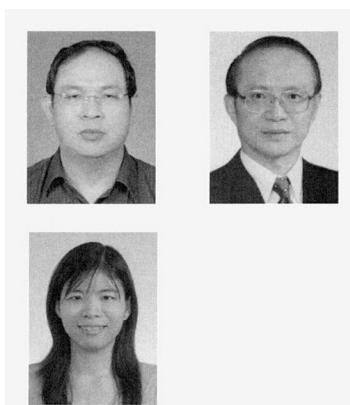# Case study on knowledge-management gaps

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Abstract

Purpose – To propose a holistic framework for understanding the "knowledge-management (KM) gap" – illustrating six types of gaps that might occur within KM activities.

Design/methodology/approach – The content-analytical approach with the thematic analysis was implemented in the study. Through an in-depth interview with the top managers of two firms, explores the causes of these gaps and fundamental approaches to bridging these gaps.

Findings – This study identifies a comprehensive set of factors that could potentially impact the magnitude and direction of these gaps and the corrective actions to enhance the success of the implementation of the KM system.

Research limitations/implications – The study has done in-depth interviews with only two firms and five companies. The results may need to be validated by a robust survey. Reasons for these gaps and several fundamental approaches to avoid them are presented.

Practical implications – This framework is expected to provide a convenient way to audit KM gaps and, thus, enterprises can make corrections and adjustments accordingly to greatly enhance their chances of success while implementing the KM system.

Originality/value – Proposes an innovative framework of "KM gaps" to fully illustrate the management gaps that might occur during the implementation of KM. Furthermore, the actions to reduce the misfit between the capability and implementation of KM systems are also demonstrated.

Keywords Knowledge management, Competitive advantage, Case studies

Paper type Case study

Introduction

Knowledge is one of the critical assets to leverage when pursuing enterprise competitive advantage (Sang and Soongoo, 2002; Lee and Choi, 2003; Sharkie, 2003). The key knowledge-management (KM) challenges facing companies today are determining what robust knowledge-management systems (KMS) to implement, which user friendly processes and practices to institute that are not cumbersome, and what added value intellectual capital to capture. Organizations have traditionally identified knowledge with a repository of information that is leveraged judiciously (Gupta *et al.*, 2000), however, it is well known that knowledge is a fluid mix of framed experience, values, contextual information, and expert insight (Davenport and Prusak, 1998). Furthermore, knowledge activities are dynamic as well as humanistic with active and subjective natures created by social interactions dependent on individuals, their community and organization interactions, and applicability to needs (Holsapple and Joshi, 2002).

The majority of studies show that knowledge can be classified as being either tacit or explicit (Hedlund, 1994; Engelhard and Nägele). Tacit knowledge is defined as experience based knowledge that resides with an individual, whereas explicit knowledge is precise and formally articulated and documented. In organizations, knowledge is often embedded in repositories, documents, routines, operational processes, practices, and norms. It is generally accepted that knowledge also comes from the meaningfully organized accumulation of information through experience, communication, or inference (Zack, 1999).

In response to issues arising from the uncertainty over identifying the enablers and barriers to implementing KM, a number of value studies have been published addressing this concern (Nonaka, 1991; Barney, 1995). Several studies proposed the concept of "knowledge gap" to describe the difference between the enterprise's current capability and the capabilities required for KM. Lorrich and Pierce (1984) identified knowledge gaps that are measurable and identified two distinct categories of gap attributes. Trans-situational attributes are socioeconomic whereas situation-specific attributes are driven by policy-relevant personal motivations. The results of this study revealed that the situation-specific influences on knowledge levels are more severe than others. By understanding the components of the KM technology framework and evaluating the existing infrastructure, Tiwana (2001) identified infrastructure gaps that hinder the building of KMS. Hall and Andriani (2002) identified gaps occur between existing knowledge and knowledge requirements and particularly occur when a firm is trying to introduce new process or products. Wild *et al.* (2002) defined the knowledge gap as the quantitative and qualitative difference between the knowledge needed and available in the organization. Beyond the aforementioned knowledge gaps, there exist different perceptions of KM activities and implementation amongst employees of differing levels and positions.

The inability to identify and resolve any gaps prior to implementation will greatly impact the implementation process. Thus, it would be beneficial for the enterprise to build a framework that would analyze the corporate knowledge needs, evaluate the implementation activities of KMS and identify any inhibitors to success. Therefore, we propose this framework to identify an organization's KM gaps that might occur during implementation. This study validates the construct of the proposed framework through data and information, obtained from in-depth interviews with senior managers, necessary to understand the impact of these knowledge gaps.

