

## **Utilizing the Balanced Scorecard for Performance Measurement of Knowledge**

### **Management**

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#### ***Abstract***

*Knowledge management (KM) is important if firms are to achieve and sustain a competitive advantage. However, measuring KM performance over time can be quite complex due to the inherent uncertainty of the exercise. The main purpose of this article is to explore integrated performance-measurement systems that evaluate financial and non-financial performance of a knowledge-management system. To achieve this, the concept of KP methodology is integrated in a knowledge-management system with the Balanced Scorecard (BSC) to present a model that can be used by firms to link resources and business activities to the firm's strategic objectives. The study presents examples of how firms can apply this integrated performance measurement system to knowledge management.*

**Keywords:** Knowledge management; Balanced Scorecard; Performance measurement; Strategy

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## I. Introduction

In the modern era of a 'knowledge economy' (Nonaka, 1994; Nonaka & Takeuchi, 1995) and knowledge-based competition (Drucker, 1993), knowledge is widely recognized as an important critical resource in seeking a competitive advantage (Quinn, 1992; Doz, 1996; Sveiby, 1997; Teece, 1998). An organization needs to be able to secure various types of knowledge assets and maximize their strategic value, and organizations are therefore examining and arranging their business strategies, processes, information technologies, and organizational structures from a knowledge perspective (Davenport, Jarvenpaa & Beers, 1996). Adoption and assimilation of the knowledge management (KM) paradigm requires the design and establishment of structures, processes, and technologies in accordance with the organization's knowledge resources (Lee & Kim, 2001).

For effective knowledge management (KM), it is important to measure knowledge. Without valid and reliable measurement, no progress can be made in treating knowledge as a variable to be researched or as an asset to be managed (Glazer, 1998). However, the inherently intangible characteristic of knowledge makes its measurement difficult. In fact, in a survey of 431 US and European organizations, 43% of respondents stated that measuring the value and performance of knowledge assets was their most difficult task, apart from changing people's behavior (Ruggles, 1998).

Effective management depends on the effective measurement of performance and results. However, it is increasingly becoming accepted that traditional measures centered on financial criteria are inadequate for the contemporary business environment (Brown and Laverick, 1994). Attention to a wider range of measures related to quality, market share, customer satisfaction, and employee satisfaction can provide greater insight into the factors which drive financial performance. Most crucially, a shortfall in these non-financial performance measures can provide an early warning of an impending shortfall in financial performance, and thus facilitate timely remedial action to moderate the damage to the financial results. However, the protection of short-term financial performance is not the main driver of the search for a more complete set of performance measures. Broader performance measurement systems are increasingly seen as a means for delivering long-term strategic objectives.

The implementation of management strategies in a changing environment requires integrated performance-measurement (PM) systems that evaluate changes in financial and non-financial measures. Integrated PM systems strive to align the organization's processes (KM, research and development, production, marketing, and other traditional functional

areas) with the corporate strategy by applying both performance drivers and outcome measures. Integrated PM systems provide managers at all levels with a clear statement of what actions they should take to implement strategy. In this, KM activities do not exist as independent, isolated operations; rather, they represent a critical component of strategy execution. There is therefore a need for application of the existing PM literature in the context of KM. The primary challenge that faces KM performance measurement is the integration of cost data (which are oriented to the past) with strategic and financial objectives (which are prospective and long term). Against this background, the objective of the present study is to demonstrate that the Balanced Scorecard (BSC) framework can be applied as an integrated PM program for KM.

In pursuing this objective, the present study draws on both the business literature and the performance-measurement literature. In particular, Bremser and Barsky (2004) extended the work of Kerssens-van Drongelen and Bilderbeek (1999) and Pearson et al. (2000) by integrating a popular research and development (R&D) management framework, the 'Stage-Gate approach' (Cooper, 1993), with the BSC (Kaplan and Norton, 1996a). The present study develops the work of Bremser and Barsky (2004) by integrating a KM management framework with the BSC. By measuring both financial and non-financial performance in the context of overall strategic and operational goals, this approach provides a practical means of measuring KM performance. The present study uses metrics based on four matrices of the so-called 'KP3 methodology' (Ahn and Chang, 2004) to evaluate and control KM investment in a BSC framework.

