

# Establishing the Key Performance Indicators of Knowledge Management

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## **Abstract**

*Knowledge represents humans' perception about solving problems in association with their environments. It is a powerful foundation for creating personal and organizational competitive advantage, and therefore enterprises must strive to effectively utilize knowledge for creating value and achieving business objectives. The approaches of management performance measurement developed previously were mainly for the industrial-based era, which are no longer suitable for the knowledge-based age.*

*The key to business success is decided by the knowledge added to products and the value it creates. The knowledge-based economy leads to global competition, and therefore, product value enhancement has become the core issue of business. Traditional performance assessment primarily stresses the previous performance of an organization, which is not a proper means for the KM era. This study intends to discover the main elements related to the Key Performance Indicators (KPI) of knowledge management, which can be divided into two categories according to recent research literature (2002): (1) Interim performance: including strategies and planning, implementation and procedure; (2) Final performance: performance evaluation. This*

*article also proposes examples of items that must be considered when evaluating both short-term and long-term knowledge management performance.*

**Key words:** Knowledge, knowledge management, key performance indicators

## **1. Introduction**

The focal point of business administration during the industrial economic period was to effectively integrate the relevant production factors, and the primary element of production management is to use machinery to process the most effective combination of production factors. Hence, the interaction between humans and machines becomes one of the major research subjects of industrial management. Since business value is decided by the full usage of tangible equipment and the efficiency of using material and production resources, the key task is to convert effectively and efficiently the raw materials into quality products. To improve the production efficiency, better equipment was frequently utilized to replace operators, and it is expected that efficient machinery can lead to higher productivity and enhance the firm's competitive advantage.

However, more than half of the top 500 enterprises listed in Fortune in 1993 disappeared [1]. The so-called traditional industries that were prosperous during 70s and 80s are now facing difficulties in this age of globalization, which explains simply why the production advantages of physical conversion using machines and materials can not guarantee permanent business operation. Only continuous innovations and persistent breakthrough allow enterprises to cope with the fast changing economic environment and therefore stay successful. In other words, management of knowledge and intelligence capital becomes the vital and strategic weapon for enterprises to compete. Knowledge represents the insight possessed by someone to understand the nature of events, and it is the main elements of competency required by personnel to undertake the objectives set by the organizations. It develops the ability of mindset to generate directly or indirectly new concepts and ideas through learning, trying,

recognizing and connecting information. Knowledge can be tangible or intangible; tangible knowledge can be documented for ease of dissemination, while intangible knowledge is difficult to be documented and it represents the core capability and the most important part for enterprises to gain competitive advantage.

The structure of knowledge management can be listed as Figure 1. It can be seen that the objective of KM is to bring values to various operating phases; however, its performance must be subjectively measured to optimize the utilization of limited resources allocated to knowledge management. The difficulties and challenges that enterprises encountered is to find ways to prevent the existing market from being penetrated while exploring the new markets at the same time. To reveal the current business situations, the industrial-based economy and the modern knowledge-based economy are compared and contrasted, and the results are shown in Table 1.

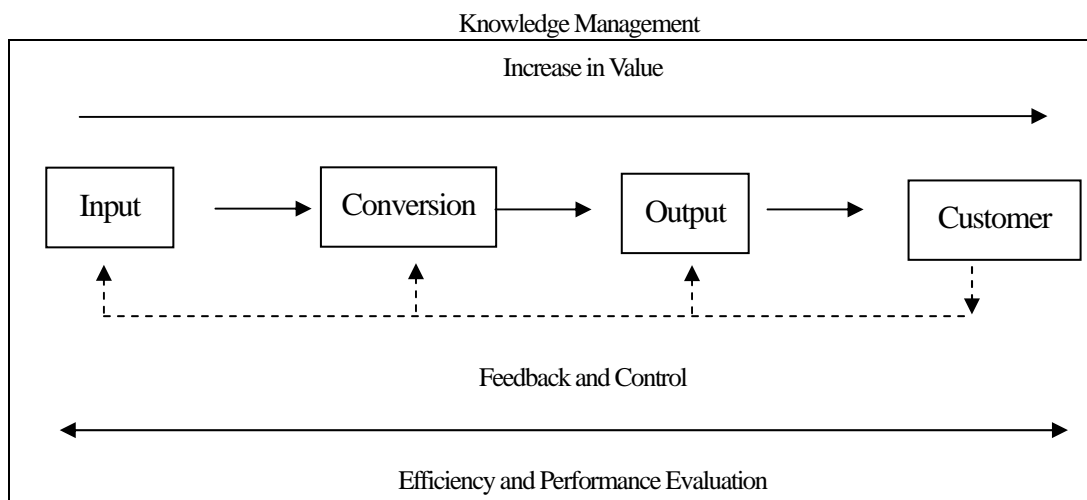


Figure 1 Structure of Knowledge Management

Table 1 Industrial-based Economy and. Knowledge-based Economy

Section	Process of Generating Outcomes	Driving forces
Industrial-based economy	Material → Production Process → Finished → Goods → Price → Profit	Cost, Quality, Delivery
Knowledge-based economy	Data → transformation Process → Information → Knowledge → Value	Innovation, Customer Satisfaction

From Table 1, it is obvious that enterprises in the industrial-based economy were mainly production-oriented, therefore, during the process of producing goods or services, all efforts were devoted to cost reduction, however, price of products could not be easily escalated due to stiff competition. The main reason for this was that many enterprises were able to produce the same products with similar quality level [2, 3]. As a result, this stage was characterized by the deployment of automated facilities, the improvement in production management and training of operation workers. As to the knowledge-based economy, the focus is now shifted to the product itself and the processes utilized to produce the products, i.e., the generation of the new products and processes. With the aid of information technology, the enterprises can collect and share innovative ideas from and between every corner of the organization and finally come out with excellent products and new processes, which can significantly outperform the competitors.

The objective of this research is to explore the mechanisms in the feedback and control system demonstrated in Figure 1, and the authors believe that an effective Key

Performance Indications (KPI) would be the most critical aspect to have promising mechanism. Thus, this study intends to achieve the following:

- (1) Discussing the sources of gaining KM competitive advantages.
- (2) Exploring the essence and functionality of KPI.
- (3) Developing the KPI evaluation approaches.
- (4) Constructing a feasible KPI model.

The common model of data-information-knowledge-wisdom is characterized by their helpfulness of solving the problems. Knowledge management is utilized to extract systematically the best practice inherent in the organization, and the best practice is derived from the above four elements. Proper deployment of knowledge management can upgrade the personnel skill and build up organization's core competency. Figure 2 illustrates a model for developing the knowledge management key performance indicators.

