

## **Developing a Framework of Double-Loop Knowledge Management Model on Customer Self-Service Systems**

**Shan-yan Huang<sup>1\*</sup>**

<sup>1</sup>Department of International Trade, Overseas Chinese University, Taichung, Taiwan

\*Correspondence: Shan-yan Huang, Department of International Trade, Overseas Chinese University, 100, Chiao Kwang Rd., Taichung, 40721, Taiwan. E-mail: hsy1118@ocu.edu.tw

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### **Abstract**

This study developed a framework of double-loop knowledge management (KM) model that constructed a successful foundation of a problem solving orientation in the main stream of public service domain. Aiming at the potential benefits on customer self-service systems, we proposed a set of research propositions that represents the essential relatedness between the necessary elements and its performance under the settings in Taiwan's e-government. The four essential elements including organization, leadership, learning and technology were inferred to have positive effects on KM implementations that provide a suitable route for enhancing problem solving performances in customer self-service systems. Facing a disproportionate condition of knowledge within interpersonal networks, the framework provides a powerful filter to sieve out the beneficial knowledge that is produced, shared, or integrated by one's own side, and could decrease the cognitive gaps among the interaction of customers or members (citizens, businesses, employees and other agencies for government administration) towards a holistic approach of KM practices.

**JEL Classifications:** H41, M15

**Keywords:** self-service systems, knowledge management, problem solving, e-government

### **1. Introduction**

Contemporary technologies to develop massive citizen participation in the public or business processes have been spread over worldwide through the effective knowledge management (KM) of electronic information. At the exchange of numerous digital data by multi-parties, the relationships between clients and servers, suppliers and demanders, users and providers, or sellers and buyers can be promptly satisfied (Chrissafis & Rohen, 2010). In practice, the various roles of users, demanders and even buyers can be considered as the customers who have specific requirements on the electronic information or knowledge in different dimensions (Payne, 2006). Thus, the best-practice organizations will understand that developing the ideal customer relationship management (CRM) plans can specifically facilitate to establish the quality foundation of remote client services in the interactive processes. Such foundation that becomes one of the organizational strategic capabilities can be realized not just in the level of improving the information technology (IT) but also in the CRM processes, related people and knowledge with insights (Gordon, 2002). In general, the research settings related to an environment of CRM are suited the investigation of the popular KM issues (Finnegan & Willcocks, 2007). Since KM functions like a receiver instrument that absorbs

requisite knowledge with insights as CRM is proceeding, it can enhance the value of intellectual assets within an organization.

Recent years, customer self-service systems has become one of the most popularized applications in CRM as they were utilized to accept and respond the customer requests on the instant. The characteristic of providing autonomous services could be the radical progression of CRM as it could be beneficiary for enhancing service quality in objective ways, improving customer satisfaction in subjective perceptions and reducing operational costs (Payne, 2006). Thus, self-service provisions in CRM can empower customers to improve their own receiving and providing with information that enable to reduce the probability of making errors. Also customer self-services enable institutions or organizations to obtain the required information; and then transform the information into useful knowledge into a cycle of CRM processes.

This study was designed to add the literature of knowledge and insight approach; especially it proceeded by structuring a theoretical concept of how to apply a double-loop KM model on customer self-service systems for construction of Taiwan's e-government. The motivator is because the increases of pursuit for greater transparency and accountability in public affairs have been frequently paid attention; at the same time, the public institutions in Taiwan are being gradually transformed themselves to e-government by equipping the flawless IT environments. Additionally, this study also addressed the essence of raising public service quality that can be enhanced by the critical factor "CRM". Therefore, the management of customer relationship could be seen as appropriate solutions to steer e-government towards rising public expectations of improved interactivity and enhanced sensitivity (King, 2007). E-government consequently could be developed to provide with a common forum for public agencies and customers to fine-tune e-services. As most of customers disclose their requirements through the forum and they expect all of the requirements to be entirely met; then CRM becomes strategically significant in promoting e-government acceptance (Chan, Pan, & Tan, 2003). At the same time, making use of the personalized knowledge to generate highly effective customer relationships is one of the pivotal e-government initiatives to predict future customer needs (Goodhue, Wixom, & Watson, 2002; Pan, Tan, & Lim, 2006).

