

Case Report

The Framework for KM Implementation in Product and Service Oriented SMEs: *Evidence from Field Studies in Taiwan*

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Academic Editor: Gayle C. Avery

Received: 24 January 2015 / Accepted: 9 March 2015 / Published: 12 March 2015

Abstract: Knowledge management (KM) is a core competency that determines the success of small and medium-sized enterprises (SMEs) in this knowledge-based economy. Instead of competing on the basis of physical and financial capital, the success of SMEs is influenced by the knowledge, experience and skills of the owners and its employees. Unfortunately, many SMEs are still struggling with KM implementation due to lacking a comprehensive KM framework. This study aims to identify enablers for KM success and build up a framework for KM implementation in service and product oriented SMEs. By using multiple research methods, this study collects data from SMEs in Taiwan to prove our suggested enablers and reference KM framework. The suggested framework can provide useful assistance and guidance for holistic KM solutions. The K-object concept, which adopted the XML standard, may become a significant managerial and technical element in the KM practice. The enhanced KM framework mandates every employee's participation in knowledge activities, not just some elite knowledge workers. The findings provide useful implications for researchers and practitioners by providing useful templates for implementing KM initiatives in different industries and more comprehensive framework for KM implementation in different types of SMEs.

Keywords: KM enablers; reference KM framework; knowledge object; KM template; service and product oriented SMEs

1. Introduction

Small and medium-sized enterprises (SMEs) are often referred to as the backbone of the economy as they provide the source for jobs and social cohesion. According to the Economic Ministry's 2011 SMEs White Paper, in Taiwan, SMEs represent around 97% of all enterprises, contributing up to 60% of GDP, 78% of the total employment and 17% of the total exports of the country. However, the average longevity of SMEs is between five and ten years. Thus, to survive and remain competitive in the market, SMEs need to leverage their *knowledge* to achieve operational efficiencies, higher innovation, and better client service relations [1,2]. Instead of competing on the basis of physical and financial capital, the success of SMEs is influenced by the knowledge, experience, and skills of the owners and its employees [3].

However, compared to the heavy investment in knowledge management (KM), the return seems far from satisfactory. Most KM projects simply do not hit their stated goals and objectives, with the failure rate of knowledge management projects at close to 70% [4,5]. According to the survey conducted by International Data Centre Taiwan (2006) [6], 96% of firms see KM as an important management tool; only 15% of firms identified the value-production of knowledge in order to reach a decent level. This indicates that some firms, especially SMEs, understand the importance of KM but do not fully grasp the concept of implementation. By reviewing previous studies, Durst and Edvardsson [7] state that in many SMEs there is lack of systematic knowledge management. SMEs do not manage knowledge in the way large organizations do since SMEs usually lack resources such as land, labor, and capital. The SME sector is weaker than larger firms on formal and systematic discussion in order to share tacit knowledge [8]. In some cases, managers of SMEs also try to prevent outflow of knowledge from the company and, thereby, block knowledge sharing. However, SMEs still have certain advantages in KM practices such as flat and flexible organizational structures, elastic and adaptable processes, strong innovation potential, and less bureaucratic in decision-making [9]. Compared to their larger counterparts, they usually feature higher socialization characteristics where employees work in close proximities [10]. Their know-how and knowledge are the most crucial of the resources they may have or use because knowledge is the most important resource in such organizations [8,11].

The most common error in implementing knowledge management is failing to coordinate efforts between information technology and human resources. Malhotra [12] figures that two broad reasons are the inadequate definition of the term “knowledge” and the problem in leveraging important KM issues. By conducting a survey, Akhavan *et al.* [4] identify the ten most important failure factors of knowledge management implementation, which are related to organizational issues (top management, knowledge manager, culture). In addition, Dalkir [13] also states that KM practitioners have been practicing “KM on the fly.” KM needs to be grounded in more robust, sound theory.

To solve the problems discussed above, many KM researchers have tried to describe the KM phenomena with implementation frameworks in order to prescribe the essential elements of KM, to communicate coherently about KM, and to design and evaluate KM solutions [14]. In this study, “KM implementation” means the way of using and integrating the appropriate knowledge for solving particular complex and unforeseen problems [15]. For SMEs, it helps to explain what is happening now, and they provide us with a valid blueprint or road map for getting organizations where they want to be with their knowledge management efforts [13]. However, until now, most of the studies have been criticized of being surrounded by confusion, due to lack of maturity and clarity of its definitions and

frameworks [16]. Most KM implementation framework seems to be oversimplified and consequently unable to represent the multifaceted nature of KM. Therefore the first research question in this study is “*How to define knowledge in order to build up a knowledge implementation framework to make it understandable and applicable?*”

Many research efforts tried to develop implementation frameworks. Some of these frameworks focused on identifying the different sets of KM activities that organizations have to deal with, in order to orchestrate knowledge resources in the organization [17]. Other studies tried to develop frameworks for the critical success factors that drive the implementation of KM programs, which in turn impact performance in organizations [18]. In the process of carrying out KM, SMEs face the varying conditions of corporate culture, workflow processes, and the integration of group members’ knowledge. They also need to increase the usage of information technology in order to help problems regarding the flow of information. Therefore, the second research question in this study is “*What are enablers for KM implementation successful in SMEs?*”

In addition, services and products differ notably with respect to the format of their input and output, delivery, and consumption [19]. Services are intangible by nature and use information and knowledge as input, whereas traditional products are tangible and require material and intangible inputs [20]. These fundamental differences also influence how knowledge is embedded and managed in business processes. Therefore, the third research question is “*Can service-oriented and production-oriented companies apply the same KM implementation framework?*”

The purpose of this study is to develop a framework for SMEs that provides a better framework for the different activities of knowledge flow and management, based on better understanding of the nature of knowledge. In consideration of a manageable scope of study, we intend to handle the following issues:

- *Redefine the concept of knowledge, make it become tangible to manage*
- *Figure out enablers for KM success*
- *Build up a new reference framework for KM implementation*

To fulfill these above research purposes, this study first reviews related concepts of knowledge and comes up with a new view of knowledge. Second, we also review different KM models and framework in the previous study to figure out enablers for KM success and build up a new KM framework in practices. To validate the new reference KM framework, this study applies different methods to collect and analyze data. The findings of this study are expected to shed new light into KM research. To practitioners, this study may be a useful reference for implementing KM initiatives. Since frameworks can provide useful assistance for holistic KM solutions and offer guidance in order to purposefully and systematically plan KM efforts.