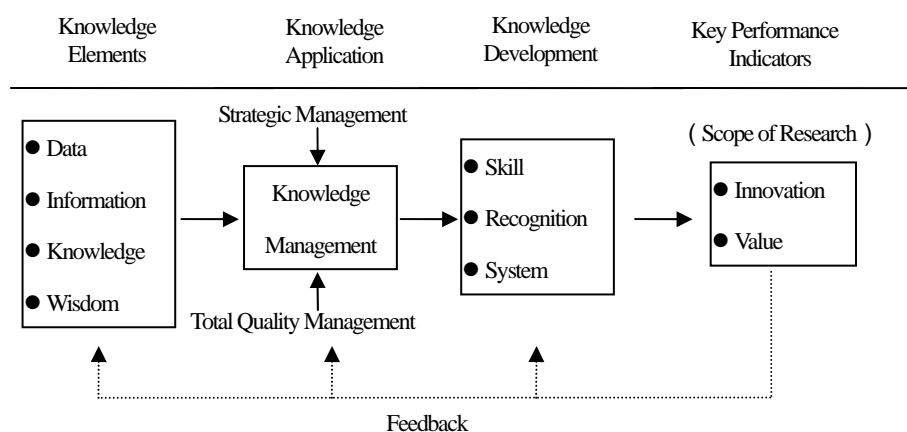


Figure 2 Model for Developing Key Performance Indicators

## 2. Literature Review

To cope with the stiff market competition, enterprises must develop the following competency [4]: (1) achieving customer satisfaction; (2) continuously innovating products; and (3) disseminating the competency to every corner of the organization. Therefore, the scarce resources must be assigned to the most vital business areas to accumulate and share the most critical knowledge so as to create better products and processes leading to better business performance.

The well-known Japanese scholars, Nonaka and Takeuchi [5], proposed the insight

of knowledge management, and Drucker indicated that, in post-capitalist society, knowledge is a resource and enterprises must stress knowledge tasks and the productivity of knowledge workers. Porter argued that enterprises must efficiently and effectively develop and apply its competency to achieve competitive advantage [6].

From the practical point of view, the competitive advantage of an organization can be assisted by the strategic management to align the business direction and total quality management to streamline the business processes. Figure 3 demonstrates the business operational system [6].

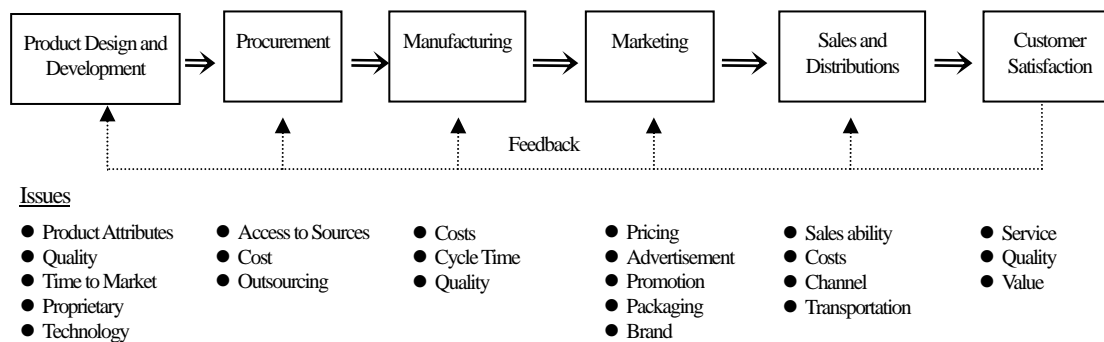


Figure 3 Business Operational System

The business operational system shown in Figure 3 connects the business operation flow to convert efficiently and effectively tangible and intangible input assets into products with market values that can satisfy the customers. The resources used are the input and the values produced are the outcome. The resources can include finance (cash, shared financial market), physical equipment (factory, equipment), law (trademark, charter), manpower (employee skill and knowledge), organization (core competence, control, policy and culture), information (knowledge of customers and competitors) and relationship (customers and suppliers). Porter believes that successful business must present superior and sustained performance compared

with competitors worldwide [4].

Value creating activities can be historically categorized as several phases: (1) phase I is Stock Price Performance, including Total Returns to Shareholders (TRS) and Market Value Added (MVA); (2) phase II is Intrinsic Value, including Discounted Cash Flow (DCF) and Real Option Valuation; (3) phase III is Financial Index, including Return on Invested Capital (ROIC), the growth of revenue and earning before income tax, and Economic Profit; and (4) phase IV is Value Drivers, including market share, unit cost, research and development value, professional management and the like [4]. Each phase plays different role with respect to decision and performance

management. Three points can be emphasized: (1) company can achieve long-term value according to Stock Performance; (2) company can evaluate strategic projects, opportunities and values of every department by Intrinsic Value Evaluation; (3) intrinsic Value could be converted into short-term and mid-term financial target; (4) performance could be evaluated by comparing the target and result of financial index.

In order to maintain competitiveness, enterprises must transfer the value created by knowledge management into profitability. Figure 4 is a framework of using knowledge management to enhance enterprises value in knowledge-based economy.

The research conducted by Cooper et al. [7] recommended 10 factors that are related to new product development, they are (1) product advantages, (2) market potential, (3) market competitiveness, (4) marketing performance, (5) technical performance, (6) feasibility design, (7) the proficiency of advanced preparation for development, (8) the proficiency of market related operations, (9) the proficiency of technical operations and (10) superiors' support. The most crucial successful elements are: (1) product advantages, (2) the proficiency of advanced preparation for development and (3) feasibility design. This lays the foundation of the value creation cycle of knowledge management shown in Figure 4.

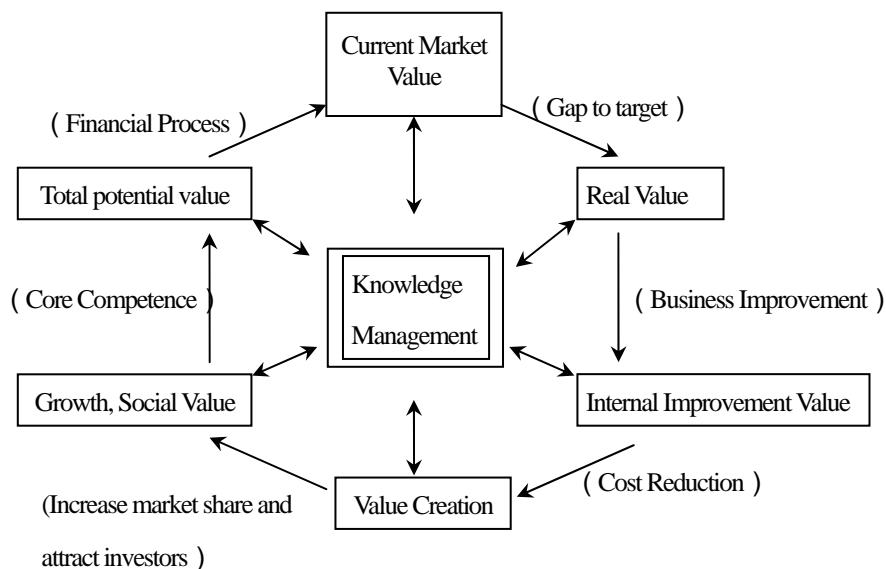


Figure 4 Framework of Enhancing Knowledge Management Value

The value enhancement due to on knowledge management starts from creation, feasibility design, new product flow, and market strategy down to the value creation. The creation is derived from comprehending, adjusting and adapting flexibly to the dynamic environment, technology and customer knowledge. Feasibility design is done after evaluating creativity, strategy, patents and authorization to formulate the best executive project. New product flow is targeting to