## 2. Literature Review

Recently, the concept of CRM has been applied as the absolute principle into the domain of public service reformations since it assists the public institutions to align the strategic direction toward competitive advantage, efficiency and productivity (Hunter & Shine, 2001; White, 2007). Through the aggressive diffusion of IT functioning into civic operations (Ho, 2002), the public agencies thus get forward a paradigmatic shift in basic governmental processes. Moreover, the maintenance and improvement of public service quality can be implemented by reinforcing the service contents, service scope and service subjects. The numerous information communication concerned with the needs of diverse citizenries that facilitate to achieve at right decision-making in public service affairs can be a significant effect to increase customer satisfaction (Taylor & Lips, 2008). CRM thus is incorporated into e-government practices to deal with customer problems rapidly and develop a high-interaction customer response by newly available information, technologies and organizational management approaches (Boulding, Staelin, Ehret, & Johnston, 2005).

The completeness of processing e-government cannot be a unidimensional phenomenon. According to the perspective, researchers are requested to understand complex and recursive relationships between factors related to technology, management philosophy and the trends of public policy (Dawes & Pardo, 2002; Fountain, 2001). The modern public management could not be deviated from the alignment of service reformation with a strategic focus on establishing and maintaining dialogic customer relations, which cater to diverse and unpredictable expectations of different public members (Haque, 2001; Rainey, Backoff, & Levine, 1976). Consequently, public

institutions have been forced to consider the use of CRM to strategize the value of each customer relationship while retaining the merits of service modernization (Pan *et al.*, 2006). Despite the goal of CRM towards the personalization of public services (Taylor & Lips, 2008), the limitations of confined organizational resources and capabilities seem insufficient to cover all range of the public service context. Thus, public institutions need to take account of customer self-service systems to provide with “self-service” governments that transcend the difficulty of limited resources and capabilities in public sections.

The emergence of customer self-service systems symbolized a great progress in CRM applications because it generated various benefits for the interactive relationships between servers and clients (Payne, 2006). These benefits can be included the cost advantage by lessening face-to-face expenditures, providing promptly information accesses and efficient transaction processes (Economist, 2004). Customers exploit these customer self-service systems to save money and time rather than wait for a person to handle their problems (Robertson & Shaw, 2005). However, successful customer self-service systems might attach importance to the balance between high-tech and high-touch in customer relationships (Salomann, Kolbe, & Brenner, 2006a). Therefore, the advanced knowledge in the self-service domain has become a significant work (Bateson, 1985). In addition, the organizational capabilities associated with the adoption of KM into customer self-service systems that enables the information usefully and immediately to match customer requirements. Utilize customer knowledge as the most valuable source for product innovation and process improvement (Salomann, Dous, Kolbe, & Brenner, 2006b).

Nonaka and Takeuchi (1995) proposed the knowledge matrix that classifies knowledge as either explicit or tacit, and either individual or collective. The processes of knowledge creation as knowledge spirals are amplified through four modes of knowledge conversion including socialization, externalization, combination and internalization. Thus, as a public or private organization expects to pursue competitive advantage, it needs constantly to move their knowledge assets into the region of minimum entropy production and hence maximum value (Boisot, 1998). In the processes of organizational acquiring useful knowledge, the related data has to be filtered to produce meaningful information, and then such information can be further abstracted and codified to produce useful knowledge. If the useful knowledge consists with the characteristics of explicitness, documentation, legitimacy and subjectivity, then such knowledge have to experience all the processes associated with the identification, sharing and creation of knowledge (Davenport & Prusak, 1998).