2. Literature Review

2.1. Perspectives of Knowledge

Alavi and Leidner [21] found that knowledge may be viewed from several perspectives: a state of mind, an object, a condition of access to information, or a capability. Newell [22] proposed a neutral, but very rich and unifying concept of knowledge, admitting the possibility that usable representations exist for both human processors and computer-based processors. In Newell’s opinion, knowledge is

conveyed in usable representations including symbolic, visual, audio, mental, digital, behavioral, and other patterns in time and space. When a specific representation is found to be usable by some processor, then for that processor it is knowledge. There are also many attribute dimensions for characterizing an instance of knowledge and its degree of usability for a particular processor may be a function of where it lies on these dimensions [23].

Knowledge is a complex and multi-faceted concept and is embedded in many entities and/or activities in an organization, including the organization's culture, policies, documents, and the employees [24]. More and more, knowledge is being regarded as a valuable commodity that is embedded in products (especially high-technology products) and in the tacit knowledge of highly mobile employees. Although knowledge is increasingly being viewed as a commodity or an intellectual asset, it possesses some paradoxical characteristics that are radically different from those of other valuable commodities. These knowledge characteristics include the following: use of knowledge does not consume it; transferal of knowledge does not result in losing it; knowledge is abundant, but the ability to use it is scarce; much of an organization's valuable knowledge walks out the door at the end of the day [13].

Through extensive review of literature and inspired by the concepts cited above, this study proposes a practical view of knowledge as *the ability to apply relevant information for a purpose*, in which:

- (1) "Ability" implies the availability of a human or computer processor with adequate competence to process the relevant information for the purpose.
- (2) "Relevant information" includes the contextual information and the specific information related to the purpose.
- (3) "Purpose" may be to find a solution to a problem, to make a decision on an issue, or to get an understanding or appreciation of a subject. Hereafter, without loss of generality, the term "problem" may also mean "issue", or "subject", depending on the context.

2.2. Classification and Presentation of Knowledge

Holsapple [23] classifies knowledge in terms of its functions into inferential knowledge, procedural knowledge, and descriptive knowledge. Inferential knowledge and procedural knowledge can be easily externalized for sharing and effectively codified for computer processing. Descriptive knowledge, on the other hand, is more subjective and ambiguous, and is, therefore, difficult to codify.

Knowledge can also be classified in terms of where it resides into tacit knowledge and explicit knowledge. Tacit knowledge resides in the human mind and entails a body of perspectives, perceptions, beliefs, and values. It is difficult to access without ongoing engagement with the knowledge holder. Explicit knowledge, on the other hand, is articulated, codified, and communicated in symbolic form and/or natural language. It can be accessed and used without the knowledge creator being present [25,26].

Ultimately, tacit knowledge will be in one of three states: it remains tacit, it has been transferred to another person, or it has been externalized. If it remains tacit, we can only get it from the tacit-knowledge holder. Therefore, the tacit knowledge may be encoded indirectly in terms of problem description, the holder's expertise or experiences related to this problem, and the holder's contact information [27]. If the tacit knowledge has been transferred to another person, then the recipient's tacit knowledge is encoded in the same way as that held by the originating tacit-knowledge holder. If the tacit knowledge has been externalized, it may be encoded in a way as described below.

Descriptive knowledge will only be used by humans; therefore, it should be encoded in a format readable by humans. Inferential and procedural knowledge, on the other hand, can be used by humans or computers. If used by humans, it should be encoded in a format comprehensible to humans (e.g., a book on how to invest in stocks in the case of inferential knowledge and assembly instructions for Ikea furniture in the case of procedural knowledge). If used by computers, then it should be encoded in a format dictated by the application software (e.g., inference rules in a format required by an expert system shell, and task execution steps in a format required by a workflow engine).

With respect to the functional and situational classifications of knowledge, and the transition between tacit and explicit knowledge, this study proposes a *knowledge encoding strategy* (see Figure 1).

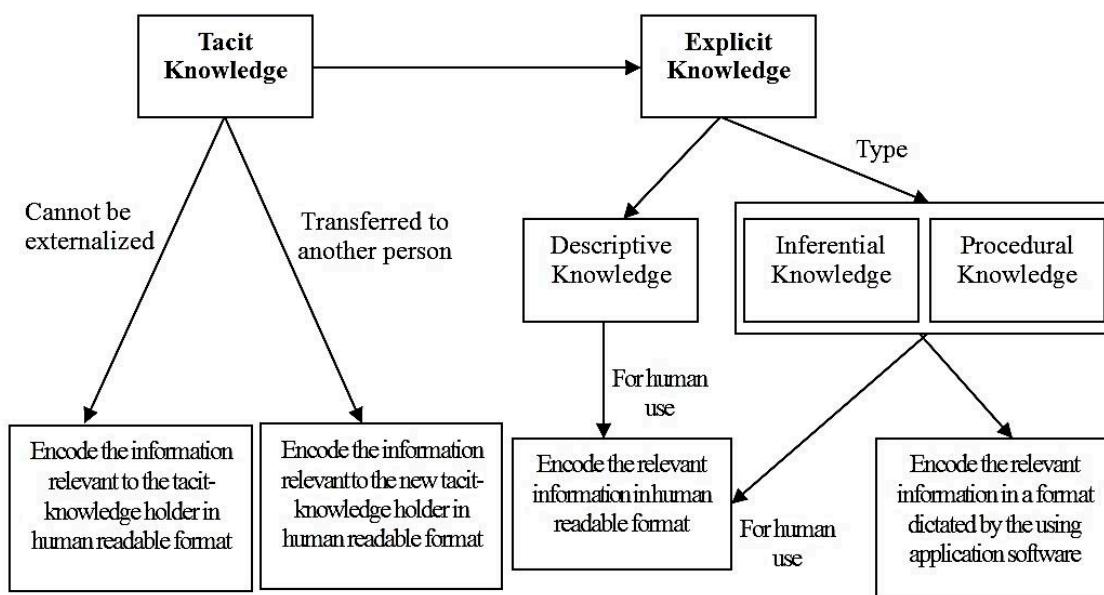


Figure 1. A knowledge encoding strategy.