efficiency and effectiveness improvement plan of operating flow to assure high quality, low cost and timely delivery. Market strategy is to evaluate strategies of entering and exiting the market. Value creation aims to achieve reasonable balance between innovation cost and profits resulted from values added. Figure 5 shows the value creation chain of the knowledge management. Figure 6 depicts the relationship between performance evaluation innovation from KM initiatives.

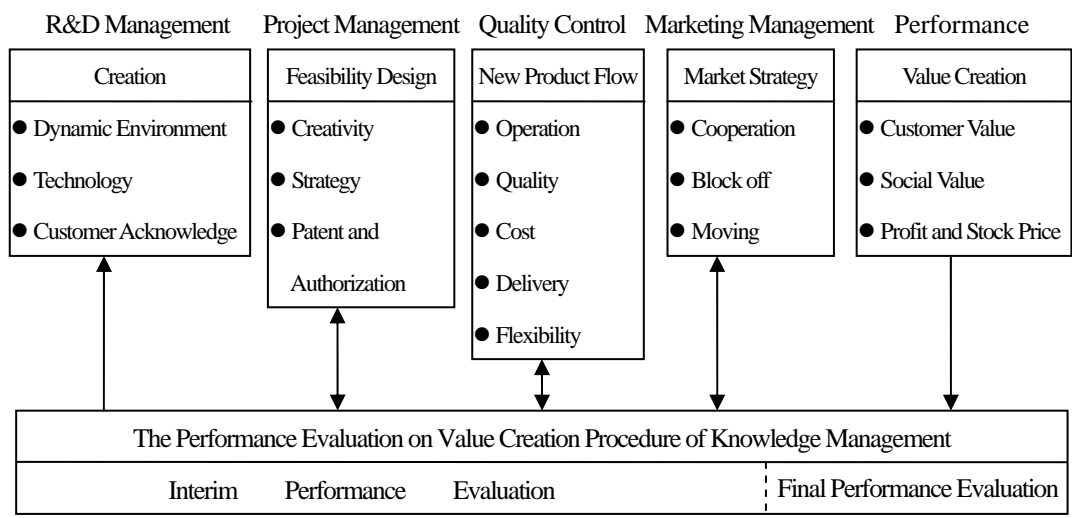


Figure 5 Value Creation Chain of Knowledge Management

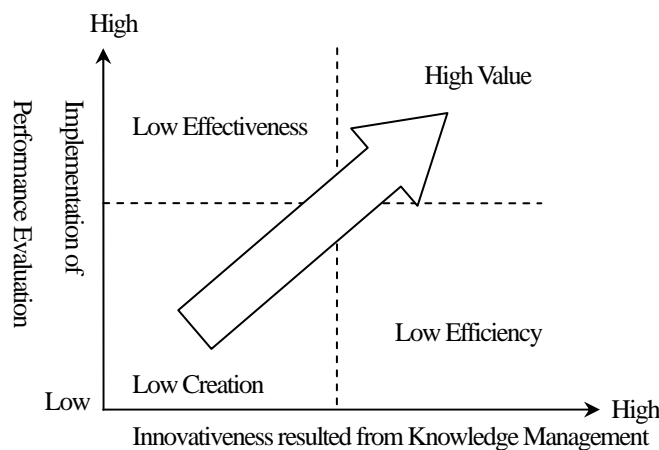


Figure 6 Framework of Business Value Growth

As seen in Figure 6, the growth of business value is determined by the level of innovation resulted from knowledge management and the implementation level of performance evaluation. Both of them must be appropriately synchronized in order to acquire maximum growth of business value.

### 3. Performance Evaluation

The generation of the business value is resulted from using resources and converting them into products and services. Different industries have utilized different kinds of resources, and customers always have different views that will certainly impact the business performance and the value-creating activities of enterprises. Table 2 shows an example [8].

Table 2 Example of Key Successful Factors

Market	Skill and performance factors that create value or lower costs	The critical value point of view of customers
(1) College book publishing	<ul style="list-style-type: none"> <li>● Relationship with quality control</li> <li>● Strong editorial capabilities</li> <li>● Publisher strength in discipline</li> <li>● Booklist depth</li> <li>● Sales per title</li> </ul>	<ul style="list-style-type: none"> <li>● The quality of books</li> <li>● The reputation of publisher</li> <li>● The applicability to other publications</li> </ul>
(2) Machine tools	<ul style="list-style-type: none"> <li>● Design and Manufacturing quality</li> <li>● Simplification of parts variability</li> <li>● Instant response from central depots</li> <li>● Raw material stock</li> </ul>	<ul style="list-style-type: none"> <li>● Tool quality</li> <li>● Parts availability</li> <li>● Usability</li> </ul>

From Table 2, we know that the technology and core competence required for college textbook publishers and machine tool manufacturers are totally different, and the value demanded by customers also vary. Business performance is determined by customer satisfaction; and thus, there is a close relationship between business value and customers expectation. Two issues need to be addressed: (1) from the customer point of view, the importance of product attributes are not identical for different customers; (2) from the manufacturer point of view, different customers have different tolerances about costs.

Financial capital and intellectual capital are two major supporting elements for knowledge management. Financial capital is the major source for obtaining operation resources of business, while intellectual capital is the major power for promoting product innovation. Only both of them coordinate mutually and

operate equally, thus achieving the maximum value of business performance. Figure 7 displays a business value structure [2], showing the categories of resource and resources requirement structure of knowledge management. The resources must be allocated proportionally and categorized systemically to assist enterprises in accumulating and applying resources, and also facilitating the processes of performance evaluation.

In this dynamic and competitive environment, enterprises must always strive to balance the resource inlet and the performance outlet. Once the expected performance of knowledge management is achieved, one can include the quantitative value of innovative capability and core competency resulted from knowledge management in the accounting balance sheet shown as Figure 8.