Following this Introduction, the remainder of this paper has four main sections. The next section discusses the importance of the strategic integration of performance measurement. The following section describes the strategic importance of KM activities. This is followed by a discussion of the usefulness of the BSC to KM managers. The paper concludes with a summary of the main findings of the study.

## **II. Strategic integration of KM performance measurement**

### **1. The BSC model**

Missions and visions are distilled into objectives and targets, and form an important part of the balanced scorecard (Kaplan and Norton 1992, 1993, 1996). The authors argued that the BSC is both a tool for organizational learning and improvement and also a good performance-measurement system (Kaplan and Norton 1996a). The four perspectives of the BSC are: (i) financial; (ii) customer; (iii) internal business process; and (iv) growth and

learning. Knowledge-related objectives are obviously applicable to some of these perspectives. For example, the growth and learning perspective typically includes strategic objectives for training and development, technology, and teamwork; and the third perspective, the internal business process perspective, can include objectives for product/service innovation and business-process improvement. Chemical Bank's BSC mentions knowledge of the product/service portfolio and financial markets as elements of customer, learning and growth objectives (Kaplan, 1996), and Mobil Oil's BSC includes core competencies and skills (Kaplan, 1997).

Competitive intelligence, industry analysis, and environmental scanning are used to assess threats and opportunities in the external environment. A 'knowledge map' covering such matters as competitors, substitute technologies, potential entrants, customers, and suppliers can be developed. This map might include a directory of corporate experts as sources of knowledge on the Internet. Companies such as Ernst & Young and Arthur Andersen have successfully implemented such a directory of knowledge sources (Drew, 1999). Some observers have also suggested using intelligent software agents over the Internet to collect up-to-date competitive and scientific information/knowledge.

Kaplan and Norton (1992, 1993, 1996b) presented the concept of the BSC in a series of articles in which they argued that traditional financial accounting measures—such as the return on investment (ROI), return on sales (ROS), earnings per share (EPS), and payback period—offer a relatively narrow and incomplete picture of business performance that does not consider the creation of future business value. They therefore suggested that financial measures should be supplemented with additional measures that reflect customer satisfaction, internal business processes, and the ability to learn and grow. Their BSC was designed to complement "... financial measures of past performance with measures of the drivers of future performance" (Kaplan and Norton, 1996b).

The development of the BSC concept in the 1990s reflected an increasing awareness of the assumptions and theories that underlie business process re-engineering (BPR). Many advocates of BPR have argued that the traditional 'industrial age' is being replaced by a new form of competition in the so-called 'information age' (Davenport, 1993, Hammer and Champy, 1993). According to this view, business success was previously based on the efficient allocation of financial and physical resources to achieve economies of scale and scope (Chandler, 1990). However, in the 'information age', the ability to mobilize and exploit intangible intellectual assets (such as knowledge) is becoming more important if companies are to produce and deliver their products and services efficiently. Kaplan and Norton (1996b) proposed the BSC not only as a tool for clarifying and communicating

strategy, but also as a foundation for actively managing it, and it has been suggested that a BSC-based system could become an organizational activity support system (Cecez-Kecmanovic, 1994). Such an action-oriented framework—including customer-based business processes rather than a focus restricted to financial results—could assist managers to monitor and improve business performance (Pinson, et al., 1997).

Future-oriented, process-based metrics have been proposed as a key element in a management strategy that drives performance improvement and enables senior management to make better decisions that prepare their organization for the future (Brynjolfsson et al., 1997, Rainer and Walson, 1995). Such a strategic management system should include a mission and vision (the purpose and intention of the organization), strategic objectives (derived from the mission and vision), and performance measures (to monitor the strategic objectives through well-chosen indicators).

Firms that invest significant knowledge-based resources in ongoing activity can benefit from the key concepts of the BSC, which applies an integrated PM system to implement strategy. A firm can develop an apparently brilliant KM strategy, but actually implementing that strategy is the challenge of KM. The BSC strategic management system developed by Kaplan and Norton (1992, 1993, 1996b, 2001a) requires firms to translate strategic goals into relevant measures of performance. Both financial and non-financial measures are indicators of the extent to which strategies are successfully being implemented throughout the organization.