However, the problem is how we can make this understanding of knowledge become tangible. Ju [28] proposed a knowledge representation scheme that uses a trio of knowledge representation constructs, representation technologies, and knowledge objects. Knowledge representation constructs include logic, ontology, and computation. Representation technologies include XML syntax and related software tools. Knowledge objects (K-objects) include three sets of distinct but closely related ontology: information ontology, enterprise ontology, and domain ontology. The information ontology describes the structure and access to the organizational knowledge assets. The enterprise ontology describes the context of the organization for proper use of knowledge assets. The domain ontology describes the contents of problem-specific knowledge assets. There are two far-reaching implications of using XML syntax to define K-objects:

- (1) Organization of contents in K-objects is flexible and can be very comprehensive, thus K-objects can effectively encapsulate or represent knowledge.
- (2) Because of the XML syntax, the content structure in K-objects can be validated by an XML parser. If the contents have been sufficiently marked up, they can be systematically processed by a computer.

It should be noted that K-objects alone are just information because knowledge is the availability of adequate competence to process the knowledge object. Since tacit knowledge is held by humans and explicit knowledge is represented by K-objects, it should also be noted that KM is people management with respect to tacit knowledge and at the same time is information management with respect to K-objects.

2.3. Common Characteristics of Various KM Frameworks

KM's spectrum of theory is broad, divergent and complex. For instance, in his review of 160 KM frameworks and theories, Heisig [14], while finding commonalities amongst some KM success factors, finds no such consensus over the nature of knowledge. Despres and Chauvel [29] count 72 different KM theories, reporting scant agreement over the nature of knowledge, but a broad consensus that people are the cornerstone of KM with most treating knowledge work as social action. It is proposed here that KM theory can be organized into the bisecting continua of organizational knowledge *vs.* personal knowledge (epistemology), and knowledge as objects *vs.* knowledge as social action (ontology). Interestingly, Spender [30] proposes a similar formula when he argues that the KM field can be split into two distinct domains: knowledge as objects *versus* a rejection of reification and the transformational properties of knowledge.

If it is the case that the most popular theory in the KM field holds, as its central thesis, that tacit knowledge has to be converted to the explicit, with the implied view of knowledge as an object, then the lack of achieved success also suggests a new approach is needed. If there is a small but demonstrable trend towards the view of knowledge as constructed in social interaction, along with the implied importance ascribed to language and communication, then is it not logical to turn in this direction, but to take the enterprise much further to the site of action: language and talk? The analysis of how human actions are accomplished in talk and text, and with what consequences, could represent a fresh perspective and approach to KM.

Heisig [14] conducted content analysis on 160 KM frameworks with emphasis on three aspects: understanding of “knowledge”, KM activities, and critical success factors of KM. His findings:

- (1) On understanding of “knowledge”: A uniform understanding of the term “knowledge” does not exist in KM frameworks. Dichotomies are most frequently used to describe the elements of knowledge, especially the distinction between implicit and explicit knowledge and between individual and collective knowledge.
- (2) On KM activities: There are five most frequently mentioned broad categories of KM activities—share, create, apply, store and identify knowledge.
- (3) On critical success factors of KM: Critical success factors of KM are human factors (culture, people and leadership), organizational aspects (structures and processes), and information technology as well as a management processes (strategy and control). A one-sided implementation of only one of these factors does not correspond to KM as a holistic effort.

Based on the findings, he proposed a representative, three-layered KM framework. The upper layer addresses “Leadership and Strategy”, “Company Culture”, “Human Resource Management”, “Controlling”, “Organizational Roles”, and “Information Technology”. The middle layer addresses

“Knowledge Activities” (create, store, share, and apply knowledge). The lower layer addresses “Business Processes”, “Knowledge as Products”, and “Knowledge as Resources”.

We understand that framework defines the relevant objects and their coherences as well as providing a scaffold for aspects that have to be considered during the design and implementation process. By that, frameworks are a proper solution to map the different contextual aspects and influence factors as well as results. However, what Heisig [14] proposes does not provide a clear map for KM implementation. Thus, it is necessary to identify how enablers play their role in KM. To provide a base for showing how the enablers facilitate KM, this study elaborates on the GPO-WM Framework and presents a more detailed, three-layered KM framework called “Reference KM implementation framework”.

3. Methodology

3.1. A Reference KM Implementation Framework

This three-layered KM framework addresses organizational support for KM, KM support for employees’ knowledge activities, and employees’ knowledge activities (Figure 2). Each layer is further described below.

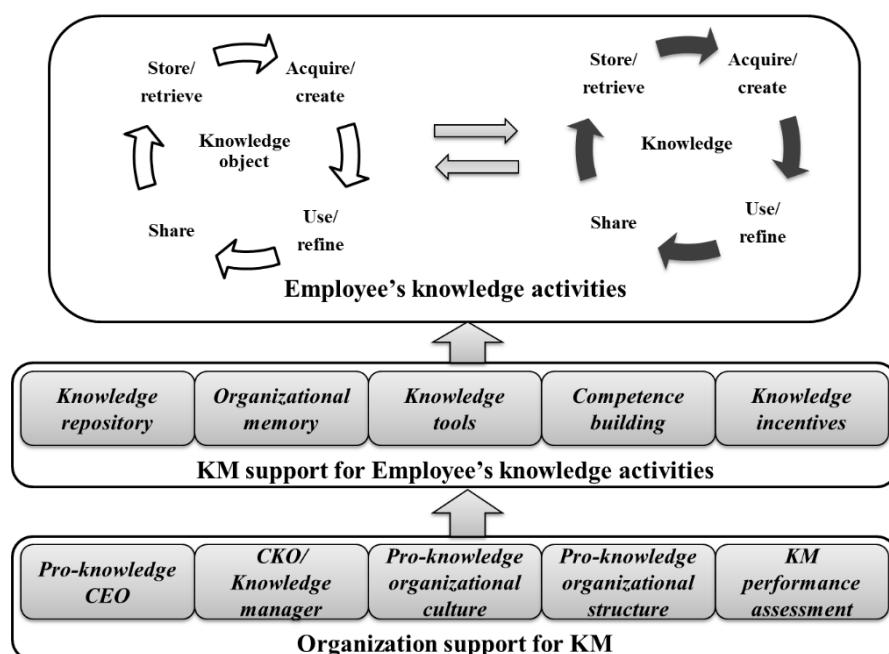


Figure 2. A reference KM framework.

3.1.1. Layer 1—Organizational Support for KM

In this layer we see a pro-knowledge CEO, pro-knowledge organizational policies and culture, pro-knowledge organizational structure, and KM performance assessment:

- (1) Pro-knowledge CEO: shapes the KM culture, allocates resources for KM initiatives, and shields the KM initiatives from political interference.
- (2) Knowledge manager: provides vision, energy, and enthusiasm to translate the knowledge concept into reality.