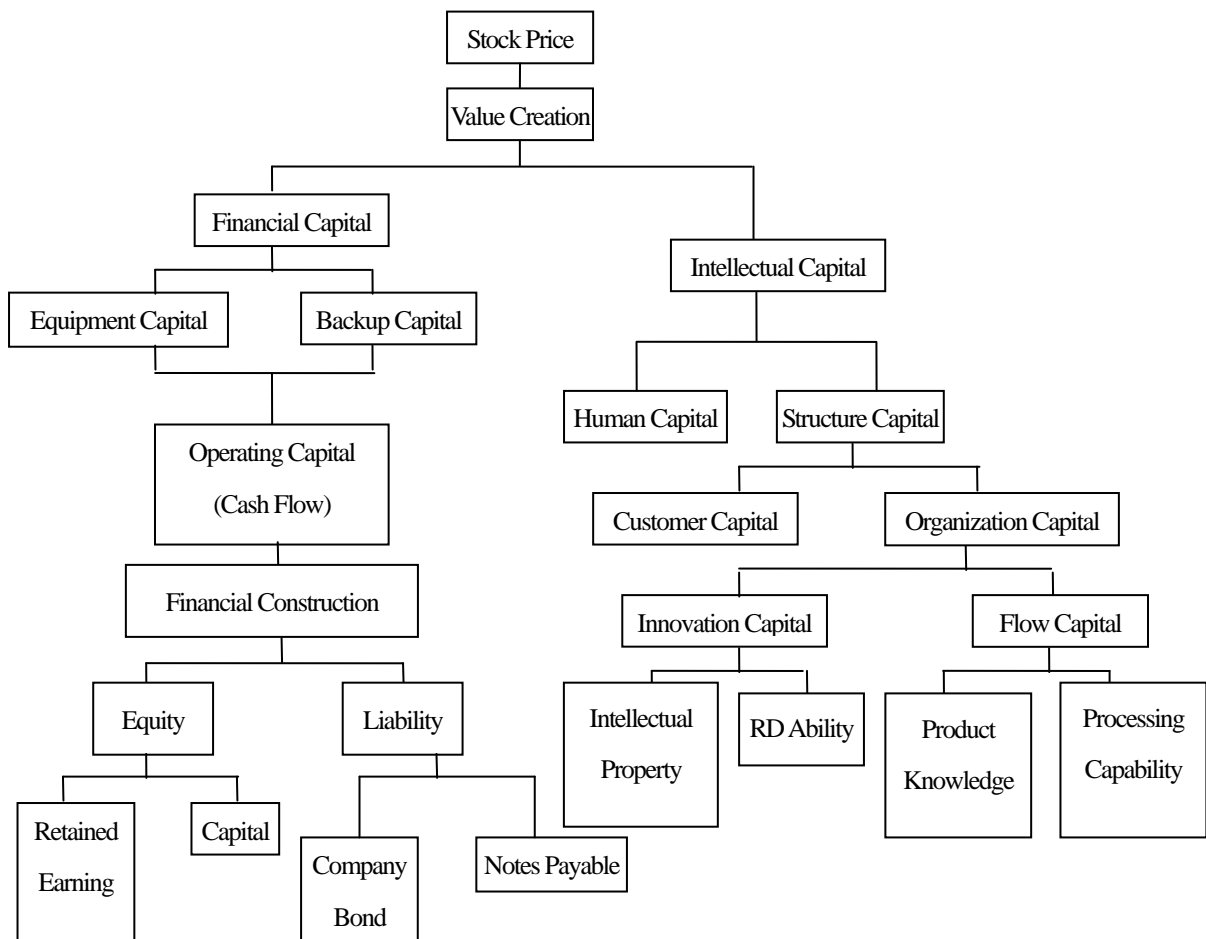


Figure 7 Business Value Structure

<u>Balance Sheet of Knowledge Management</u>	
Asset	Liability
Financial Capital	The Split of Financial Capital
Intellectual Capital	The Split of Intellectual Capital
	Equity
	Core Competence
	Innovation Capability
	Stock Price

Figure 8. Balance Sheet of Knowledge Management

#### **4. Key Performance Indicators**

The objective of the enterprises is to create value to the shareholders and all related parties. However, several concerns must be first solved prior to value creation: (1) planning the strategies and goals for value creation; (2) developing the executive plans to achieve the goal, (3) correctly detecting variances and deploy proper corrective actions for improvements and (4) formulating an organization culture that supports continuous learning and innovation. Figure 9 depicts a performance evaluation system.

As mentioned earlier, the production efficiency, customer satisfaction and business and investment decisions made by the top management will impact the company's value creation. Three critical points must be considered: (1) managers and other intellectual staff must know how to create and maximize the value, (2) the decision of the priority of utilizing resources must be carefully planned, and (3) all employees must understand the business priorities set by the top management. Combining metrics and value drivers to disclose periodically the business outcome is referred to as Key Performance Indicators (KPI) [6]. There are three major principles:

- (1) Value drivers must have direct connections with related parties and be disseminated to whole organization.
- (2) Value drivers must connect KPI goal to finance and operations and measure them at the same time.

- (3) Value drivers must coordinate with short- and long-term goals: short-term goal emphasizes on profit and efficiency, while long-term goal stresses value growth and potential of permanent development.

Performance management is a very important part of measuring value creation, and it must be closely related to value drivers and daily operations. In other words, the knowledge management strategy and goals must be transferred down to the level of planning and further down to the level of operation. Frequent interactions among related parties and better internal communication and understanding would improve the value creation outcome, thereby leading to common consensus and mechanism that drives the enterprises to success.

The successful performance management should consider the following factors:

- (1) The strategy of exercising value creation of knowledge management must be consistent.
- (2) The executive goal must be concrete and able to be quantified.
- (3) The goal must closely connect to individual value driver and be manageable.
- (4) Periodic reviews allow timely correction and improvement.