Stankosky, Calabrese, and Baldanza (1999) suggested a defined framework of KM. All the elements of KM could be grouped into leadership, organization, technology and learning. Complete KM needs leverage the technologies of the era, while at the same time balancing the right alignment of mix of leadership, organization and learning. The goal of KM is connecting people to the best practices, knowledge and expertise. KM consists of the applications for the normal management functions (planning, design, supervision and reporting) and processes (identify, collect, adapt, organize, apply, share and create knowledge) (O'Dell & Grayson, 2000; Vanini & Bochert, 2014). Therefore, KM is the set of processes that seeks to change the present pattern of knowledge processing, and then the quality of knowledge claims may improve (Firestone & McElroy, 2005). Within the knowledge processing, each data, information, or knowledge is objective existence. Regardless of integration, production, or sharing all can treat as KM while it providing solutions for problems solving (Firestone & McElroy, 2003).

Through the effectual and systematical KM implementation, the focused information can be collected at customer interaction points that mainly support the operations of customer self-service systems. Inside the loop of KM processes, the disclosures of customer requests and suggestions can be used to permanently update the quality of customer self-service systems (Dous, Salomann, Kolbe, & Brenner, 2005). Moreover, the joint elaboration of customer knowledge could be incorporated by

organizations for product and service innovation, idea generation as well as for the continuous improvement of its products and services (Kristensson, Gustafsson, & Archer, 2004).

### 3. Double-Loop KM Model and Interpersonal Networks

Knowledge, defined as a purposeful coordination of human actions (Zeleny, 1989), is the whole set of insights, experiences and procedures which are considered to be subjectively reasonable and feasible. Therefore it guides the thoughts, behavior and communication of people. Davenport and Prusak (1998) indicated that knowledge is a fluid mix of framed experience, values, contextual information and expert insight that provides with a framework to evaluate and incorporate further new experiences and information. Nonaka and Takeuchi (1995) suggested that knowledge can be created by the interaction of between tacit and explicit knowledge through socialization, externalization, combination and internalization. Albert (1998) pointed out that KM included various processes such as acquisition, creation, renewal, archival, dissemination and application of knowledge. The processes of collecting, organizing, classifying and disseminating information are served well by the searching, indexing, collating, archiving and transmission capabilities of new technologies. McElroy (2003) provided a new perspective of KM and also stated that the conventional practice of KM is often associated with the following common phrases: “the right information to the right people at the right time”; “If we only knew what we know”; “to capture and codify our tacit and explicit knowledge before it walks out the door”. McElroy also emphasized that producing new knowledge is not always happened in knowledge integration; in fact, the practice of KM begins after knowledge is produced at times.

This study proposes a vision of double-loop KM model on customer self-service systems that is considered to build a successful foundation with the four pillars – leadership, organization, technology and learning (Stankosky *et al.*, 1999). Meanwhile, this study adopted the essential concepts of knowledge integration, knowledge production and knowledge sharing to interpret the double-loop KM model. As shown in Figure 1, we present a double-loop KM model and then illustrate new relationships of among data, information and knowledge.