There are five basic principles for a strategy-based organization applying the BSC (Kaplan and Norton, 2001b), which can be summarized as follows (Bremser and Barsky, 2004): (i) translate the strategy into operational terms applying balanced scorecards and strategy maps; (ii) align the organization to the strategy by passing the highest-level scorecard down to strategic business units, support departments, and external partners; (iii) ensure that strategy is perceived as being ‘everyone’s job’ by incorporating initiatives that create strategic awareness and by using personal scorecards with related incentives; (iv) make strategy an ongoing process by linking budgets to strategy, implementing a process for learning, and adapting the firm’s strategy; and (v) mobilize leadership for change to a strategic management system.

**Andy, see below: Text states Kaplan and Norton 1996b; however, your reference list does not designate any 1996 reference as ‘b’. Please review this notation.**

The highest-level scorecard is usually implemented at the firm level, but the BSC can be implemented at the division level or the department level. The BSC framework is used

to implement strategy from four perspectives (Kaplan and Norton, 1996a): (i) customers; (ii) internal business processes; (iii) learning and growth; and (iv) financial performance. The first of these, the customer perspective, addresses the question: ‘To achieve our vision, how should we appear to our customers?’. The second perspective, the internal business process perspective, addresses the question: ‘To satisfy our shareholders and customers, what business processes must we excel at?’. The learning-and-growth perspective addresses the question: ‘To achieve our vision, how do we sustain our ability to change and improve?’. The fourth perspective, the financial perspective, addresses the question: ‘To succeed financially, how should we appear to our shareholders?’. Taken together, these questions provide a basis for linking strategy with planning and accountability.

The BSC is designed to link and align the organization with its strategy at all levels. After the BSC is formulated at the top level of the organization, it is passed down to strategic business units and support departments. These units develop their own scorecards to implement the strategy communicated from the scorecard at the firm level. These BSC scorecards at department level are, in turn, passed down to the individual level. This provides for each staff member having an understanding of his or her role in overall strategy implementation. For each measure in the personal scorecard, goals of strategy implementation are set. Incentives such as stock options and income incentives are linked to the staff member’s performance in implementing strategy. Measurements are applied throughout the organization to implement strategy.

An integrated PM system aligns KM, R&D, production, marketing, and other traditional functional units, with corporate strategy applying both performance drivers (leading indicators) and outcome measures (lagging indicators). In this context, there is a need to expand KM performance measurement from a traditional cost-based approach to incorporate strategic and profitability objectives. The challenge for KM performance measurement is to integrate past-oriented cost data with prospective long-term strategic and financial objectives.

### **III. Cause and effect**

A strategy is a set of assumptions about cause-and-effect relationships. If cause-and-effect relationships are not properly reflected in the BSC, the firm’s vision and strategy will not be translated and communicated through all levels of the organization. These cause-and-effect relationships might involve one or more of the four perspectives of the BSC framework. For example, better personal skills (learning and growth perspective) will reduce the frequency of ‘bugs’ in an application (internal business processes

perspective). An application with fewer ‘bugs’ will be more likely to meet end-user expectations (customers perspective). This will enhance the support of core business processes (financial performance perspective).

For BSC, the leading indicators are the performance of driver-oriented metrics. A strategy includes a set of hypothesized cause-and-effect relationships. If the firm does certain things (cause), a value-creating result will occur (effect). A strategy map can be applied to show the cause-and-effect relationships (Kaplan and Norton, 2001a). For example, a firm might hypothesize a value proposition that increasing the average quality of a new product or service will increase customer retention. In this case, the average quality of the new product or service would be a leading indicator on the balanced scorecard, which would also include an outcome measure of customer retention. The scorecard would also include a financial outcome-based measure such as ROI or economic value-added (EVA). If the average quality of a new product or service did increase for several months or quarters, a subsequent improvement in customer retention would be expected, along with improvement in the financial outcome-based measure. If the subsequent improvement is not realized, the set of hypothesized cause-and-effect relationships associated with the strategy would require reassessment. By implementing a process for learning, and then adapting the firm’s strategy, the firm goes beyond the traditional budget-oriented management control loop and applies a strategic learning loop to test hypothesized strategies. Increasing the strategic learning loop should provide the motivation for change to a new strategic management system.