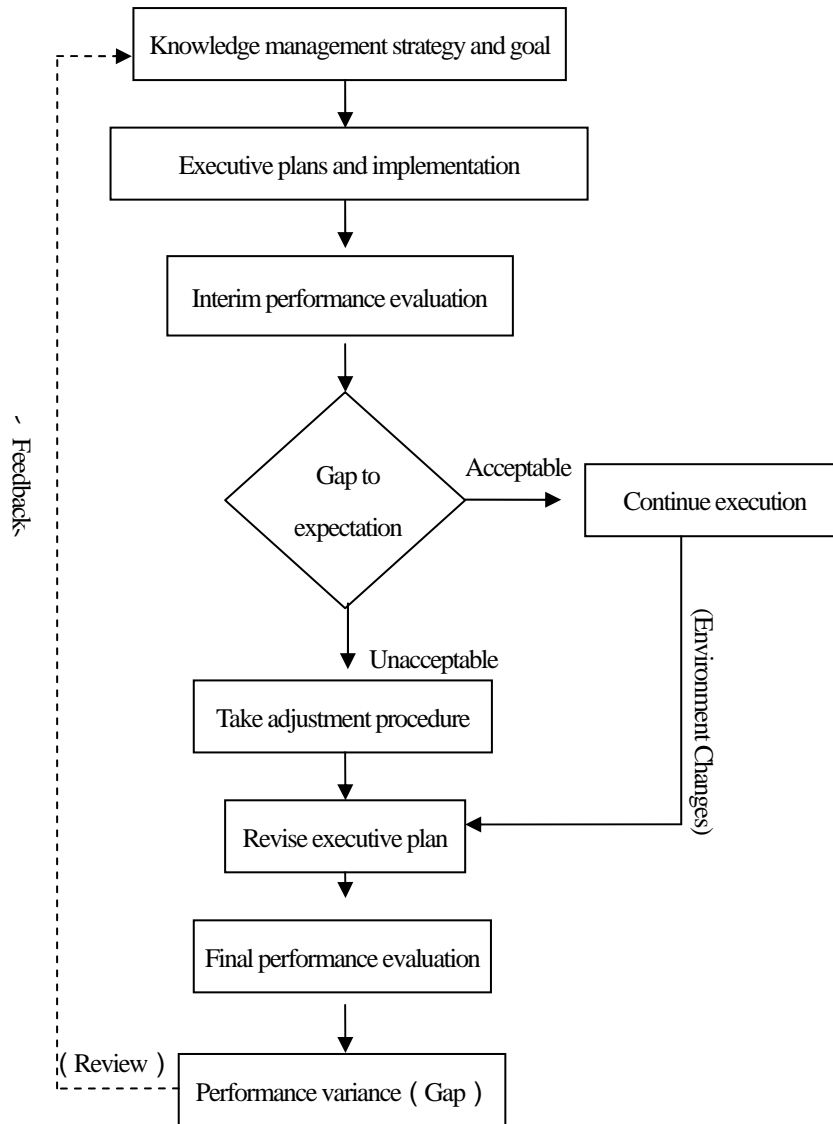


Figure 9. Performance Evaluation System

The general performance evaluation approaches, such as discounted cash flow and the return on investment, emphasize mostly on the financial aspect. These models cannot measure the monetary value of the knowledge management. It is widely known that knowledge management not only can improve

the tangible financial performance, but also build up the core competency of personnel and the entire organization. When personnel capability is enhanced, then the organizational performance can certainly be upgraded, and finally, the business objective and goal can be surely achieved. Figure 10 illustrates the concepts.

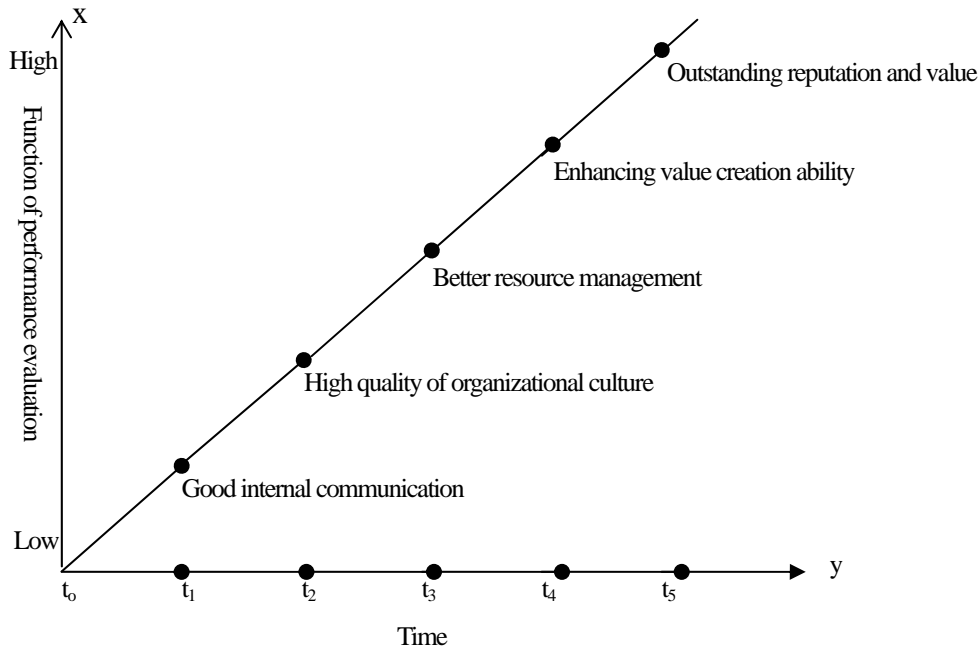


Figure 10 The Function of Performance Evaluation

As seen in from Figure 10, the more feasible the performance evaluation context, the shorter the time to reach the goal of knowledge management is. If the performance evaluation mechanism does not work well, then it might take a very long time to achieve the expected performance objective. The slope of line in Figure 10 represents the strength of the evaluation functionality; and the steeper the slope, the better the functionality is.

The performance evaluation of knowledge management must take into account the factor

of time, i.e., different indicators must be adopted to suit the needs at different stages. North et al. [9] have proposed the concept of phased indicators shown in Table 3. During the industrial-based economy, measuring performance is to aggregate resources efficiency, while in knowledge-based economy, what customer concerns most is the value accompanied by the knowledge added to products or service they acquired. Therefore, the performance evaluation of knowledge management must be different from those used in the early stage.

Table 3. Phased Indicators of Knowledge Performance

Class of indicators	Definition of term	Examples
I. Organization knowledge base	Describes the content of the organization knowledge base at time $t_x$ in qualitative and quantitative terms	①Portfolio of employee skills according to core competencies ②Number and quality of external knowledge links ③Quality and number of internal centers of competence ④Patents
II. Interventions	Describes processes and inputs (costs) for changing organizational knowledge base	①Number of 'lessons learned' workshops ②Producing profiles of experts ③Implementing action training (action training/total training %)
III. Intermediate results and transfer effects	Measures direct results of the interventions (outputs)	①Publications by employees with suggestions for improvement ②Response times to customer queries ③Index of intranet use ④Transparency index
IV. Business results	Measures business results at the end of the period (e.g. quarter, financial year)	①Cash flow, ROI ②Market share ③Business Image