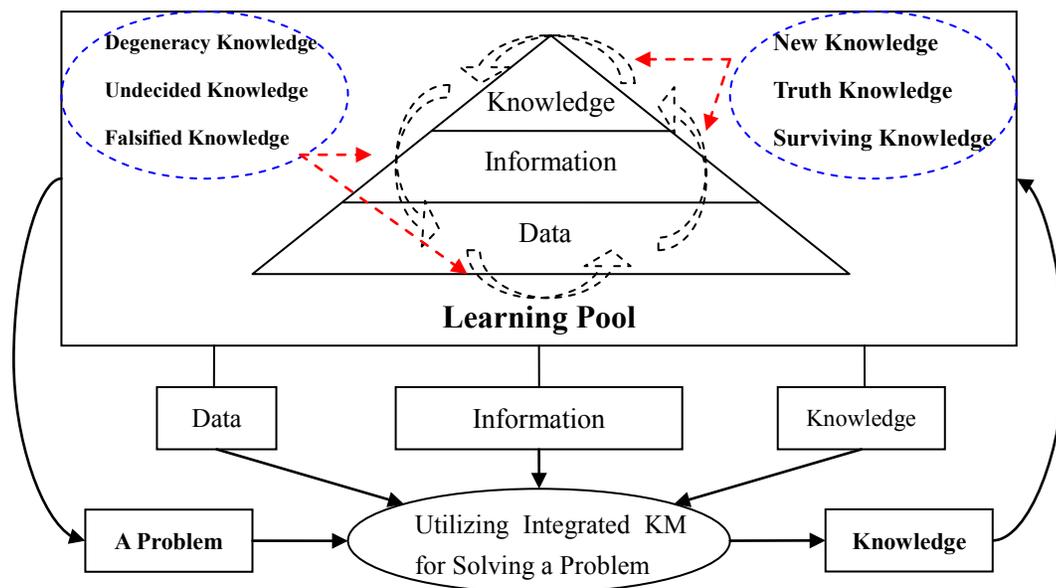
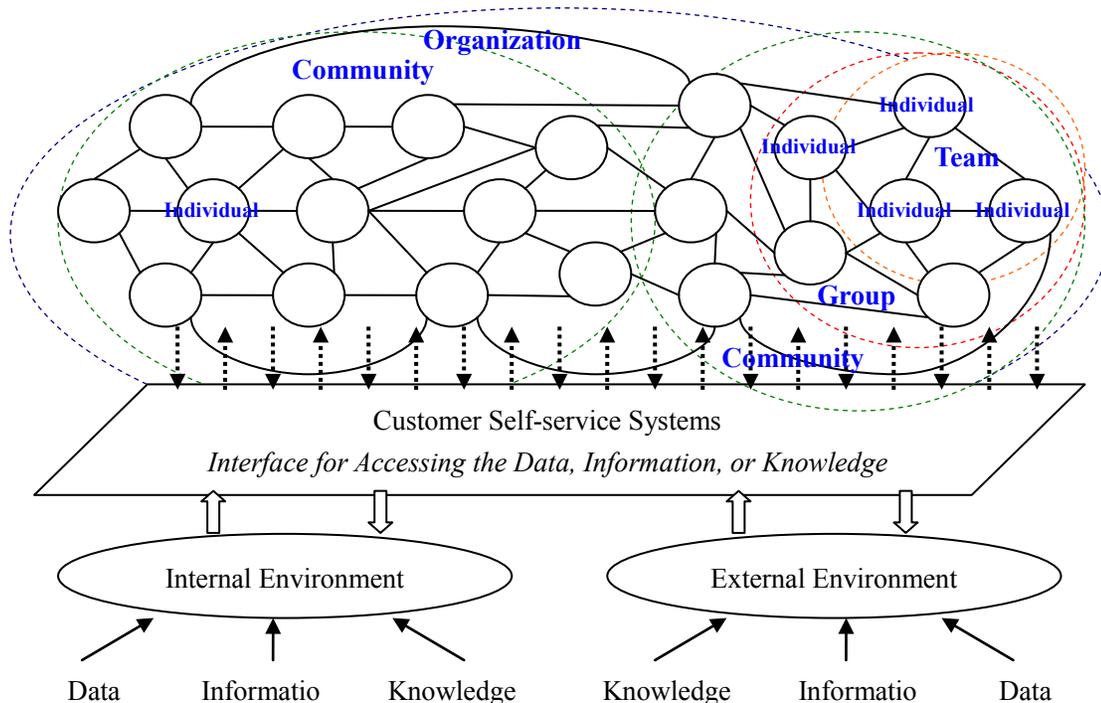