- (3) Pro-knowledge organizational culture: encourages employees to leverage knowledge for their work and share their knowledge with their colleagues [31].
- (4) Pro-knowledge organizational structure: supports employee empowerment and facilitates knowledge sharing [32].
- (5) KM performance assessment: measures the usability of knowledge in terms of number of knowledge objects created; frequency of their use; and richness of the content in them. Most importantly, the value of knowledge should be measured in terms of product/service improvement [33,34].

3.1.2. Layer 2—KM Support for Employees' Knowledge Activities

In this layer we see knowledge manager, controlled vocabulary, organizational memory, knowledge repository, knowledge tools and technical support, knowledge incentives, and competence building.

(1) Knowledge repository: Knowledge repository operates as a single point for the storage and retrieval of knowledge objects. A basic knowledge repository should have a user interface, storage and retrieval functions, and ample capacity for storing knowledge objects. A knowledge repository may be configured as shown in Figure 3.

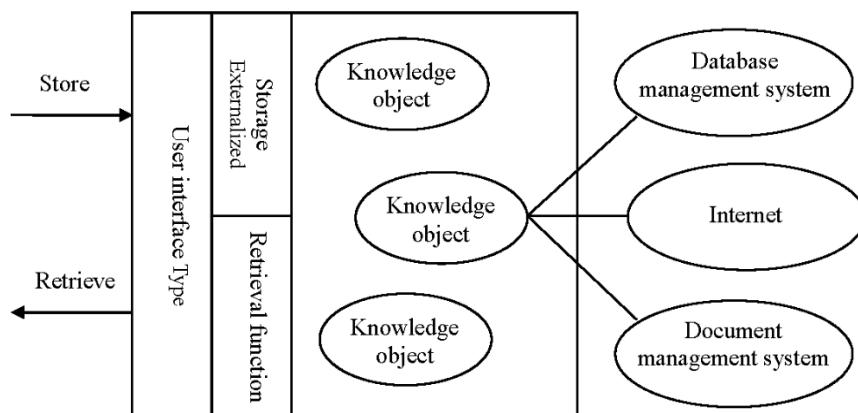


Figure 3. Knowledge Repository.

(2) Organizational memory: There are three categories of organizational memory: (a) Those related to the organization's context, such as organization chart, organizational policies, rules and regulations, standard operating procedures, and organizational norms; (b) Those related to the IT resources in the organization, such as usage of application software, inference engine, workflow engine, knowledge tools, and knowledge repository; (c) Those already existing in the organization's document management system (e.g., official documents, meeting minutes, memoranda, reference materials, frequently asked questions (FAQs), case studies, patents and research findings), database management system (e.g., files and records, archived data, statistics, mathematical models), and Internet-based sources (e.g., corporate website, corporate social media channels, corporate Webmail system).

(3) Knowledge tools and technical support: To most employees, sharing and using knowledge are not innate behaviors. Therefore, suitable knowledge tools and technical support are indispensable to facilitate knowledge activities [35].

(4) Competency building: Competency can be built in the following ways [36]: (a) Someone with the desired competency is recruited as an employee; (b) A consultant with the desired competency is hired

for a specified duration; (c) Training sessions are held periodically to improve employees' competencies; (d) Encourage self-learning and innovation.

(5) Knowledge incentives: Knowledge incentives entice employees to engage in, contribute to, and experiment with knowledge activities [33,37]. The quantity and quality of knowledge objects are good measurements for assessing knowledge contributions.

3.1.3. Layer 3—Employees' Knowledge Activities for Business Processes

The organization's business processes produce products and/or deliver services. It may change due to efficiency or quality issues. In essence, all the knowledge activities are for the good of the business processes [34]. This layer addresses the creation, sharing, and use/refinement of knowledge. Knowledge objects are the core of these activities, so employees are encouraged to encode valuable tacit and explicit knowledge into knowledge objects [38]. This layer highlights the knowledge activities that support business processes and is the focus of KM practice. There are two modes of knowledge activities: SECI-oriented and K-object-oriented.

(1) SECI-oriented knowledge activities: This mode of activities does not involve K-objects because a suitable K-object for the problem at hand is not available. *Knowledge acquisition* means an individual learns from a tacit-knowledge holder. It is done through socialization. *Knowledge creation* means an individual collects relevant information and encodes it into explicit knowledge. It is done through externalization. Note that "creation" does not involve any other party. *Knowledge use* means an individual applies his/her tacit knowledge to solve a problem. If the individual does not have the suitable tacit knowledge, then he/she must go through the internalization process first. *Knowledge refinement* means an individual enhances his/her tacit knowledge by reflection and experiment, by learning from existing explicit knowledge, or by capturing lessons learned. It is done through combination, which is exclusively a human endeavor. *Knowledge sharing* means a tacit-knowledge holder actively transfers his/her expertise or experiences to another person. It is done through externalization or socialization. *Knowledge storage* means to store explicit knowledge into a KM system. It is done through externalization, followed by KM system's intervention. *Knowledge retrieval* means knowledge users can perform efficient and effective queries to retrieve desired explicit knowledge from the KM system.

(2) K-object-oriented knowledge activities: K-object-oriented knowledge activities will reap the maximum benefit of knowledge use and achieve the most effective KM. *K-object acquisition* takes place when there is a need for a K-object of particular purpose but it does not exist in the K-object Repository. If relevant explicit knowledge can be found, then the explicit knowledge is encapsulated into a K-object. Otherwise, the SECI-oriented knowledge acquisition must be done first. The newly acquired tacit knowledge should then be externalized through externalization and encapsulated into a K-object. If externalization is difficult to achieve under the circumstances, the newly acquired tacit knowledge must at least be tracked with a K-object. *K-object acquisition* may take place only when a suitable K-object can be acquired outside the organization. *K-object use* assumes that a suitable K-object for a purpose is found. It should be noted that given the same K-object, higher competence will achieve better results. *K-object refinement* is achieved exclusively by knowledge workers who update the contents of the K-object. Any K-object in the K-object Repository can only be archived or deleted by the authority of the CKO. *K-object sharing* can easily be realized through application software that integrates the storage

and retrieval functions of the K-object Repository and the Internet/Intranet facilities. *K-object storage* is done by the K-object creator through the user interface of the K-object Repository. The user interface in turn calls upon storage function of the K-object Repository to do the job. The user interface will help the user to browse the problem descriptions in each identified K-object, and select the matching or most suitable ones. The retrieval function then retrieves the desired K-objects for the user.