Knowledge-gap framework

Based on the concept of Holsapple and Singh's (2001) knowledge value chain and Nonaka's (1991) spiral of knowledge, we propose a holistic framework for the "KM gap" to fully illustrate the management gaps that might occur during the implementation of KMS. As shown in Figure 1, there are six KM gaps that can be viewed from four different aspects: strategic aspect, perception aspect, planning aspect and implementation aspect. The detailed descriptions of the four aspects are stated as follows:

Figure 1 The model of the KM gap
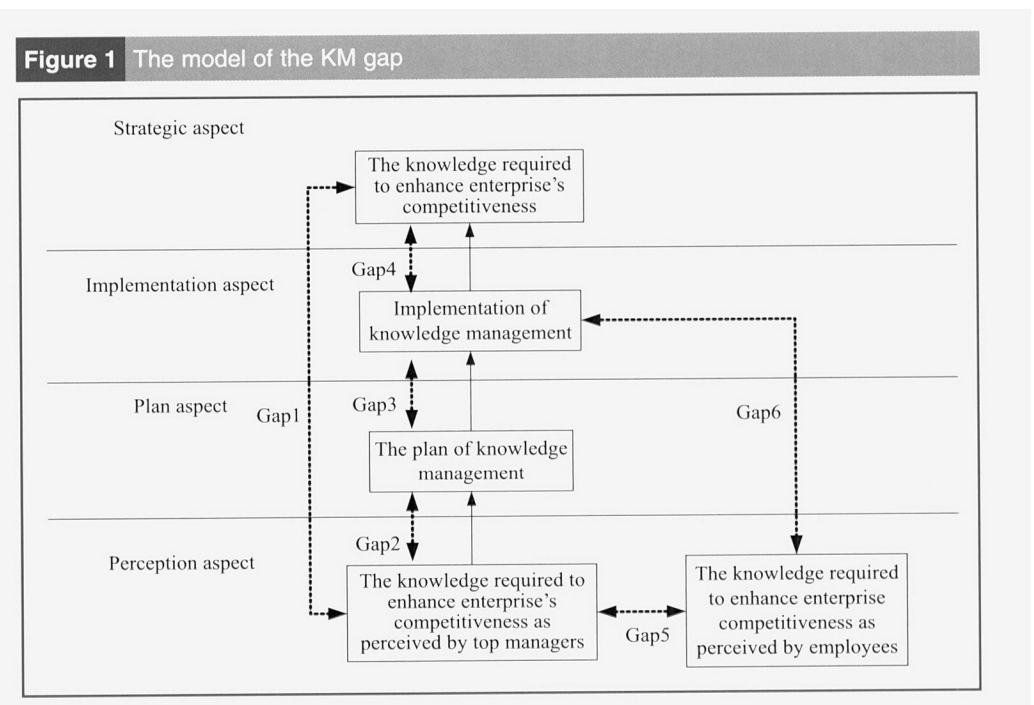
1. *The strategic aspect.* Enterprise should review their internal and external environment to determine the knowledge required to enhance its competitiveness (Suyeon *et al.*, 2003). Fail to do so may result in a gap between the knowledge required to enhance the competitiveness of an enterprise as perceived by the top managers and the knowledge actually required (i.e. gap 1). Fail to evaluate the performance of KM may result in a gap between the results of implementation and that perceived by the top managers (i.e. gap 4).

2. *The perception aspect.* Top managers may not be able to define clearly what they need (Kwan and Balasubramanian, 2003). This may result in a gap between the perception of the top managers and the enactment of the KMS plan (i.e. gap 2). Within a company there may be gaps between perceptions of the top managers and that of the employees due to difference in position, role, and professional knowledge (i.e. gap 5). Finally, it may exist a gap between the knowledge required to enhance an enterprise's competitiveness and that as perceived by the employees when they implement the KM (i.e. gap 6).

3. *The planning aspect.* Understanding the enterprise's internal and external environments will enable the top managers to enact a proper plan for KM implementation (Liebowitz *et al.*, 2001). If top managers cannot convey this knowledge into the implementation, then it may result in gap 2. If employees do not understand the KM plan while engaging in KM, then it may result in gap 3.

4. *The implementation aspect.* Implementation should fit the plan, or gap 3 will occur. Furthermore, during implementation the employees should have the right perception about what knowledge required to enhance enterprise's competitiveness, or gap 4 will occur.

Thus, the definitions of the six KM gaps are stated as follows:

- *Gap 1.* The gap between the knowledge required to enhance the competitiveness of an enterprise as perceived by the top managers and the knowledge actually required to enhance its competitiveness.

- *Gap 2.* The gap between the knowledge required to enhance an enterprise's competitiveness as perceived by the top managers and the plan to implement KM.