Figure 1. A double-loop KM model

We inferred the research settings as following. In the initiative step, a problem could be never occurred or have existed in circumstances. Learning pool that is composed of data, information and knowledge provides a means of solving problems. Moreover, the decay and development phenomenon of acquired data, information and knowledge would be replaced by turns while those are used for solving problems. What can remain subsistent in the pool is to decide the capabilities of problem solving. Under this circumstance, new knowledge, truth knowledge, or surviving knowledge would be extracted from collected data, information and knowledge that would be combined toward the function of solving problems. All knowledge is going to decay with time and becomes degeneracy knowledge, undecided knowledge, or falsified knowledge through the examination processes from organizational members. In an operational perspective, a dynamic relationship exists among data, information and knowledge. The improper knowledge will become data or information in the course of time. Furthermore, the serviceable data or information will upgrade knowledge in the long run. Hence, knowledge could be viewed a disproportionate condition among the interaction of people. If someone wants to solve a problem in the organization; the solving knowledge becomes the real knowledge for him/her. Nevertheless, the forms of the solving knowledge could be data, information, knowledge, or real new knowledge from oneself or providers.

Figure 2 shows the interactions between interpersonal networks and customer self-service systems through the environment. The scope of interpersonal networks specializes in organizational level and relies on knowledge integration, knowledge production and knowledge sharing for solving new or existent problems.



**Figure 2.** Interpersonal networks and customer self-service systems

Customers or members (citizens, businesses, employees and other agencies for government administration) can access the data, information and knowledge through customer self-service systems. In addition, the scale of knowledge services can be revised and hinged on organizational requirement plans. Each individual can link a relationship arbitrarily with any others by obtaining a membership in any of identifiable teams, favorite groups, or suitable communities. According to

sociology, an organization can comprise individuals, teams, groups, or communities; and in fact, a community also can comprise individuals, teams and groups. Concerning the scope of environment, it covers the internal environment and also the external environment, both of that exists data, information and knowledge. This study attempted to provide customer self-service systems with interpersonal networks, the internal environment and the external environment. The customer self-service systems become the available interfaces to access the data, information and knowledge that derive from the internal and external environment. The wide range of organizational members are able to utilize the prototype architecture to acquire the suitable resources for solving new or existent problems if the capabilities related to the double-loop KM model in customer self-services has been built.

In this study, the double-loop KM model focuses on knowledge mining, integrating, knowledge producing and knowledge sharing for solving new or existing problems. Due to the disproportion of cognitive abilities for individuals, people possess discrepant opinions about data, information and knowledge. However, for the purpose of problem solving, the demanded knowledge needs to be produced, shared, or integrated in accordance with individualized subjectivity by one's own side, other persons, or joint collaboration.

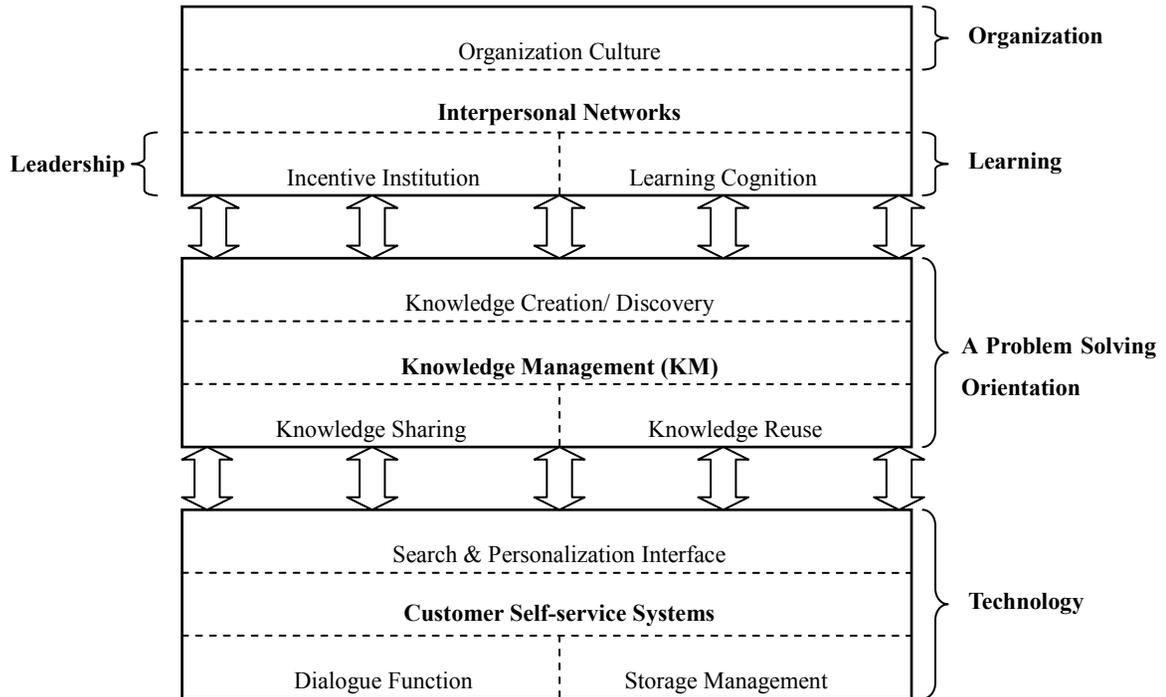
#### 4. Establishing the Research Propositions