3.2. Validation of the Reference KM Implementation Framework

To assist the small and medium enterprises (SMEs) in Taiwan complete knowledge asset management as early as possible and strengthen their competitiveness, Ares International Corp. and the Small and Medium Enterprise Administration (SMEA) of the Ministry of Economic Affairs (MOEA) kicked off the “Plan for Small and Medium Enterprise” in 2003. This program was divided into two—phase 1 started from 2003 to 2006 and phase 2 was implemented from 2007 to 2010. Since the start of the plan, more than 460 professional KM consultants have been selected to execute on-site KM diagnosis services for over 500 SMEs, helping them to find the basic problems of the management process, and establish core knowledge to assist them to prepare for a knowledge innovation transformation. In addition, about 62 SMEs have received KM introduction counseling services. To help SMEs understand the current status of KM implementation, an evaluation project was conducted in 2010. The results of this report showed that up until 2010, there were still 43 organizations implementing KM in their organization. In order to validate the reference KM framework, this study will collect data based on this program. There are two stages that will be conducted and described in detail below.

3.2.1. Stage 1—Documentary Review

In this stage, we analyzed existing documents and reports related to KM implementation in organizations, which have received support from the government. This step was carried out from March until May 2014. Those documents were provided publicly, presented at meetings, or used in knowledge management initiatives by companies. For the purpose of data acquisition, the documents and reports relevant to the topic “KM” were investigated for the period of 2003 to 2010.

In the first step, the data was extracted as “keywords” from each document, if required translated into English, and assigned to the following analysis categories: (1) Sources including title of document, company, department, author, and year; (2) Statements to respective definitions of knowledge; (3) KM activities; and (4) KM involving enablers. The emphasis on the content analysis is on the last three categories: definitions of knowledge, KM activities, and enablers for KM. That information was classified and put into different three layers of proposed framework. In the second step, the results in these categories were coded and counted out according to the frequency they were mentioned. After finishing the data analysis, we knew whether the information that we got from documents and/or reports of organizations fit with all items in three layers of reference framework. In cases where have new items not included in the framework, we added them into the framework to make them more complete.

3.2.2. Stage 2—Cases Study

Based on the results of Stage 1, we found that information we gleaned from documents and/or reports from organizations is accurate but not enough. There may be hidden problems that are unable to be clearly described in documents. The purposes of this study are not only focusing on coming up KM implementation framework but also figuring out the differences of this framework in manufacturing and service industries. Therefore, we still need to conduct case studies to get more insights into KM implementation in different organizations. Using case study surveys is the main way to gain insights into the “how” and “why” of an issue happening in companies and to analyze influencing factors [39]. Moreover, data collected from cases help us evaluate whether reference KM framework can be applied for all organizations in different industries. This method enables us to gain a holistic view of provided KM framework, providing a rounded picture given the many sources of evidence used [40]. A multiple-case study is useful in capturing the emergent and imminent properties of an instable context like KM that is changing very quickly. A multiple-case study might allow generalizations of the findings that neither lead to some form of replication nor strictly related to KM [41]. The main benefits of the multiple case study approach are also the comparison of different case studies supports explorative investigations [39].

We select two companies from both product and service-oriented companies from the list mentioned in stage 1. The units of analysis are KM projects that have been conducted for at least three years and produced some specific results. This step was carried out from June until August 2014. We decided to apply the triangulation method of data collection since this is a method used by qualitative researchers to check and establish validity in their studies by analyzing a research question from multiple perspectives [42]. We conducted lengthy, semi-structured interviews in each company with three to five interviewees, the number varied depending on the size and complexity of the KM project. All interviewees were senior executives, KM managers, and knowledge workers who are involved in activities related to KM. Interviews were supplemented by archival studies of reports, memoranda, and presentation materials in each firm. The interview questions were sent to the interviewees in advance to allow them get familiar with the topic. Each interview were recorded and transcribed. We also conducted observations of knowledge workers to get more understanding about KM activities in each case. Our main questions which we asked senior executives and KM managers are related to: the understanding of “knowledge”, KM activities, KM enablers, and KM performance assessment.

After collecting data from the cases, we continue to conduct group interviews with consultants and KM project managers who are in charge of supporting the government to promote KM programs. The data analysis for this stage consists of four stages: (1) accumulating different data; (2) developing an in-depth case history of the company activities from the raw data that provided all the information; (3) open coding and subsequent selective coding of the in-depth case history for the characteristics and origins of KM processes in the company; and (4) analyzing the pattern of relationships among the conceptual categories. The chronological descriptions of the project’s activities were constructed with respect to the KM process in the companies, describing how it came about, when it started, who was involved (rank of authority in the company), the level of involvement, and the major outcomes. Through this work, an in-depth case history of the project was completed.

4. Research Findings and Discussion

4.1. Stage 1—Results of Documentary Review

After completing the gathering of literature and other materials, we classify information into different categories: purpose of KM implementation, KM activities, and KM enablers. We review reports of 43 companies in which 20 product-oriented companies and 23 service-oriented companies.

4.1.1. Purpose of KM Implementation

Looking at the KM implementation purposes, managing knowledge resources is considered the main objective of pursuing KM in business operations (employees retire or quit their jobs and organizations need to keep/remain their knowledge). All of 43 SEMs believe that KM implementation will enable the companies to gain competitive advantages. They also suggest that KM operations will assist the organizations in improving business processes and reducing duplication of work to increase the company profits and inspire innovation. For 20 product-oriented organizations, KM plays an important role in developing new products because when knowledge can be managed well, employees will avoid the problems related to “reinventing the wheel”. They are able to keep track of which ideas they already have and what they should do to improve them or create new ones. For 23 service-oriented organizations, KM is a good way to enhance customers’ satisfaction. Employees are able to respond to customers in the shortest time since they can retrieve knowledge easily and quickly.

4.1.2. Understanding of Knowledge

Related to understanding knowledge, knowledge can be categorized into explicit and implicit types, and the former is easier to acquire and represent in an organization:

- Classification of knowledge: knowledge may be referred to as “know about,” and the latter as “know how”.
- Knowledge structure: Refers to the domain theory, knowledge acquisition, knowledge system design, system documentation, and knowledge exchange.
- Source management: This may include major and minor classifications, and the source varies with the business type and functional area.
- External schemata: It defines the characteristics of knowledge that is not only related to the content but also may be of use for further knowledge retention and access. The attributes include the person, subject, time, place, object, document serial number, main purpose, summary, content, language and so on.