- *Gap 3.* The gap between the plan to implement KM as proposed by the top managers and the implementation progress of the KM plan.

- *Gap 4.* The gap between the knowledge obtained after implementing the KMS and the knowledge required to enhance an enterprise's competitiveness.

- *Gap 5.* The gap between the knowledge required to enhance an enterprise's competitiveness as perceived by the top managers and as perceived by other employees.

- *Gap 6.* The gap between the knowledge required to enhance an enterprise's competitiveness as perceived by employees and the knowledge actually obtained after implementing the KMS.

Research methodology

Research methods can be generally divided into two types. One is quantitative research and the other is qualitative research. The main objective of this research is to explore the framework of KM gaps with emphasis on the "contextual" factors suitable for further exploration in qualitative research (Hammersley, 1996; Berg, 2000). The case study

In organizations, knowledge is often embedded in repositories, documents, routines, operational processes, practices and norms.

represents one of the most common research designs for qualitative research. Case analysis is a good starting point in the inductive process of theory building (Yin, 1988). In addition, case analysis is the method of choice for inductive or teleological studies since it permits the researcher to observe and gather information about new or never researched natural phenomenon. The purpose of our case study is to explore the causes for these gaps and provide several fundamental approaches to bridging these gaps. As this research is rooted in organizational rather than technical interests, the case study approach is, therefore, most appropriate. Usually, we can develop the core categories of the constructs from the case study (Yin, 1994).

The study design

This study involves two-phased design and each is with distinct methodology. First, volumes of literature review and in-depth interviews with senior managers from two companies were used to collect data. Interviews are one of the most intensively used methods of data collection (Bryman and Burgess, 1999). The individual in-depth interviews that we will conduct are face-to-face and semi-structured nature, which is one of the most common approaches to interviewing in qualitative research (Bryman and Burgess, 1999). This type of interview involves the implementation of a number of predetermined questions and/or special topics. That allows the respondents to determine the direction and content of the interview within a broader framework provided by the interviewer. After each company's interviews were completed, the results were assembled, transcribed and e-mailed to the respondents for their review and approval eliminating any misinterpretation. It is expect to provide a richer and more holistic appreciation of the problems regarding KM gaps model. Second, a questionnaire (developed through literature review and in-depth interviews) that quantified the constructs was mailed to another five companies. After a few days, respondents were reminded by e-mail to submit the completed questionnaires. This measurement technique was used as a preliminary assessment of our understanding of the KM gaps and to verify whether the qualitative data from the interviews matched the quantitative responses.

Data analysis and validation

The content analytical approach with the thematic analysis was used for qualitative data analysis. Essential themes were pre-determined by a volume of literature review, and fourteen core categories were identified. There are environmental scanning, vertical information feedback, knowledge domain defining, self-diagnosis, goal-setting, knowledge standardization, employee orientation, management commitment, knowledge repository, knowledge measurement system, teamwork, communication, knowledge communities and reward system. By using thematic analysis, the interview data was parsed into information – rich quotations that was ultimately placed into thematic categories (Anderson and Felsenfeld, 2003). To reduce the likelihood of misinterpretation, we employ various procedures, including redundancy of data gathering and procedural challenges to explanations. For qualitative case works, these procedures are called triangulation (Stake, 1998). Triangulation is a notion drawn from land surveying, and is often used to confirm the validity in qualitative research. It involves the comparison of data relating to the same phenomenon that are derived from different phases of the fieldwork, different sources, and/or different points in the temporal cycle (Khera et al., 2001). In qualitative research, one of the methods for validating the findings is the use of participant check. For this check, the draft questionnaire was examined by interviewing two companies for minor modifications on the wordings of some survey items and then we invited several companies engaged in KM for participation in this study.

Case study

Our case study examines the cause and corrective actions of KM gaps within an enterprise. We have selected two companies for research purposes – the first company is in the consumer goods/food manufacturing/convenience stores industries while the other is involved in the semiconductor/integrated circuit (IC) packaging industries. In the following,

we provide background and a profile of the competitive environment for these two companies.

Uni-President was established in 1967, since then its business scope has diversified from its original activity of flour manufacturing, animal feed, and beverage to convenient chain stores, distribution, construction, etc. – all consumer related commodities and services to become a life industrial group with diversified operations. The company believes in and practices the concept of best quality, highest credibility, best service, and reasonable price. They belief that human resources are its company's biggest asset have led them to undertake a series of human resource management developments and innovations. They encourage employees to participate in more executive management courses, and share their experiences with different people among different business fields (www.uni-president.com/). The company initiated the implementation of KM in July 2000. Due to the low homogeneity of the core knowledge owned by different business units, the company separates the units into different clusters based on the possibility of core knowledge sharing. However, each cluster obtained different results; as the implementation levels and the effectiveness of the projects are dependent on the commitment of the directors of each cluster.