A firm might apply the key concepts of BSC, rather than adopting a formal BSC management system. The BSC assists managers to implement strategy through the development of integrated financial and non-financial measures. Properly selected non-financial measures should be drivers of sustained profitability. KM presents a context in which past financial results and future expectations must be considered concurrently in managing progress towards strategic goals.

#### **IV. Performance measurement of KM and shareholder value creation**

Business performance can be assessed in financial terms or in organizational terms. Financial performance is directly affected by how products and services perform in the market. Depending on the characteristics of the product and service, different metrics can be applied. The typical metrics for measuring financial performance are revenue, EVA, profit, and so on. Satisfactory financial performance is a prerequisite before KM activities can be adopted and diffused in the regular business activities.



Organizational performance is usually defined in terms of non-monetary metrics, and is therefore relatively difficult to measure. Although it can be measured indirectly using various 'intermediate' measures (such as the number of new ideas, the number of new products, and the job satisfaction level), it is difficult to assess the contribution of KM activities to organizational performance in terms of tangible benefits. Nevertheless, organizational performance is important because organizational quality can be a moderating factor that indirectly influences financial performance. However, despite the fact that many firms recognize the link between KM and business performance, few have been able to establish an explicit causal link between them, regardless of how it is measured (Davenport, 1999). This remains a significant item on the research agenda (Teece, 1998).

Although various studies have attempted to develop metrics and models to measure knowledge (Dehoog and Van der Spek, 1997, Edvinsson, 1997, Liebowitz, 1999, Liebowitz and Wright, 1999, Roos and Roos, 1997), measurement remains one of the most difficult aspects of KM (Ruggles, 1998). Indeed, some studies have argued that knowledge itself cannot be measured, although the activities or outcomes associated with the application of knowledge can be measured (Davenport and Prusak, 1998).

Measuring the value created by KM is thus a challenge. Some attempts have been made to evaluate KM (Davenport, 1999; Teece, 1998), and Ahn and Chang (2004) have developed the so-called 'KP3 methodology' to assess the contribution of knowledge to business performance by employing product and process as intermediaries between the two. Apart from these studies, few papers on the performance of KM can be found in the literature.

### **1. KP<sup>3</sup> methodology**

The KP3 methodology developed by Ahn and Chang (2004) enables an assessment to be made of the contribution of KM activities to business performance. The present study extends the KP3 methodology by aligning it with the BSC. The methodology establishes logical links between knowledge and business performance through product and process concepts, and suggests various application areas for improving business performance. Applying these linkage metrics, the contribution of KM to business performance can be assessed. Because the direct link between KM and business performance and its assessment are inherently difficult for practical implication, a two-step approach is proposed by applying product and process as intermediates.

In the framework of extended KP3 methodology presented here, KM assists business performance through products and processes, which serve as key intermediaries. Figure 1



provides an overview of the extended KP3 methodology. This includes four components: knowledge, process, product, and performance. Knowledge is further subdivided into product-related knowledge and process-related knowledge. Take in Figure 1 about here

Four components are linked together through four linkage matrices: (i) a knowledge–product matrix; (ii) a product–performance matrix; (iii) a knowledge–process matrix; and (iv) a process–performance matrix. The purpose of the linkage matrices is to link knowledge to business performance through product and process. Specifically, product knowledge is linked to product by the knowledge–product matrix, and further linked to business performance—which includes four perspectives (financial, customer, internal business process, learning and growth)—by the product–performance matrix. On the other hand, process knowledge is linked to process by the knowledge–process matrix and further linked to business performance by the process–performance matrix. Process is indirectly linked to product performance (represented as a vertical dotted arrow in Figure 1). These linkages enable the monitoring of all four business performances, and allow for action to be taken to improve them through KM activities.

In knowledge-intensive firms, product/service is the explicit output of the value-adding activities or production processes of the organization, whereas process is the procedure that transforms information and knowledge input into an explicit output in an efficient way. Product knowledge thus tends to be more objective in that it is focused on a specific product, whereas process knowledge is relatively more generalized.