4.1.3. KM Activities

There are four main stages related to handling knowledge in organizations. *Acquisition* is capturing knowledge from external and internal sources at the right time and place. *Conversion* is transforming knowledge from employees and business partners to its operations. *Application* is applying knowledge to the business operations and decision making appropriately. *Protection* is ensuring the knowledge asset is in its safe state. Although, the terms used to define these stages are not the same as what we

proposed in the reference framework, the meaning is not different from activities related to the SECI-oriented knowledge activities in Layer 3.

4.1.4. KM Enablers

Based on the reports of 43 companies, we found that they also classified KM enablers into three main groups:

- *Human perspective*: For a KM project to be successful, the first step is to gain the support and commitment of top management to the initiative.
- *Organizational perspective*: For a KM initiative to be effective, it must fit into the organization's missions and objectives. In addition, the organization also focuses on management activities. The government is a mechanistic hierarchy, and the KM initiative is intended to maximize administrative efficiency and increase the utilization and innovation of government information and knowledge to the public.
- *IT architecture perspective*: The perspective refers to the IT application for the capture, transformation and sharing of knowledge.

4.2. Stage 2—Results of Case Study Analysis

4.2.1. Purpose of KM Implementation

Through 40-minute meeting interviews with top manager and knowledge managers of KM projects in each organization, 2-hour group interviews with two consultants of organizations and project managers of KM programs, and one-day observations, we figured out the purpose of KM implementation of each case as follows:

Organization P, which was selected from 20 product-oriented organizations, is one of the leading printing companies in Taiwan. Radical shifts in printing technologies has fundamentally changed the industry in recent years from traditional manufacturing into digital as well as automated ways. In order to survive, the company's leaders try to find the effective ways to reduce R&D time in order to create more new products in the shortest time. It is essential to leverage existing knowledge of current employees and integrate it with new knowledge in the printing industry; therefore, they started to kick off KM projects in order to reduce costs by effectively enhancing internal knowledge and re-using information. Companies can create more valuable products by leveraging knowledge and experiences of employees even though they already left to deal with repeat, routine transactions and reduce the time of trial and error. Through KM, employees have a common platform for knowledge sharing; they quickly catch up on new knowledge to enhance the core competitiveness of enterprises. In addition, by integrating KM system and ERP; employees handle their tasks well since they can get responses quickly to solve problems.

Founded in 1998, *Organization S*, which was selected from 23 service-oriented organizations, is a well-known consultancy company. The main consultant services of this organization are knowledge management, human resources, lean processes and reengineering, marketing and so on. After expanding target customers, they not only got projects from the local market but have also become a consultant for China companies. Companies need to recruit more experts and employees. However, they do not have

enough resources (time and money) to support them in their training. The management found that if they have “storage” from which their new employees can easily get information for self-learning and quickly responds to customers’ problems, the performance of the company will be improved. Therefore, they decided to set up a “network” which is able to connect experts’ knowledge, support their employees, and then decide to implement KM.

The purpose of KM implementation is related to timesaving, improve responsiveness to customers, better financial results, and better management process and activities. However, in product-oriented organizations, the main purpose is enhancing R&D performance to reduce the cycle time of new product development. Meanwhile, service-oriented organizations shift their focus to customer satisfaction. They invest more effort to support the customer service department.

4.2.2. Understanding of Knowledge

This study proposes a practical view of knowledge as *the ability to apply relevant information for a purpose*. We found that in two cases the knowledge workers have different concepts of knowledge but the nature is the same. They define knowledge as “know-how” or “experiences”. In some cases, employees see knowledge-like information and they can use to support their tasks. So KM just looks like a tool to help them handle their tasks smoothly. However, once it understands the value of knowledge, KM becomes a philosophy of the company—it is a company’s asset not just a tool. The Manager of *Organization P* say that: “*KM, first, is implemented in manufacturing and viewed as an ‘engineering concept’. However, after four years of implementation, I found that it belongs to philosophy*”. What he claims is rather understandable since the manager of *Organization S* also said that he wants to integrate KM and ERP, since he thought KM could work as a “Global Positioning System” to show the map or destination of knowledge.

4.2.3. KM Activities

Normally, KM activities are classified in to four main categories: create/acquire, use, share, and store. In general, the findings of two cases show that KM activities have not much different from theory (Figure 4). Both organizations add one more activity related to *Plan* into the process of knowledge activities. Since KM systems also integrate with other systems in an organization, before conducting any activities related to KM, knowledge workers should have a well-prepared plan. In addition, in *Organization P*, *Store* activity will come before *Share* while in *Organization S*, before *Store* knowledge they also need to add a feature to *Protect*. Since in product-oriented organizations, KM is mainly applied in the R&D departments and related to new product development, which takes time and effort. Every “product” should be stored well to consider before sharing to apply in practical conditions. However, in service-oriented organizations, handling problems should be conducted upon receiving feedback from customers. Once solutions are found, knowledge workers share ideas to other employees to get to solve problems. In addition, customers’ information should be kept secret, therefore service-oriented organizations pay more attention to *Protect* activities.

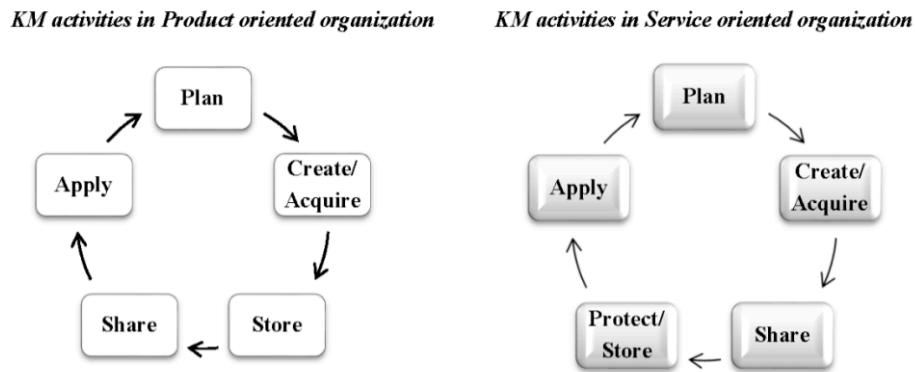


Figure 4. KM activities comparison.