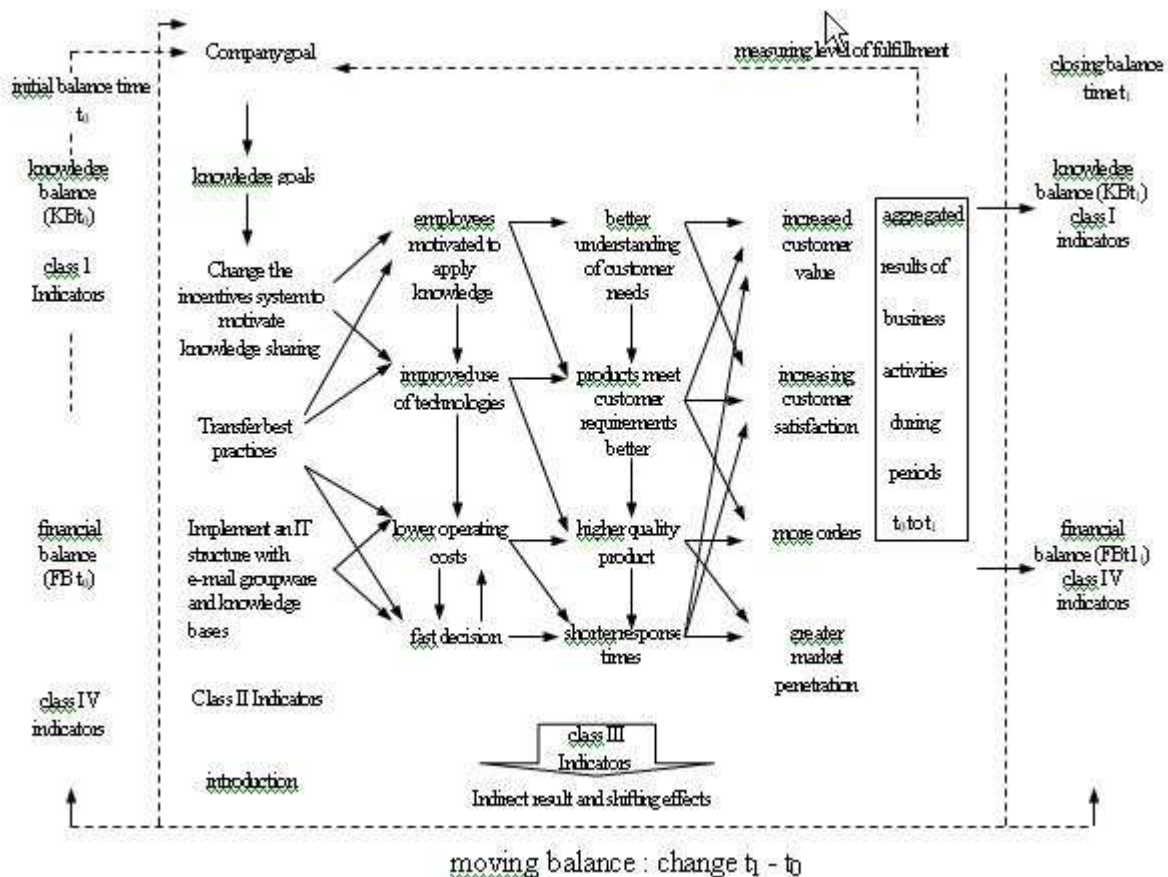
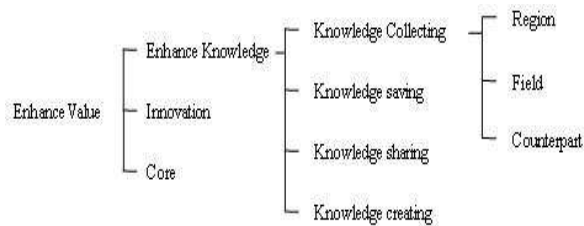


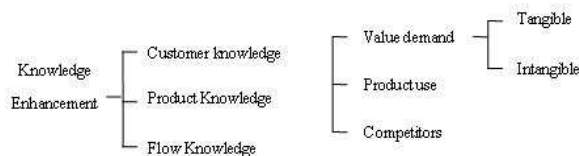
Figure 11 Multi-Dimensional System for Measuring Knowledge

North et al. later revised the phased concept to process structure shown as Figure 11. This is a sequential measuring system that can contribute to the establishment of the overall performance evaluation structure, and considers both strategic and implementation perspectives. There are three steps for implementation [6]:

- (1) Identification: use value trees to connect systemically operating factors to value.



- (2) Prioritization: prioritize knowledge enhancement activities by customer knowledge, product knowledge and process knowledge.



- (3) Institutionalization: connect value drivers to business goal and measure performance continuously.

According to result of a knowledge management research conducted in Europe and America from 1997 to 2001, four areas can be categorized as: (1) strategy and plan, (2) implementation and procedures, (3) knowledge management, and (4) performance evaluation. Table 4 shows the details [10]. As can be seen strategy and plan has 13 items and is on the list 28 times; implementation and procedures has seven items and is 10 times on the list; knowledge management has 27 items and is 81 times on the list and performance evaluation has seven items and is 24 times on the list. Furthermore, a Plato analysis is shown in Table 5.

According to Tables 4 and 5, a KPI model is developed as displayed in Figure 12. It is apparent that four stages are proposed for measuring the performance, and several points can be stressed: (1) company strategy is the major guideline, and KM must be closely connected to company strategy; (2) the TQM concept can be combined with KM, (3) the customer and employee satisfaction, value enhancement, stakeholder satisfaction are the ultimate goals of KM. To facilitate the assessment of KPI, a set of sub-items is developed for each category.

- (1) Strategy and Plan ( category I: t<sub>0</sub> )

① Company strategy:

- Business environment analysis (economic, society, culture, technology, politician and competition)
- Current situation evaluation (resource demand, risk, advantage, weakness, threat, and opportunity)
- Core competence identification (organization, structure, knowledge asset, process)
- Goal and action plan (quantitative, qualitative)

② Management support:

- Level of the one who supports KM in the organization
- Ratio of expenses to revenue
- Announce KM information periodically.
- Assist eliminating the KM obstacles

③ Customer knowledge:

- Understand customer demands
- Responses to customer complaints
- Customer relationship management
- Satisfaction of customer about delivery

④ Commitment and leadership:

- Depth and width of commitment
- Degree of empowerment
- Culture of knowledge sharing
- Promote organization learning

Table 4. Major Researches of Knowledge Management (1997-2001)