Advanced Semiconductor Engineering Inc. (ASE Inc.; see www.asetwn.com.tw/) was founded in 1984. It is one of the world's leading providers of semiconductor manufacturing services and takes pride in being the leader in offering a comprehensive range of advanced integrated circuit (IC) packaging. The company possesses expertise in product and process technology for the manufacturing of chip scale package, high frequency packages, multi-chip module, flip chip and wafer bumping manufacturing. It offers customers turnkey services for integrated tests, packaging, system assembly and product delivery. The company's vision is to become the world's best and largest IC package foundry with a mission to satisfy the needs of its valued customers while improving overall employee satisfaction. The company can accomplish this by remaining as flexible as possible while working with its customers and partners. The company has always considered its employees as its most important asset and treats employees with fairness, provides the best training opportunities available in the industry and promotes a happy and open working environment (ww.asetwn.com.tw/). The company has a strong culture, which unites everyone in the organization with emphasis on respecting humanity, encouraging dedication, and enabling involvement and team work. The company built its center of knowledge management in-house, after first rolling out a careful and sequent assessment then challenging the engineering departments to take serious actions of KM independently.

In order to find the comprehensive set of causes for these gaps, we selected both traditional and high technology industries to interview. Uni-President is the leading food industry company in Taiwan, and clearly a good example of a "traditional industry" model; while ASE Inc. is the leader in the Taiwan IC packing industry, and a representative model of the high-technology industry. Both companies established dedicated departments to implement KM, and are recognized as having successfully adopted KM and quality philosophies.

Case findings

In the following we provide a description of our findings and describe the main theoretical constructs and related variables associated with the six KM gaps.

Gap 1

The interviewees indicated that firms usually import a substantial part of their knowledge from outside sources. Relationships with customers, suppliers, competitors and partners in cooperative ventures have considerable potential for providing knowledge. Upper management's understanding of the consumer depends largely on the extent and types of communication received from customer-contact. Knowledge development is anchored in the firm's market research and research and development (R&D) departments. However, valuable knowledge can also spring from any other parts of the organization. Interviewees find it difficult to gain a clear understanding of what knowledge is relevant for success, and

how this knowledge should be distributed across the company and its employees. A concise summary of the primary causes for gap 1 is described as follows:

- failure to understand the enterprise's position;

- difficulty in acquiring valuable information due to the communication barriers between the upper management and line employees; and

- lack of awareness on what core knowledge the firm possesses.

Based on these findings, upper managers need to realize firm's internal and external conditions in order to successfully adopt KM by enacting proper implementation strategies as mentioned by Ndlela and Toit (2001). It is a tough job because each firm has its own unique knowledge domain as well as specific problems that can be identified and solved, in a unique way. No detail criteria can be easily derived to fit for all firms to implement it. However, following concise issues may be a good reference to eliminate gap 1:

- *Environment scanning.* The critical task of the top managers is to identify the core knowledge required to sustain competitive advantage (Turban *et al.*, 2002). Thus, top managers should review the internal and external environments of the company to understand the enterprise's strength, weakness, opportunities, and threats.

- *Vertical information feedback.* Vertical information feedback typically provides information to upper level managers from frontline employees (Read, 1962).

- *Knowledge domain defining.* The knowledge domain relies on the firm's strategy and can be described through a knowledge map of core capabilities. The knowledge map is useful for the distribution of knowledge concerning the firm's core capability (Woo *et al.*, 2004). It depends on the firm's strategy as well as core capability identification, and should be revised continuously during implementation of KM (Kim *et al.*, 2003).

Gap 2

Interviewees indicated all attempts to manage knowledge must start with an honest self-diagnosis. The results of this assessment can be checked against an external appraisal by consultants, customers or suppliers. Companies should aim to ensure the use and development of skills and knowledge that are relevant to the organization's objectives. These managers are unable to translate concretely their core knowledge needs into the KM implementation plan due to the non-standardization problem of knowledge. To speed up access to the required information, a standard (classified) code should be provided. A concise summary of the causes for gap 2 is described as follows:

- inability by the enterprise to describe or recognize its core knowledge required for competitiveness;

- knowledge management goal is not relevant to the organization's objectives; and

- difficulty in transferring the necessary knowledge to the km plan due to non-standardization.