Product knowledge is knowledge directly related to the firm’s specific product or service. On the basis of studies by Hall (1992), Day (1994), and Hitt et al. (2000), three key forms of product knowledge can be identified: technology-related knowledge, operations-related knowledge, and market-related knowledge. Technology-related product knowledge includes manufacturing ‘know-how’ and understanding of technical functions for a specific product. Operations-related product knowledge is knowledge that is concerned with the value-chain activities of a specific product. According to Hall (1992), the most important form of knowledge in this area is ‘employee know-how’. Finally, market-related product knowledge is product-specific understanding of the behavior of suppliers, competitors, and customers.

Process knowledge is knowledge associated with the activities performed in each stage of a value chain from logistics to customer care. Compared with product knowledge, which is directly related to the provision of products or services, process knowledge brings the organization’s knowledge assets together and enables the achievement of better business performance (Day, 1994).

Because core processes, such as product-development processes, demand-management processes, and order-fulfilment process are important activities that produce products or services and eventually determine the performance of a company, they need to be well managed (Miller and Dess, 1996). Process knowledge should make the core process the most efficient and productive contributor to all four perspectives of performance.

## **2. KM metrics**

To represent the relationships of KM to business performance, four linkage matrices are employed to link the four components of the KP3 methodology. They are the knowledge-product matrix, the product-performance matrix, the knowledge-process matrix, and the process-performance matrix. The knowledge-product matrix links product knowledge to product and is basically product-related. Product knowledge can be measured for each individual at a certain point of time, and later updated. The product-performance matrix links product to performance—usually a financial performance that is achieved through knowledge activities. The knowledge-process matrix links process knowledge to process, and is primarily process-related knowledge. The process-performance matrix links process to organizational performance. This matrix shows how each core process contributes to organizational performance. Because organizational performance is sometimes viewed differently for different processes, process-related performance metrics can be developed for each process, depending on the management needs.

Knowledge productivity in terms of organizational performance can be defined separately for each core process or as an aggregate level for a specific product division. The sample metrics at KM department level corresponding to the strategic indicators at firm level are selected on the basis of the four matrices described above (see Table 1). Take in Table 1 about here.

## **3. Role of the balanced scorecard**

The BSC is a performance-measurement system (PMS) for implementing strategy, which can be used in many ways to achieve organizational goals. Kerssens-van Drongelen (1999) proposed seven possible measurement system functions for a PMS, which are listed in Table 2. This table also shows how the BSC model fulfils the seven functions when fully implemented. The strategic goals and measures designed for the top level of the firm are passed down through divisions and departments to the individual level. The value of the BSC is that it links measures to strategy in a clear fashion. The traditional budget-oriented management control loop is improved because budgets are linked to strategy. A strategic

learning loop is applied to test hypothesized strategies and update strategies. The BSC is thus a measurement model that can be used effectively by professionals in all functional areas. (Take in Table 2 about here)

#### **4. Putting the tools together: KM and the BSC**

Firms applying the BSC framework to implement strategy should put most non-financial metrics directly or indirectly related to KM in the internal business perspective section at the corporate level. The KM process is important in implementing these strategies, and the operational processes need to be efficient, effective, and timely. The important implication of applying the BSC for KM is the idea of measuring performance applying a balanced mix of strategic and financial indicators over time.

#### **5. Cascading KM metrics**

An example of specific KM metrics selected from the list in Table 1 for a BSC framework is proposed as shown in Table 4. The four perspectives of the BSC provide a context for the measures. The above-mentioned literature suggests many possible measures. The proposed BSC implementation process includes careful selection of measures to implement strategy. Measures will keep changing due to the strategic learning loop. In this example, strategic indicators at the firm level and measurements at the KM department level are cascaded from the firm level.

A cascading approach is proposed to obtain a consensus agreement between managers at the senior level with those at lower levels. The process begins with a statement of strategic indicators at the firm level. These measurements are communicated to divisions, which can pass a prepared balanced scorecard down to the department below. Departments at the next level can review all possible metrics for their balanced scorecard that are linked to the measures that have been passed down.