Item	Content	No.	Item	Content	
Strategy and Plan	(1) IT role, infrastructure	5	Knowledge Management	(8) Learning culture	
	(2) Commitment and leadership	4		(9) Knowledge creation and innovation	
	(3) Customer knowledge	4		(10) The reason of implementing KM	
	(4) Mission and strategy	3		(11) The definition and technology of knowledge	
	(5) Superior supporting	3		(12) The value and recognition of KM	
	(6) KM strategy	2		(13) The price of ignoring KM	
	(7) Strategy and operation implementation	1		(14) Human factors	
	(8) Knowledge vision	1		(15) Important knowledge	
	(9) Culture and strategy	1		(16) KM directions	
	(10) Company goal	1		(17) Information and KM	
	(11) Knowledge environment	1		(18) Key successful factors	
	(12) Knowledge investment	1		(19) KM's future	
	(13) Region, Place	1		(20) Company system	
Subtotal	28	(21) Knowledge requirement			
Implementation and Procedures	(1) Knowledge and knowledge mgt. process	3		(22) Knowledge externalization	
	(2) Implemented procedures	2		(23) The definition of KM	
	(3) Training and personal development	1		(24) The mission of KM	
	(4) Product development, processing innovation	1		(25) The functions of KM	
	(5) Best practices	1		(26) The tools of KM	
	(6) Job descriptions and experiences	1		(27) Knowledge network	
	(7) Project management	1		Subtotal	
Subtotal	10	Performance evaluation		(1) Performance	
Knowledge Management	(1) KM role, culture, behavior, responsibility			11	(2) Incentives & performance evaluation
	(2) Current KM situation, practice and trend			10	(3) KM evaluation
	(3) Knowledge obstacles and limitations			8	(4) KM benefit
	(4) Knowledge sharing			7	(5) Delivery of knowledge basis
	(5) KM organization and revolution			6	(6) Employee turnover & satisfaction
	(6) KM elements, conditions and technologies			5	(7) Efficiency
	(7) Intellectual capital	4	Subtotal		
			Total		



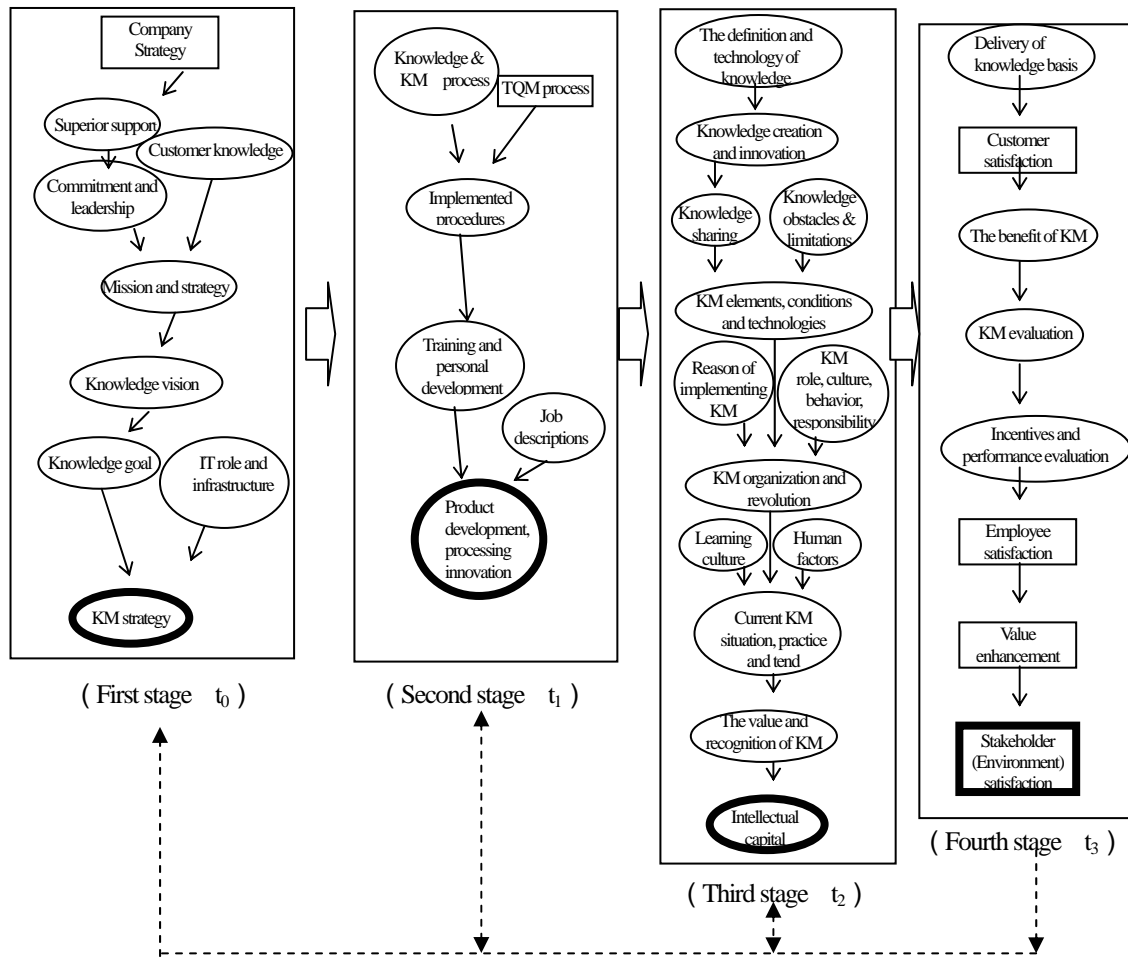


Figure 12. KPI Model of KM

⑤ Mission and strategy:

- Mid- and long-term business development goal
- Strategic action plan and goal of business unit
- Profit structure and financial plan of business unit

⑥ Knowledge vision:

- Knowledge classification and extraction
- Knowledge creation and development
- Knowledge standard

⑦ Knowledge goal:

- Smoothness of knowledge spiral operation
- Increased number of knowledge quality and quantity
- Learning effect by knowledge

⑧ IT role and infrastructure:

- Hardware facility (saving, processing, communication equipment)
- Software facility (searching, document management, internet)
- IT personnel quality ( education, work experience, skill )
- Decision support system (assist

- learning, virtual reality model)
  - Knowledge application
- ⑨ KM strategy:
- Ways of acquiring knowledge (internal, external, creating)
  - Structure of organization learning methods (experience, benchmark, customer, research institute)
  - Vision, goal and KM strategy
  - Obstacles and limitations of organization change
- (2) Implementation and procedures (category II: t<sub>1</sub>)
- ① Knowledge and KM process:
- Accelerating knowledge leveraging system (data, information, knowledge, intelligence)
  - Knowledge map and KM structure
  - Completeness of KM system process (knowledge spiral)
  - Diagnosis of knowledge and KM
- ② TQM process:
- Customer service, customer satisfaction
  - Continuous improvement
  - Internal training and learning
  - Measurement, evaluation and encouragement
- ③ Implementation procedures:
- Internal and external communication
  - Combining KM processes with company procedures
  - Interim diagnosis and evaluation
- ④ Training and development:
- Training hours
  - Job proficiency and innovation index
  - Employee self-growth index (reading, certificates, specialty and so on)
- ⑤ Job description:
- Identify the definition of organization
- and jobs.
- Job equivalence (job line, personal responsibility and so on)
  - Completeness of rules and description
- ⑥ Product development, process innovation:
- Work flow improvement and innovation
  - Number of errors reduced
  - Work cycle time reduction and improving efficiency
  - Utility of knowledge improvement process
- (3) Knowledge management (category III: t<sub>2</sub>)
- ① Definition and technology of knowledge:
- Clarity of knowledge definition
  - Completeness of knowledge level
  - Knowledge searching and reservation (knowledge bases)
- ② Knowledge creation and innovation:
- Number of knowledge creations and innovations
  - Identification to knowledge value
  - Aggressiveness of employees (able to face challenges and pursue perfection)
- ③ Knowledge sharing:
- Common knowledge recognition culture
  - Creating knowledge network
  - Smoothness of internal communication
- ④ Knowledge obstacles and limitations:
- Knowledge searching deadline (expected finishing time/ actual finishing time)
  - Variance of knowledge recognition
  - Valued degree of knowledge