Moreover, we also found we can group these activities into three main stages which are described as follows:

- *Stage 1—Identification (Create/Acquire):* In this stage, management should define the knowledge concepts, “what knowledge is important for their organization” and “which departments keep and need this type of knowledge”. Knowledge workers start to collect related knowledge and put it the required forms. Knowledge is collected or created based on the position of knowledge workers. Employees are required to follow regulations related to documentation. Otherwise, K-objects cannot be created and KM systems get into trouble. To get the right answers, communication takes an important role in this phase.
- *Stage 2—Management (Share/Store):* In this stage, employees start to arrange K-objects in order based on task orientation since employees in different positions understand what they need and what they have in hand. Knowledge is also classified into different levels or set with access rights. Identify which information can be shared to whom. The *Organization S* manager suggests that knowledge should be classified into different levels: “*We classify information/knowledge into three main types based on three levels of management—top, middle and operational. The knowledge workers in lower levels have no right to access information stored in higher levels. However, higher levels can see all the documents of his employees*”. He also requires employees to share knowledge through formal KM platforms. Meanwhile in *Organization P*, over two years, the manager found that employees use Facebook instead of KM platforms to share knowledge since knowledge workers feel more free to share their minds. Both organizations point out that there are three main of groups people involved in knowledge sharing: experts, administrators, and users. If users are in charge of contributing knowledge objects, viewing and rating knowledge objects, experts have two more rights related to editing and approving knowledge objects. Administrators are responsible for editing and publishing K-objects (Figure 5).

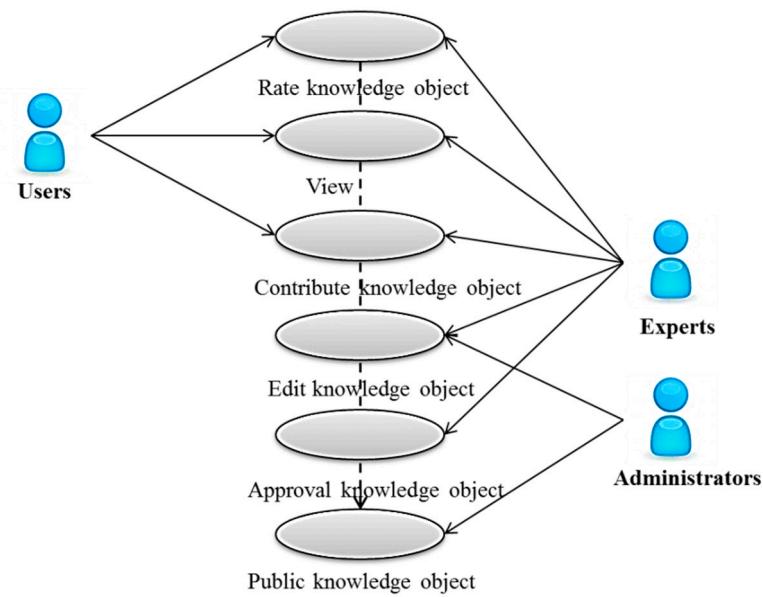


Figure 5. Knowledge workers' activities.

- *Stage 3—Implementation (Use/Update):* In this stage, knowledge workers use completed knowledge to support their tasks. At the same time they can revise or update it. KM performance is also measured in this stage. For individuals, organizations can be based on number of pieces of content and number of times of access. For organizations, they can see the value through customer satisfaction and training time for new employees.

In addition, the interviewees also suggest further stages of KM implementation in the near future: *the collaboration stage and the innovation stage*. In collaboration, stage knowledge workers utilize knowledge for maximum gain individually or with the exchange between individuals. Alternatively, it could be done through an interactive forum to share the knowledge online. The innovation stage is a stage in which a collection of knowledge that was previously owned by the company in the system of knowledge management is no longer sufficient so everyone in the company will attempt to search for and find new knowledge. Consequently, a collection of knowledge in the system, known as “knowledge management”, is continued to be updated.

4.2.4. KM Enablers

Both organizations and consultants agree that there are three main groups (humans, IT, and organization), and the most important factor is top management commitment. However, *Organization P* adds one more factor, “company size”—he thinks the more people in an organization, the better the KM performance. *Organization S* adds “teamwork”, since they handle problems together to avoid answering customers redundantly. In addition, based on the ideas of the project manager and two consultants for the KM program, support from the government is the key factor, because they found that when the government cuts the financial support, the number of companies decrease. Therefore, to implement KM successfully, organizations need to pay attention to both internal and external factors. In relation to internal factors, SMEs need to provide efficient resources (IT and human) and support leadership. Related to external factors, they need to get both financial and training support from the government.

4.3. Proposed Organizational KM Model

The results of the first and second stages show that it is essential to revise the reference KM framework prosed to make it more applicable. We still keep three layers but need to pay more attention to assessments and relationships between KM performance and Organizational performance (Figure 6). In reference to KM framework, we put “KM performance assessment” in layer 1—Organizational support for KM. Since we think that top management has a right to evaluate KM performance through the final results that are shown in the reports (sales reports or financial reports). However, from the cases’ results, we found that KM assessment is conducted in different ways. Firstly, each KM activity of every employee is evaluated (for example, how many knowledge-objects they created and revised or how many problems were solved by using solutions that they proposed). Secondly, each department also can validate their KM performance by checking whether the KM system is able to support them to handle activities in their department. Finally, companies can measure the value that KM implementation brings to their companies through the statistical and non-measureable values.

In addition, to make the framework more applicable, KM activities in layer 3 are also described clearly (Figure 7). We added more important issues into the framework—*core knowledge profile*, which is strategic or operational knowledge that contributes to essential organizational purposes or outcomes. Core knowledge profile is different from one organization to another. It will guide employees’ attention in knowledge activities. It must be updated as business processes change.

Employees create knowledge-objects which are suitable with the business purposes. The business purposes are shown in business processes that are influenced by what kind of product or service is provided by an organization. These objects are codified and stored in knowledge repositories. Once they want to use it, employees can just access this storage and get the knowledge that they want. To make sure that employees create valuable and suitable knowledge—objects, their positions, as well as rights and duties, are clarified in the core knowledge profile. In addition, to improve the skills of employees, organizations also need to conduct competence building programs, and provide knowledge incentives to encourage employees to create more knowledge-objects or get involved in KM implementation activities.