It implicates that the upper management may be unable to recognize the core knowledge that the enterprise needs, or even if they do, they may not be able to pursue knowledge due to an inability to describe what they need as be indicated by Zeithaml *et al.* (1988). Thus, these managers may be unable to translate concretely their core knowledge needs into the KM implementation plan. In conclusion, the level of gap 2 will depend on how effectively the following activities are conducted:

- *Self-diagnosis.* In establishing a KM plan, it is crucial to diagnose and understand its value, and how suitable the plan is for building the KMS for the enterprise (du Plessis and Boon, 2004).

- *Goal setting.* The ultimate goal of KM is to create value through knowledge usage. A strong emphasis on KM in the firm's business plan indicates the importance of well-developed strategies for establishing a program to achieve the firm's overall objective (Kamara *et al.*, 2002).

- *Knowledge standardization.* The effective translation of tacit knowledge into explicit knowledge depends on the degree to which knowledge can be made standard or routine. Thus, the firm should leverage information technology to provide a user-friendly repository to store standardized knowledge (Desouza, 2003).

Gap 3

The interviewees recognized that companies must create the right employee management conditions and culture essential to enabling large-scale change initiatives. Proper training and effective communication are critical to calm employee fears of change and persuade them into embracing a more effective way of working. To gain full support from the upper management, it is vital for knowledge managers to communicate to them the added value and necessity of KM implementation efforts. A concise summary of the causes for gap 3 from the analysis of the in-depth interview is described as follows:

- lack of awareness, comprehension or willingness by employees to share their knowledge; and

- lack of top management commitment to KM.

The results reveal that employees may not fully understand the value of the KMS or are concerned that their personal value in the enterprise might be negatively affected after sharing their knowledge. As a result they are unwilling to share their self-possessed knowledge. Top management must encourage employee to accept this new culture (Moller and Svahn, 2004). Thus, the size of gap 3 in any firm will be a function of its employee orientation and management commitment, and two key issues, as follows, should be carefully handed for bridging the gap:

1. *Employee orientation.* KM problems often occur because employees are not well suited for their positions. Managers commonly do not give enough attention or devote sufficient resources to hiring and selection processes (Zeithaml *et al.*, 1988).

2. *Management commitment.* If there is an absence of total management commitment, then KM cannot be implemented successful. It is essential that the top managers instill in their employees the importance and the benefits of KM (Ndlela and Toit, 2001).

Gap 4

Interviewees indicated that there is limited database usability for employees in the initial stages of KMS. Most of these initial databases are either critically important or easily built. This is usually caused by the fact that a limited number of employees are actually involved in the initial document reviews due to poor participation. This, thereby, severely limits the relevancy and appropriateness of the available documents to a select segment of the employee population. Furthermore, routine revisions, database updates and functional audits by a committee are also important activities required to implement the KMS. Due to the tacit and dynamic nature of knowledge, it is difficult to measure knowledge assets with existing accounting systems. Many companies fail to evaluate the results of KM to determine whether or not it meets expectations. Therefore, a complete measurement system needs to be developed to evaluate whether the KM activities will enable the enterprise to enhance its competitiveness after implementation. A concise summary of the causes for gap 4 from the thematic analysis of the review is briefly described as follows:

- Limited employee involvement during initial document review resulting from difficulty in attracting participants, and it results in an incomplete knowledge repository, unfortunately.

- Failure to evaluate the results of KM to determine whether or not it meets the expectations. And, existing accounting systems are not appropriate for measuring knowledge assets.

As several studies' arguments that a robust set of metrics that evaluates the value of the KMS is needed to be developed before the initial database is built for an effective knowledge repository (Tiwana, 2001). It can be inferred that gap 4 will occur if firms are unable to build a suitable knowledge repository and knowledge measurement system:

- *Knowledge repository.* A knowledge repository should be designed to use and provided access to required knowledge. In large organizations, each day brings experiences that can be reused and applied in future instances and should therefore be captured. Knowledge managers play a critical role in maintaining the knowledge repository by uploading new capital, refreshing outdated information and purging material (Chang *et al.*, 2004). Without these activities, the knowledge repository soon becomes unwieldy and dysfunctional, potentially causing the firm substantial costs if investment decisions are based on outdated or faulty knowledge (Probst *et al.*, 2000).

- *Knowledge measurement system.* A comprehensive measurement system needs to be developed in order to evaluate KM activities (Kreng and Tsai, 2003). Knowledge measurement involves the evaluation of knowledge resources and knowledge processors, which consist of identifying and recognizing value-adding processors and resources, assessing and comparing the execution of KM activities, and evaluating the impact of an organization's KM conduct based on the bottom-line performance as mentioned by Ahn and Chang (2004).