For instance, if the KM department is the next level below the firm level, the KM department would set strategic goals that are aligned with the firm's goals. The department would select the metrics that are closely linked to the strategic goals. For strategy implementation, the BSC should focus on the most critical measures. The new metrics must promote alignment. A given metric is a promising candidate if it has a positive impact at a higher level. The thinking underlying the metrics selected are documented and sent to the next level for discussion. Sometimes, changes are required in the metrics at the upper and lower levels in order to achieve consensus agreement. Finally, the

KM department's scorecard is passed down to the next organizational levels, so that they can prepare balanced scorecards in a similar fashion.

The BSC model includes goals for strategic competencies and strategic technologies, and a context for action (Kaplan and Norton, 2001b). All measures should be in alignment with the firm's strategic objectives even though some measures are naturally unique to KM. For example, as shown in Table 3, the firm-level employee retention (Item M) is captured at the KM department level by the strategic skill coverage ratio (Item 27) and KM training, development budget (Item 20), employee training (Item 29) and turnover/retention of KM employees (Item 24). Employee development (N) is also associated with training (Item 29) and turnover/retention of KM employee (Item 24). Strategic skill coverage ratio (by competency category) is cascaded down into Items 13, 14, 15, 22, 23, 24, and 25 for department skill. The number of papers and patents is shown to be associated only with Item O. The cascading process strives to achieve as much alignment as possible. The documented relationships used to check hypothesized strategies are important for the strategic learning loop.

The internal business process measures are formulated as three types of outputs contributing to knowledge strategy (Loch and Tapper, 2002): new technologies & breakthrough concepts, customer support, knowledge repository and external reputation. For knowledge-intensive firms, KM is central to the internal business process perspective. Three strategic indicators selected at firm level—staff productivity (Item J), new product or service efficiency (Item K), and improvement of product or service (Item L)—are captured by metrics Items 13, 14, 15, 16, 17 and 18 at KM department level.

From the customer perspective, The BSC model considers customer satisfaction, retention rate, acquisition, and market share. The KM department can affect these directly or indirectly. The customer responses provide KM with insights into all activities operated in all levels.

From the financial perspective, measures at firm level for revenue growth and productivity are proposed. The financial outcomes through financial measures reflect value creation driven by success in the customer, internal, and learning and growth perspectives. The value creation by the KM department level affect the financial outcomes through the customer, internal, and learning and growth perspectives, and the value created will result in future revenues and profits. The firm level's overall financial objectives (Items A–E) are passed down to KM value-creation measures (Items 1–6).

The BSC is thus provides a useful model for overcoming the difficulties in measuring and implementing a KM system. It is apparent that the BSC can be used to assist the KM department in measuring performance and achieving operational excellence. The model is applicable in all organizational levels and in various operating environments.(Take in Table 3 about here)

## V. Conclusions

In today's competitive environment, knowledge is very important if knowledge-based high-tech firms are to sustain their competitive advantages; however knowledge is difficult to measure by traditional financial metrics. Implementing management strategies requires integrated performance and measurement systems that capture changes in financial and non-financial measures. The proposed BSC model presented here provides a basis for linking measures to strategy. The integrated performance measurement is an essential element for effective measuring and managing of a KM system. Drawing upon the literature and the wide array of metrics that have been used to measure KM performance, the present study concludes that integrated metrics that combine several types of quantitative and qualitative measures can best demonstrate the perceived cost/benefit of each alternative.

The study thus overcomes the limitations cited in the extant KM literature about performance measuring and managing value creation by demonstrating the value of the BSC as an integrated performance-measurement system. The BSC can thus serve as a decision-support tool for KM managers. It can be applied not only to assess the contribution of a specific KM system, but also to evaluate the performance and guide the activities of a KM department or functional area.