People try to enhance the personal performance by solving the individual and organizational problems through the effective KM processes. The philosophy is that the greater the personal performance can be enhanced, the greater the organizational performance can do as well. According our theoretical notion (Figure 3), the double-loop KM model can generate requisite knowledge that is produced, organized, extracted and refined by the major sources of interpersonal networks and the entire environment. Operated in customer self-service systems for public usage, these knowledge derived from multi-domains that provide with variety of knowledge material such as raw data, scattered information, or the already knowledge. To people, the useful knowledge in our double-loop KM processes can be built up as the specific content, can be created as well-classified references, and can be structured the related connection among various documents (Chua, 2004). Such organized, explicit and precise-purposed knowledge allows users to solve their existing problems (Albert, 1998). By the effective implementation of double-loop KM model, customer self-service systems provided by the public institutions can serve a powerful filter to sieve out the exactly demanded knowledge for the purpose of solving problems. We therefore propose the proposition 1.

***Proposition 1:** The double-loop KM operation in customer self-service systems can facilitate the success of problem solving that can be regarded as a personal performance enhancer.*

IT usually plays a role of the interface between providers and users. Technology includes software and hardware systems is utilized to operate data and information storing, and is as well applied to capture, share, transform, distribute and accumulate highly structured knowledge. Therefore, IT is the essential element to succeed in the processes of managing knowledge because it can concretely bridge the interactions of knowledge servers, customers and other shareholders. Specially, customers may issue their problems and also simultaneously create/utilize knowledge to solve the problems within the processes of double-loop KM model. In the holism, public or private organizations can exploit IT to increase customer value (citizens, businesses, employees and other agencies for government administration) by incorporating knowledge, information and data from any forms of social interactions among the each role of knowledge networks. At present, customers have been invited to the KM processes by participating in knowledge accumulation (like Wikipedia, Government Blog, or e-Forum) through two-way channels between organizations and customers. Aiming at the created knowledge within the model, customers are able to understand, interpret and

realize the knowledge in mind; also organizations can make use of patents or formal documents to accumulate such knowledge. Technology implementation and deployment contributes to mining and linking the contextual relations of related knowledge that includes various forms of proposed problems, published formal documents and unstructured data though the plenty of multi-parties' uploading (Kleist, Williams, & Peace, 2004).



