Time of Performance	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Respondents will checkmark the level that best describes their degree of agreement with the statements. The higher the level, the more important the evaluation of knowledge management.

Personal Data

Age: _____ Sex: Male ☐ Female ☐

Company: _____ Department: _____ Position: _____ Experience: _____ years

Education: High School ☐ College ☐ University ☐ Postgraduate ☐