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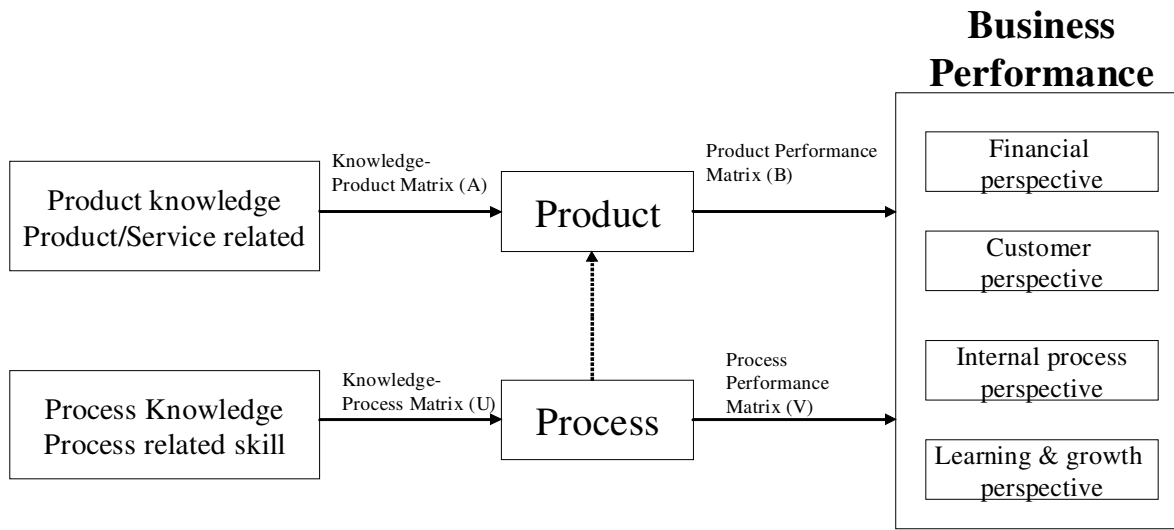


Fig. 1 Overview of the extended KP<sup>3</sup> Methodology

Table 1. The sample metrics at KM department level associated with four matrices of KP<sup>3</sup> methodology

Matrices of KP <sup>3</sup> methodology	Sample metrics at KM department level
Knowledge-Product matrix ( <i>product-related knowledge</i> )	<ul style="list-style-type: none"> <li>● Revenue from KM-related products and services</li> <li>● Percentage of value creation from new products or services</li> <li>● Product or service market cycle</li> <li>● Customer satisfaction with new products or services</li> <li>● Average time required to address an customer problem</li> <li>● Percentage of resources devoted to application development</li> <li>● Time required to develop a standard-sized new application</li> <li>● Number of new products or services approved</li> <li>● Time spent to repair bugs and fine-tune new applications</li> <li>● Productivity of KM employees</li> <li>● Number of papers or patents published</li> </ul>
Product-Performance matrix ( <i>financial performance</i> )	<ul style="list-style-type: none"> <li>● Percentage over/under overall KM budget</li> <li>● Revenue from KM-related products and services</li> <li>● Financial evaluation based on traditional measures (e.g., ROI, ROE, ROS, payback period)</li> <li>● Percentage of resources devoted to strategic projects</li> <li>● Percentage of resources devoted to planning and review of KM activities</li> <li>● Percentage of value creation from new products or services</li> </ul>

	<ul style="list-style-type: none"> <li>● Product or service market cycle</li> <li>● KM training and development budget as a percentage of the overall KM budget</li> </ul>
Knowledge-Process matrix <i>(process-related knowledge)</i>	<ul style="list-style-type: none"> <li>● Percentage of resources devoted to strategic projects</li> <li>● Percentage of resources devoted to planning and review of KM activities</li> <li>● Average time required to address an customer problem</li> <li>● Percentage of time spent by KM manager in meeting with corporate executives</li> <li>● Percentage of new idea approved</li> <li>● Time spent to repair bugs and fine-tune new applications</li> <li>● KM training and development budget as a percentage of the overall KM budget</li> <li>● Turnover/retention of KM employees</li> <li>● Strategic skill coverage ratio by competency category</li> <li>● Employee survey measures</li> <li>● Employee training (hours)</li> </ul>
Process-Performance matrix <i>(organizational performance)</i>	<ul style="list-style-type: none"> <li>● Customer satisfaction with new products or services</li> <li>● Perceived satisfaction of KM employees</li> <li>● Number of customer queries handled</li> <li>● Number of new products or services approved</li> <li>● Productivity of KM employees</li> <li>● Perceived satisfaction of top management with the reporting on how specific emerging technologies may or may not be applicable to the company</li> <li>● Number of papers or patents published</li> </ul>