Gap 5

The interviewees indicated that there is daily sharing of experiences within group and in which the members behave interdependent that can only be explained in terms of group interactions. This suggests that some types of innovation cannot be achieved by individuals, but only by a team. Furthermore, organizational structures are not generally formed to suit the needs for KM. Geographical or functional barriers that have developed in the firm's past may make efficient knowledge distribution difficult or impossible. This analysis reveals the following concise summary to describe the reasons why gap 5 occurs:

- different perceptions of KM between the upper management and other employees due to difference in position, role, and professional knowledge; and

- the employees at different levels have distinct attitude toward planning, responsibility, accountability, and authority.

It is easy to see that there are gaps between the perception of the upper management and that of employees due to differences in position, role, and professional knowledge in a firm (Nonaka, 1991). Hence, employees' perceptions of what type of knowledge they need will be different and will depend on their positions and roles. In addition, in each level there are differences in planning, responsibility, and authority. To press down the occurrence probability of gap 5, briefly speaking, we have to avoid the malfunctions occurring in teamwork and communication:

- *Teamwork.* In general, implementing a KM system usually requires the combination of many individuals' specialist knowledge; the key to efficiency is to achieve effective integration while minimizing knowledge transfer through cross-learning by organizational members (Ditillo, 2004).

- *Communication.* Although relevant communication may be formal or informal in any firm. Herein, we found that the effective upward communication is critical, which in turn depends on the medium through which it occurs. Only when there is interaction, communication, transparency and integration can individual knowledge become organizational knowledge. This kind of arguments can be found in many studies (e.g. Zeithaml *et al.*, 1988; Choi and Lee, 2003).

Gap 6

The interviewees indicated that the KM activities could be facilitated by cooperation and collaboration between members. For example, marketing experts will be more willing to share and apply new marketing knowledge with each other within their department than with those outside their field. However, if sharing the knowledge with others will hurt benefit, efficient sharing of knowledge is usually impossible. Upper management should convey simple and definite messages to all employees, demonstrating that sharing knowledge is a critical requirement in day-to-day jobs as well as for obtaining rewards. Based on the results
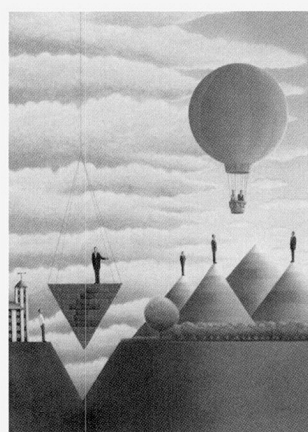
of the analysis, two key reasons that induce the occurrence of gap 6 are described as follows:

- employees do not feel that they are encouraged to share the existing knowledge; and
- employees are deluged with highly specific knowledge that may be difficult to communicate to others.

The power of knowledge for each employee comes from what one knows. So the knowledge workers usually do not want to share their intellectual assets with others. If employees do not feel that they are encouraged to share existing knowledge in the organization, they may refuse to participate in the implementation of the KMS (Martin and Oliver, 2000). The interview reveals that gap 6 will happen if an enterprise cannot build a suitable knowledge communities and reward system, which are described as follows:

- *Knowledge communities.* The organization should establish an atmosphere providing a friendly and effectively communication channel, and further emphasizing the sharing of knowledge and innovation explicitly, so that the employees will be more willing to share and apply new knowledge with each other (Bhatt, 2002). Enterprises should draw their expertise and establish a community of common professions before implementing the KMS (Ardichvili *et al.*, 2003).
- *Reward system.* By encouraging employees to form a sharing culture through a reward system (Goh, 2002). The firm should take step to foster a trust culture by establishing an incentive system for sharing knowledge between employees (Barrett *et al.*, 2004).

The results of analysis from these two case studies are summarized in Table I and are used to develop a questionnaire to quantify the KM gaps.

The draft of questionnaire was examined by interviewing two companies for content and validity, and minor modifications on the wordings of some survey items were made. We then called upon several companies engaged in KM for participation in this study. Five companies were willing to take the survey; they are Philips Electronic Building Elements (Taiwan) Ltd., Winbond Electronics Corp., Via Technologies Inc., Aerospace Industrial Development Corp. and Vanguard International Semiconductor of Taiwan Ltd. A mail survey was used for collecting the data. Table II shows the demographics of the five companies. A seven-point Likert-Scale was used for measuring the research variables. There were 41 responses complete and usable for analysis, yielding an effective response rate of 82 percent.

Based on the survey findings from these five companies, the mean values of the theoretical constructs for each KM gap, which measure the influence factor of each item, are summarized in Table III. The interview and survey responses provided a strong basis for developing our research model. The model is validated to some extent by the results of the survey.