**Figure 3.** A framework of double-loop KM model on customer self-service systems

In this study, three of the essential functions in the pool of technology can be workable and effective in the processes of double-loop KM model. First, “search & personalization interface” is used to fortify the inflow of customer-driven knowledge through keyword searching purposively that can be brought out a series connection of related information with it. Such interface can be regarded as an accessory engine that provides customers or members (citizens, businesses, employees and other agencies for government administration) on customer self-service systems with more autonomy for obtaining abundantly expected knowledge from interpersonal networks, the internal environment and the external environment. Customers can select to set up an additional function to increase the presence of related information with embedded personalized interface. For example, as customers key in subjects into specific databases, websites, emails or forums and then they can allow the content of subjects to be treated as keywords to further implement automatically information searching. Therefore, “search & personalization interface” can benefit the quantity and quality of information-flow in the double-loop KM model that increases the efficiency of serving customers or members. Second, “storage management” is concerned with database technologies to manage knowledge, information and data from inside and outside of an organization. This dimension consists of two powerful technologies, data warehousing and data mining, are used to analyze relationships including classes, clusters, associations and sequential patterns in stored transaction data based on open-ended user queries (White, 2007). The storage of information is the beginning stage of forming the useful knowledge; and it will be involved of structuring specific client-server interactions, and will be maintained by trusted groups or individual providers (Chou & Lin, 2002). Last, “dialogue function” is exploited to augment customers’ or members’ abilities of

problem solving. The proceeding of interactive dialogue in customer self-service systems by way of multimedia technologies (like Skype, MSN, or Groupware) broadens the efforts for problem solving. The augmentation of dialogue functions can increase graphic interactions of information-flow among collaborators through multimedia capabilities (Chua, 2004). Customer self-service systems with “dialogue function” can increase transparencies of communicated content; and with “storage management” can extend capacities of data, information and knowledge existed in the pool; and with “search & personalization interface” can link problems and solutions rapidly. In other words, the achievement of successful customer self-service systems in the public institutions need the specific technical factors that can operate the explicitly searching, dialogue and data-storage in the double-loop KM model (Stankosky *et al.*, 1999; Stankosky, 2005). Therefore, we propose the proposition 2 as follow.

***Proposition 2:*** *Technology that includes search & personalization interface, dialogue function and storage management can be beneficiary to the double-loop KM model that facilitates the success of customer self-service systems in the public sector.*

An organization culture formed by organizational routinizations and historical conventions that can be the important key to influence on the manner of how an organization manages its knowledge and what can motivate members to learn more and deeper in the processes of KM. As previously mentioned, the four elements in the foundation of KM implementation include organization, leadership, learning and technology (Stankosky *et al.*, 1999; Stankosky, 2005). The former three elements are attributed to the domain of organizational behaviors. In terms of the resource-based view (RBV), the value of an organization is to be based on the creation of its core competences that depends on what the organization have and how well the organization use limited resources to achieve its expected goals (Wernerfelt, 1984; Rumelt, 1984). The forms of organizational resources may consist of money, land, tangible goods and materials, and also of intangible technology, expertise, linkage of social capitals and existing knowledge (Bhandar, 2010). Thus, the configuration development of an organization is influenced by its given resources that may impact the double-loop KM operation because of the conditions of organizational limited resources. For example, if the governmental long-term policies support the tourism bureau to improve the infrastructure of online customer service systems of each scenic spots, then the tourism bureau would have sufficient resources to establish the ideal KM hardware. However, the long-lasting resource commitment from the central government can maintain the stability of operational quality for the double-loop KM operation. We therefore propose the proposition 3 as below.

***Proposition 3:*** *The organizational configuration can impact the double-loop KM operation that influences the success of customer self-service systems in the public sector.*

The other element to support the KM implementation is leadership since it can direct strategic development of an entire organization, and can influence the possibility of succeeding in a mission or a project related to KM operations (Stankosky *et al.*, 1999; Stankosky, 2005). Leadership in an organization is to be represented by a series of specific behaviors that are guided by strong leader characteristics. In a physiological perspective, if leaders with high extent of self-confidence and self-esteem would be helpful for molding an organization to become an ideal one due to the zealotness to achieve at goals. To achieve at the expected goals, leaders can utilize incentives associated with certain performance to motivate specific member behaviors in response to the well-done job (Campbell, McCloy, Oppler, & Sager, 1993). Hence, the double-loop KM operation needs the appropriate leadership to direct and instruct the development scheme that can sequentially establish the fitting organizational environment to respond customer requirements. Thus, the proposition 4 is proposed as below:

***Proposition 4:*** *Appropriate leadership in an organization that can zealously support and direct members to put efforts on the double-loop KM operation that facilitates the success of customer self-service systems in the public sector.*