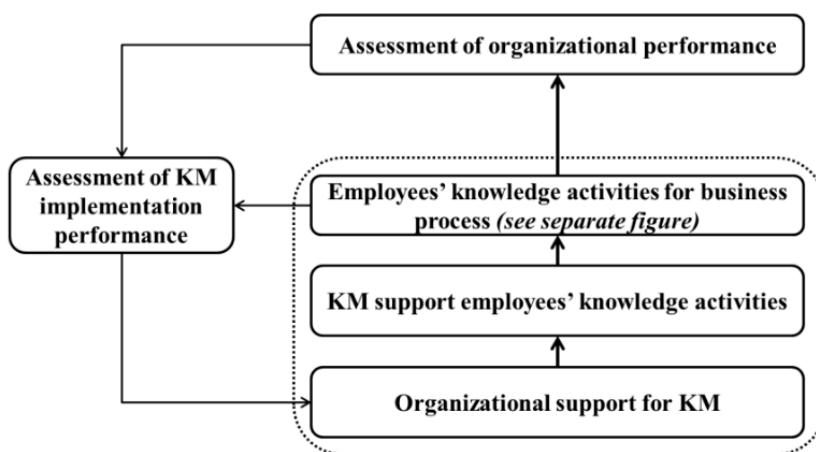


Figure 6. An organizational KM model.

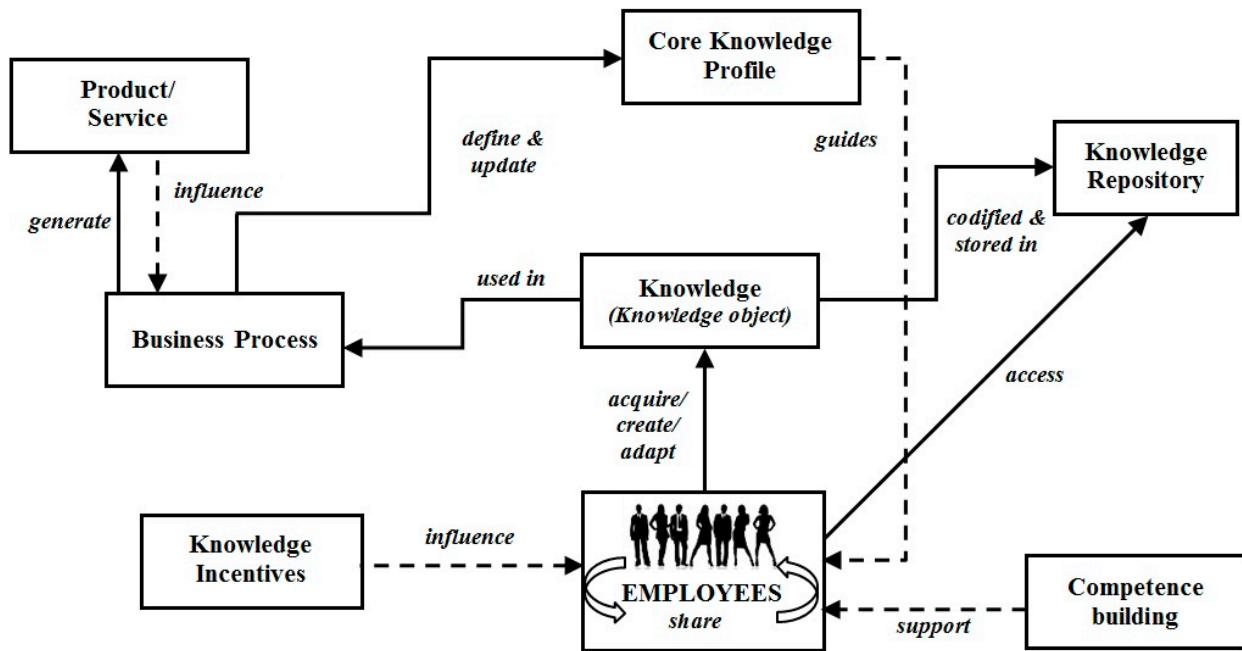


Figure 7. Knowledge workers' activities.

5. Conclusions and Implications

To date, not many organizations have seriously implemented organization-wide KM that has a dedicated knowledge manager, not even knowledge-intensive institutions like universities, research centers, and hospitals. Meanwhile, in the academic community, scholars already talked about the second-generation KM [12]. This indicates that most discussions of KM are either too theoretical or too sophisticated. So, from the outset, this study has decided to design a practical KM that is tractable and affordable by most medium-sized enterprises, and understandable and usable by employees with different levels of competence. With regard to implementation, the suggested framework can provide useful assistance and guidance for holistic KM solutions. In addition, the K-object concept, which adopted the XML standard, may support many employees and become a significant managerial and technical element in the KM practice, since it can replace the current sophisticated concepts related to knowledge representation when the organization's KM environment is more mature. The enhanced KM framework mandates every employee's participation in knowledge activities, not just some elite knowledge workers. It also promotes a concerted effort of humans and IT, not just the interaction between technical staff and the KM systems, to ensure well-rounded and effective KM and produce the best outcomes.

The results may support the extant literature used in the development of KM implementation framework by providing a better understanding related to how KM enablers may evolve to support KM activities. Another important extension to the current body of knowledge in KM, provided by the research results, is that it shows that the influence of KM enablers may not be a direct influence. In addition, these results provide another view of KM implementation in different types of organizations. This will be the starting point for other studies on KM implementation in specific industries to provide more applicable values for practitioners. The findings of this study also show the common problems that organizations have faced in KM implementation. We provide suitable solutions in various cases to

support them with evaluating the KM implementation status at different stages to make sure that the failure rate of KM projects will be reduced.

Several limitations of this study should be noted when interpreting the findings. First, related to document review, there are some companies that have not recorded all activities of the KM implementation program. What we have in hand are the final reports that they submit to the government for evaluation. Thus, it is difficult to explore the hidden problems during the execution of this KM project. Moreover, due to limited time and resources, we only conducted two organization cases; the generation of results may not really fit for all of SMEs. To complete this topic, further research will be conducted, by using empirical studies in product and service-oriented SMEs. Based on the proposed framework, we will evaluate whether what we proposed can be applied widely.

Acknowledgements

The authors express their gratitude to Teresa L. Ju for her ideas throughout the research. Thanks also to the consultants of program “Plan for Small and Medium Enterprise, *Company P*, and *Company S* for their detailed feedback.

Author Contributions

Yao Chin Lin and Nhu-Hang Ha jointly designed the research and prepared the manuscript. Both authors have read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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