As seen from Table III, we found:

- Almost all of the KM gaps scored more than 4.33 on a scale of 1 to 7, indicating that the measurement instrument is good enough to quantify the exploratory study.
- Among the influence factors of gaps 1-6, vertical information feedback, goal-setting, employees' orientation, knowledge measurement, communication and knowledge communities have lower concurrence scores, but still above 4.90, meaning that the influence factors identified in this study are valid.
- The companies have lower concurrence score on gap3 and gap 4. These gaps concern with the disparity between employees' execution of the KM plan devised by the management, and the improvement of enterprise competitiveness after actual execution. This process seems simple, but it implied the internalization and externalization of corporate knowledge in KM, top managers should let the employees to understand their KM plan. In other words, the employees must absorb the KM plan as their tacit knowledge, so that they can correctly implement this plan. This is the hardest part of KM (Nomura, 2002), and therefore it is difficult to identify all the factors that influence these two gaps.

Table I	Theoretical constructs and relevant problems associated with the six gaps	
Theoretical constructs		*Relevant problems*
Gap 1	Environment scanning	Does the core knowledge owned by firm dominate in the industry? If not, what is the position of it and how far away compared with benchmark firms? Which industries have been developing knowledge that could pose a threat to you?
	Vertical information feedback	How can effectiveness and efficiency employees communicate the knowledge obtained from external environment with their managers? Can employees screen out the useful KM for the firm from external environment?
	Knowledge domain	Do you know about the knowledge that is critical to your firm's success? Can the firm create required knowledge for itself?
Gap 2	Self-diagnosis	Does the corporate culture facilitate introducing the KM? What infrastructure of information technology owned by the firm can support the implementation of KM?
	Goal-setting	Do the goals of KM align with the firm's goals? Are the goals of KM consistent with the individual goals?
	Knowledge standardization	Can the knowledge-coded by a standard hardware system? Does the firm provide friendly software to standardize the knowledge?
Gap 3	Employees' orientation	Do top managers and employees truly understand what KM is? Do employees have the good skills to apply to use the information technology for successful implementing the KM?
	Management commitment	Does the firm commit to provide abundant resources to support KM? Are top managers and employees both committed to implement KM?
Gap 4	Knowledge repository	How long and how much of the budget can the firm provide to build an appropriate knowledge repository? How long does it take to update the knowledge repository?
	Knowledge measurement	Does the firm have an explicitly quantitative and financial monitoring system and culture? Which function or department of the firm be a successful prototype or benchmark?
Gap 5	Teamwork	Do employees feel they are cooperating rather than competing with one another in fulfilling the goals of KM? Do employees feel personally involved to the implementation and commitment to devote themselves?
	Communication	Is the communication between functions or departments good enough? What is the number of layers of the hierarchy of the organization structure.
Gap 6	Knowledge communities	Can knowledge communities be mapped on to the existing organizational structure? Do top managers support the knowledge communities?
	Reward system	Does the firm provide enough incentives and resources to stimulate employees to build up the skills that they need in implementation? Do the employees continuously improve their knowledge and skills under current reward system?

Table II Demographics of sample firms

Company name	Sales (million NT$)	Capital (million NT$)	Number of employees	Date of KM introduction	Number of responses
Philips	63,553	4,920	2,453	2001/4	10
Winbond	32,089	44,252	3,571	2000/6	6
Via	25,121	11,918	1,635	2001	6
AIDC	9,257	9,082	3,330	2000/9	10
Vanguard	8,307	22,000	1,828	2000/11	9

Table III The gaps mean of each company

Theoretical constructs		Philips	Winbond	Via	AIDC	Vanguard	Total average
Gap 1	Environmental scanning	5.3	5.58	5.92	5.95	5.89	5.73
	Vertical information feedback	5.25	5.17	5.5	4.9	5.22	5.21[a]
	Knowledge domain	5.5	5.44	6.06	5.47	5.74	5.64
Gap 2	Self-diagnosis	5.33	4.56	5.94	5.17	5.85	5.37
	Goal-setting	5.2	4.78	5.44	4.5	5.37	5.06[a]
	Knowledge standardization	5.35	4.5	6.08	5.05	5.61	5.32
Gap 3	Employees' orientation	5.27	4.5	5.33	4.4	5.0	4.90[a]
	Management commitment	5.3	4.83	5.58	5.0	5.17	5.18
Gap 4	Knowledge repository	5.15	4.5	5.42	4.85	5.39	5.06
	Knowledge measurement	5.2	4.33	5.67	4.5	5.0	4.94[a]
Gap 5	Teamwork	5.1	4.44	5.44	4.97	5.22	5.03
	Communication	5.15	4.67	5.42	4.35	4.94	4.91[a]
Gap 6	Knowledge communities	5.37	4.33	5.5	5.13	4.96	5.06[a]
	Reward system	5.35	4.67	5.58	5.2	5.17	5.19

Note: [a] The lowest concurrence on the gap

Fortunately, the survey results indicate that the lowest average of concurrence on gap 3 and gap 4 is 4.90, meaning that the influence factors identified in this study are valid.