Most of the research in KM field acknowledges that learning is considered as a fundamental element to make the outcome performance with high quality (Kimble & Hildreth, 2004; Wenger, 2004; Daele, Deschryver, Gorga, & Kunzel, 2007). Recent researches show that collaborative learning played an important role in tacit KM that community members owned (Kimble & Hildreth, 2004; van Winkelen & McKenzie, 2007; Wenger, 2004). Collaborative learning has several characteristics that distinguish them from formal organizations and learning situations; such communities are groups of people who share a concern, a set of problems, or a passion about a topic, expand their practical knowledge and expertise in the area under consideration, and interact on an ongoing basis. In the proceeding of double-loop KM model, learning magnitude might influence the extent of individual cognition and perceptions to customer self-service systems. In other words, if clients and servers are willing to perform learning works in the processes of double-loop KM model, they may obtain well understanding of how to create their valuable knowledge to solve problems (Stankosky *et al.*, 1999; Stankosky, 2005). We therefore propose the proposition 5 as below.

***Proposition 5:*** *Learning activities in an organization that can enhance collaborator realizing of double-loop KM operation that facilitate the success of customer self-service systems in the public sector.*

The effectiveness of KM capabilities that facilitate the organizational knowledge accumulation, use, innovate and recycle can be regarded as critical factors to affect the success of CRM initiatives (Croteau & Li, 2003). Under the structure of developing robust e-services, public institutions have to combine KM practices and principles in CRM initiatives because of considerable benefits being brought about when done correctly (Gibbert, Leibold, & Probst, 2002). Subsequently, the requisite knowledge and expertise would be built into customer self-service systems to guide organizational operations and customer behaviors through automatic exchanges or transactions (Newell & Huang, 2004). Nevertheless, the importance of CRM can be represented in a number of governmental pilot projects which has been funded to promote service quality in public domain. It is doubtless that the vision of transforming governmental services into more customer-oriented functions has been continuously called in the theoretical literature (Tan & Pan, 2003).

## 5. Conclusion

This study attempted to unleash the full potential of customer knowledge in the public sector, therefore it emphasized on high-tech and high-touch knowledge applications simultaneously by addressing the implementation of double-loop KM model on customer self-service systems. This perspective is the same with the conception of “advancing CRM initiatives with KM” (Salomann *et al.*, 2006b). Since knowledge could be viewed a disproportionate condition among the interactions of people, the most important is how to obtain and manage the useful knowledge (data, information, or knowledge) for existing and emerging problems. Facing a new problem that never occurs in the past, the solutions can be treated as new knowledge or real knowledge for each one. The solutions can derive from various ways include brainstorming, joint production, production alone, or integration among data, information and existent knowledge. By contrast about knowledge sharing, someone provides the solutions to another one who face a problem. At this point in time, the solutions can be treated as knowledge for the request one rather than the provider. The solutions could be data, information, or real knowledge base on the degree of epistemology for the provider.

Targeting the goal of double-loop KM model, interpersonal networks and IT should be hung together pushing the goal forward. IT is a catalyst that gives an impetus to KM initiatives. Moreover, interpersonal networks can enhance knowledge integration, production and sharing promptly through a technological interface. A useful customer self-service system bridges the available resources between Intranet and Internet to perform the circulation of double-loop KM operation. Eventually, this study proposed a set of research propositions that represents the essential

relatedness between the necessary elements (organization, leadership, learning, and technology) and performances of implementing the double-loop KM model under the settings of proceeding well-structured customer self-service systems in the public institutions. The four essential elements involved in the formal operations of KM practices were inferred to have positive effects to double-loop KM model. Hence, the double-loop KM model with the necessary elements is anticipative to solve existing and emerging problems on customer self-service systems. This study provides a suitable route for applying KM initiatives in customer self-service systems. The organizational members and customers as a valuable source of knowledge act the role of knowledge integration, production and sharing fluently through interpersonal networks.

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