- ⑤ KM elements, conditions and technologies:
- Establishing KM organization structure under business's demand.
  - Appropriateness of KM structure
  - KM vision, goal, strategy and tactic
  - Applicability and feasibility of KM action plan
  - Completeness of IT infrastructure
  - Performance accessing and encouraging system

- ⑥ Reason for implementing KM:
- Establishment of internal KM common consensus
  - Understand KM trend
  - Understand the importance of knowledge incentives

- ⑦ KM role, culture and behavior:
- Identification of organization position, duties and responsibilities
  - Encourage business culture of learning and sharing
  - Common business values

- ⑧ KM organization and revolution:
- Common consensus of changes
  - Threats from competitors
  - Company's long-term development trend
  - Executive strategy (project management) of change plan
  - Expected performance and evaluation measures of change

- ⑨ Learning culture:
- Willingness of self-learning
  - Evaluation of training system, process and result
  - Learning the method of work from competitors
  - Well-communicated channels among departments

- ⑩ Human factors:
- Employee training plan
  - Employee career plan
  - Encourage learning and innovation
  - Conflict management

- ①① Current practices and trend of KM:
- Announce periodically the implementation performance of KM
  - Review periodically the advantages and weaknesses of KM
  - Accumulate experiences and lessons and predict possible development trend
  - Conduct risk prediction and management
  - Analyze key success factors
  - Leverage best practices

- ①② Value and recognition of KM:
- Use participative KM (empowerment, autonomy and so on)
  - Enhance core competence
  - Degree of technology and skill innovation
  - Efficiency improvement by accumulating learning of knowledge
  - Eliminate obstacles to revolution and reduce resistance to change

- ①③ Intellectual capital:
- Number of intellectual property ownerships
  - Pieces of successful research and development on new products, new processes and new technology
  - Growing situation of product knowledge and customer knowledge
  - Improvement of process capability

The strategy, plan, implementation and procedures all contribute to KM performances. They can be qualitatively or quantitatively measured to discover if the current situation meets expectation, and if corrective actions are necessary.

(4) Performance evaluation (category IV: t<sub>3</sub>)

① Delivery of K base:

- Delivery ratio that complies with customers' order specifications ( number of qualified orders / total number of orders )
- Delivery ratio that complies with the quantities required by customers (actual amount delivery/ total amount ordered)
- Delivery ratio that complies with the number of requests from customers (number of delayed deliveries/ total number of deliveries)
- Frequency of visit of important customers (times/month)
- Ratio of owning customer information (amount of owned information/ amount of deserved information)

② Customer satisfaction:

- Ratio of customer complaining (number of complaints/ total number of deliveries)
- Frequency of customer complaining (number of complaints/ month)
- Ratio of one-transaction customers to total number of customers (total number of one-transaction customers/ total number of dealing customers)

③ KM benefits:

- Ratio of cost of good sold over total cost (cost of good sold/ total operating cost)
- Sales net income (net income/ net sales)
- Percentage of revenue from innovative product to total revenue (innovative product sales/ total sales)
- Number of internal conflicts (number of conflicts/ month)
- Number of external conflicts (suppliers, customers, environment) (number of conflicts/ month)

④ KM evaluation:

- Employees' level of comprehending KM (use radar or trend chart to analyze questionnaire)
- Frequency and days delayed for reporting performance (frequency or days/ month)
- Items and days delayed for closing case of correcting items (items and days/ month)

⑤ Incentives and performance evaluation:

- Percentage of increased productivity ( Increased productivity (V) / Increased input )
- Percentage of incentives to net income (incentives amount/ net income)
- Percentage of reaching the expected goals of production, marketing, human resources (actual performance/ expected performance)

⑥ Employee satisfaction:

- Number of employee complaints (number of complaints / month)
- Employee turnover rate (number of employees leaving office/ average of initial & final number of employees)
- Safety Rate (number of accidents / total working time)
- Frequency of accidents (number of accidents/ month)
- Level of employee satisfaction (questionnaire; radar, trend and Plato chart analysis)

⑦ Value enhancement:

- Number of new products developed (number /month)
- Growing trend of intellectual capital

⑧ Stakeholder satisfaction:

- Increase in intangible intellectual assets (final intellectual assets – initial intangible intellectual assets)

- Governmental encouragement and benefit measures ( benefit amount/ month, or number of praises )
- Rating of business distinction ( comparison by net revenue and net income )
- Market share (the sales of this company/ whole market sales)

Measuring the knowledge management performance is to increase the learning effect, to reduce resistance to change, to promote process efficiency and to discover return on investment. Both tangible and intangible returns or outcome will enhance the business value. Performance could be measured according to short-term and long-term outcomes, and short-term performance generally improve efficiency, reduce cost, develop core competence and establish competitive advantages; while long-term performance emphasizes more on financial incentives, business value and stock price.

## 8. Conclusion

Performance evaluation is an important element of business administrative control system. Effective control system should have features such as measurability, cost effectiveness, timeliness, understandability and flexibility, and can detect the variance between target and actual performance at certain points of time as necessary to trigger proper countermeasures, including corrective action and reward system to assure goal achievement. KPI is a vital part of control system and performance evaluation is an important mechanism to maintain high organizational efficiency and effectiveness.

Knowledge-based economy will be vastly prevalent in any industries, and it is more than just a value-adding process. Through knowledge acquisition, knowledge accumulation, knowledge transferring and knowledge application, enterprises can develop their own core competency, which not only can

prevent the existing markets from being penetrated, but also develop new markets that was previously enjoyed by the competitors.

All the management theories and approaches point to finding ways to enhance efficiency and effectiveness, and allocating the most appropriate budget to the most needed areas to acquire maximum profit and value. By using system thinking, this research develops a value chain to reveal the roles that knowledge management can play, and identifies key items for performance evaluations of knowledge management. A KPI model composed of four stages is proposed to measure the performance of the knowledge management initiative. It is concluded that four areas must be stressed when appraising the key performance indicators. They are: strategy and plan, implementation and process, knowledge and performance evaluation. Moreover, sub-items for each area have been suggested to ease the adaptation of the model.

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