■ The concurrence on gap 5 is lower. Gap 5 concerns the perception disparity between top managers and employees on the knowledge required for enterprise's competitiveness. To have an in-depth understanding, we found that at present top managers still cannot fully appreciate the importance of communicating with the employees and allow them participate in decision-making process; all decision making still takes place in the traditional top-down fashion. Therefore, when a firm pursues a KM plan, it not only needs top managers' commitment and knows the employees' capability, but also be aware of other influence factors. Overall speaking, members will have different expectation and concurrence on the gaps based on their positions.

Conclusion and future research direction

From the aspects of strategic, perception, planning and implementation, we have derived six management gaps in implementing the KMS. After interviews with two companies a clear picture was obtained, and the findings were used to develop questionnaires, which is designed to verify whether the qualitative data from the interviews matched the quantitative responses. We identified the major theoretical constructs and their relevant problems associated with these six KM gaps. The results reveal that:

■ From the strategic aspect, to reduce gap 1 and gap 4, the upper management should address the enterprise's strength, weakness, opportunities, and threats, and then formulate a suitable KM strategy (Hooff et al., 2003; Pana and Leidnerb, 2003). Furthermore, they should be equipped with information about the activities and performance throughout the organization.

> **The inability to identify and resolve any knowledge gaps prior to implementation will greatly impact the implementation process.**

- From the perception aspect, to reduce gap2 and gap 5, the critical task of the top managers is to identify the core knowledge required to maintain competitive advantage. Employees and top managers work together for a common goal; thus, employee efforts can guarantee a successful implementation of the KMS (Barrett *et al.*, 2004). Therefore, an enterprise should provide suitable training and resources to the employees, and use information technology to provide a friendly repository to standardize and store knowledge (Kwan and Balasubramanian, 2003). The enterprise should also establish an atmosphere emphasizing knowledge sharing and innovation and encouraging employees to form such a culture through a reward system (Tiwana, 2001). Then, gap 6 can be reduced.

- From the planning aspect, the action plan should include schedule, people involved and resources required, although it is difficult to transfer the necessary knowledge to the KM plan due to non-standardization. Employees' orientation toward KM, including the awareness of the importance and benefits of KM and IT skills for KM process, should be completely addressed (Desouza, 2003). Then, gap 2 and gap 3 can be reduced. knowledge-oriented employee assessments can also fail if they are not linked closely to existing incentive systems (Probst *et al.*, 2000). The company should take steps to build up the trust of the knowledge owner's by associating knowledge sharing to pay and incentives.

- From the implementation aspect, a robust set of metrics that evaluates the value of the KMS after implementation will need to be developed (Mitri, 2003). It is essential that the top managers instill in the employees the importance and benefits of KM. Employees often fear that if they pass on their knowledge to others, they will endanger their own position, authority, even power in the organization. Training and communication are essential to calm down employees' fears of change, and perhaps to help them to enjoy new ways of working with their colleagues (Probst *et al.*, 2000). Thus, firms need to create the right circumstance around the organization, primarily in the areas of KM activities and culture (Barrett *et al.*, 2004). Then, gap 3 and gap 4 can be reduced, and the implementation of KM can truly enhance the enterprise's competitiveness.

Every organization has its own way of dealing with data, information and knowledge, and it creates its own structures, jobs and system for that purpose (Nonaka *et al.*, 2000). Therefore, there are no standard methods for introducing KM; the best way is to start with the existing structures and methods, and then apply them effectively to achieve the company's knowledge goals (Hall and Andriani, 2002). In the start activities, our study provides a useful reference to realize what problems many happen and how to conquer them. However, this study has only done in-depth interview with two firms and do survey with five companies for validating the proposed framework of KM gaps. Although we obtained valuable results from our framework, it may be necessary to conduct survey with larger size of samples to validate it empirically and obtain more robust survey instrument is ready to be mailed to conduct quantitative analysis following a pilot test of the same after these case studies. Such analysis will provide a foundation to understand those aspects that are unique and different for different KMS; as long as appropriate changes in the model and instrument are made to reflect those differences. Furthermore, through analysis of the relationship between the gaps and their influence factors, we can develop concrete measurement indices for the KM gaps.

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