Table 2. Performance measurement system (PMS) functions and the Balanced Scorecard (excerpt from Bremser and Barsky, 2004)

<i>Performance Measurement System (PMS) functions</i> (per Kerssens-van Dronglen et al., 2000)	<i>How the Balanced Scorecard is useful</i> (per Kaplan and Norton 2001a)
Provide insight into deviations and actual performance from objectives, in order to support the management in diagnosing whether, and if so which, steering measure should be applied	The BSC utilizes causal sets of performance measures to monitor results, Variance analysis of metrics provides insight into deviation from objectives.
Fuel learning as to how the system that has to be controlled works (in other words, improving the conceptual model of this systems' functioning), which enables better planning and control in the future	The primary purpose of the BSC is to highlight strategy and its impact on operating decisions. Utilizing the BSC over multiple periods provides the basis for feedback (strategic learning loop and management control loop) and planning.

Facilitate alignment and communication of objective	The BSC provides a common framework and reference point for employees across levels and functions. The cascading process provides for alignment.
Support decision making about performance based rewards	Most BSC organizations link objectives to personal rewards to guide employee decision making. In fact, Mercer & Company (1999) report that 88% of BSC companies link performance to rewards.
Provide insight into deviation of actual performance from objectives, in order to support the staff themselves in diagnosing whether, and if so which, steering measures should be applied	The requirement to use causal linkages throughout the BSC forces employee to analyze performance deviations and identify, assess and manage drivers of outcomes and results
Provide inputs for justification of the existence, decisions and performance	BSC objectives guides employee decision making and provides a common framework to evaluate decision alternatives.
Support motivating of people through feedback	The BSC requires frequent monitoring and routine feedback of operating measures to employee across organization levels. Target setting and budget goals are intended to provide motivation for employee actions.

Table 3. Illustrated application of the Balanced Scorecard to the KM department.

Strategic objectives	Strategic indicators at firm level	Sample metrics at KM department level
Financial perspective	A. Return on capital employed	1. Percentage over/under overall KM budget(A, C)
	B. Customer profitability	2. KM expenses per employee(A, C)
	C. Revenue growth rate	3. Revenue from KM-related products and services(A, C)
	D. Percentage of resources to sustain existing products or services	4. Financial evaluation based on traditional measures (e.g., ROI, ROE, ROS, payback period)(A, B, E)
	E. New product or service profitability	5. Percentage of resources devoted to strategic projects (A, C, D) 6. Percentage of resources devoted to planning and review of KM activities (C, D)
Customer perspective	F. Customer retention rate	7. Percentage of value creation from new products or services (D, E)
	G. Market share	8. Product or service market cycle (D, E, G)
	H. Customer satisfaction	9. Customer satisfaction with new products or services (F, G, H)
	I. Customer acquisition (number and Quality)	10. Perceived satisfaction of KM employees

		(D, F)
		11. Average time required to address an customer problem (F, H, I)
		12. Number of customer queries handled (D, F, H)
Internal business process perspective	J. Staff productivity	13. Percentage of time spent by KM manager in meeting with corporate executives(H, J, L)
	K. New product or service efficiency (time to market)	14. Percentage of resources devoted to application development (D, J)
		15. Time required to develop a standard-sized new application (K, L)
	L. Improvement of product or service	16. Number of new products or services approved (K, L)
		17. Percentage of new idea approved (K, L)
		18. Time spent to repair bugs and fine-tune new applications (I, L)
Learning and growth perspective	M. Employee retention	19. Productivity of KM employees (J, K, L)
	N. Employee development	20. KM training and development budget as a percentage of the overall KM budget (C, O, M)
	O. Strategic skill coverage ratio by competency category	21. Expertise with specific existing technologies(N, O, P)
	P. Employee survey measures	22. Expertise with specific emerging technologies
	Q. Innovative culture surveys	23. Age distribution of KM staff (M, P)
		24. Turnover/retention of KM employees (M, N)
		25. Perceived satisfaction of top management with the reporting on how specific emerging technologies may or may not be applicable to the company (O)
		26. Number of papers or patents published (O)
		27. Strategic skill coverage ratio by competency category (M, O)
		28. Employee survey measures (P, Q)
		29. Employee training (hours) (M, N)

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