Evidence-Based Investigation for Determining the Characteristics of Knowledge Management on Organizational Innovation within Taiwanese Teaching Hospitals

Chien-Chang Yang[1], Chen-Chung Ma[2*], Yung-Yu Su[3], Patricia Moulton[4]

[1]Far Eastern Memorial Hospital, Taipei, Taiwan; [2]I-Shou University, Kaohsiung, Taiwan, China; [3]Meiho Institute of Technology; Meiho, PingTong, Taiwan, China; [4]University of North Dakota, Grand Forks, USA.
Email: up000238@isu.edu.tw

ABSTRACT

Knowledge management models assist executives in generating and adopting sufficient information for managerial decision-making. These models may have utility in health care systems. This study examined knowledge management and innovation through the development of a culturally-appropriate instrument and collection of information from health care providers at several Taiwan teaching hospitals. Results indicated that several dimensions of the knowledge management model are associated with innovation and sharing of information in the study hospitals.

1. Introduction

In the knowledge-based economical age, entrepreneurs who can master the information of evidence-based knowledge management will enhance their competitive advantage. This is especially important in order to ensure that new products and/or processes are innovative [1]. Healthcare organizations are facing many challenges due to the rapidly changing global healthcare system in the 21th century. These challenges include spiraling costs, increasing demands for quality care, and patient safety issues. Health care professions are knowledge-intensive professions which place health care organizations in the position to find ways to manage their information and knowledge-bases more effectively [2].

There are various forms of knowledge: experiential (tacit), literature-based (theoretical), and evidence-based (both implicit and explicit). Experiential and literature-based knowledge, provide direction for executives in problem-solving; the process of scientific methodology can be applied to guide the process in testing whether the direction generated from experiential and literature-based knowledge is suitable for specific circumstances. As healthcare management is based on the process of scientific replication and verification of facts to generate evidence-based knowledge (EBK) [3], the development of theoretical knowledge could provide a framework for guiding evidence-based knowledge [4]

Health care executives who apply knowledge management (KM) techniques have utilized an objective method for collecting sufficient information and for generating/estimating the required supervision information for managerial decision-making within healthcare administration [5]. Evidence-based decision-making is the focus of knowledge management which "*deals with critical issues of organizational adaptation, survival, and competence in a rapidly changing environment* [3]."

The KM process can not only positively affect organizational innovation (OI) [6]; it has also been shown that Taiwanese business with more KM show higher capability in enhancing OI [1]. However, such evidenced-based investigation has not been conducted within the Taiwanese healthcare delivery system, especially in relationship to patient care issues and EBM in healthcare administration. As a result, there are two aims of this study: 1) creating a local culturally appropriate instrument for exploring the relationship between KM and OI for EBM; 2) recognizing the key factors of the affects of KM on OI within teaching hospitals based on the feedback of health professionals .

2. Background and Conceptual Framework

There are a variety of different KM models in the literature. Gloet and Terziovski (2004) described KM processes as knowledge creation, knowledge transport, knowledge storage, knowledge distribution, and knowledge sharing [7]. Cui, Griffith, and Cavusgil (2005) indicated that KM consists of three interrelated processes: Knowledge Acquisition, Knowledge Conversion, and Knowledge Application [8]. Sandars & Heller (2006) explained KM is the generation of knowledge, storage of knowledge, distribution of knowledge, and application of knowledge [9]. In short, KM could be regarded as an umbrella term for a variety of interlocking processes.

Effective knowledge management has been presented as one of the methods for improving innovation; as a result, innovation could be defined as a new product or service, a new production process technology or a new structure or administrative system pertaining to organizational members [1]. For understanding and identifying different types of innovation within organizations, such issue had been discussed [10]. Accordingly, the classification of innovations included technical innovation and administrative innovation [1].

Based on literature review [6,9,11] and with the current challenges in the healthcare industry, this study proposed that the aspect of OI will be affected by KM directly in health care settings. Accordingly, in order to recognize the strength of relationship between the aspect of OI and KM, a conceptual framework and a model with 10 hypotheses which was generated for achieving its study target was displayed in **Figure 1**.

H1: Knowledge acquires creation will affect management innovation positively.

H2: Knowledge acquires creation will affect technological innovation positively.

H3: Knowledge circulation proliferation will affect management innovation directly.

H4: Knowledge circulation proliferation will affect technological innovation directly.

H5: Knowledge storage internalize will affect management innovation directly.

H6: Knowledge storage internalize will affect technological innovation directly.

H7: Knowledge application sharing will affect management innovation directly.

H8: Knowledge application sharing will affect technological innovation directly.

H9: Management innovation will influence technological innovation directly.

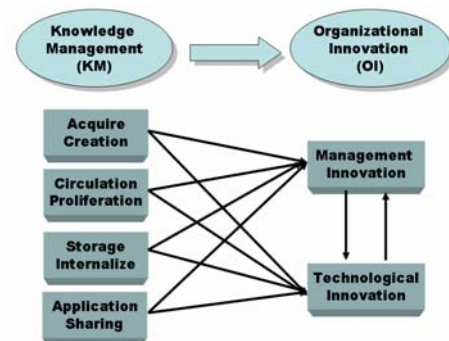H10: Technological innovation will influence management innovation directly.

Figure 1. Conceptual framework and model.

3. Method

This study used a cross-sectional research design utilizing a structured questionnaire containing 55 questions with a likert-type scale from 1 (strongly disagree) to 5 (strongly agree) to recognize health professionals' (physicians, nurses, and medical technologists) opinion of KM and OI within teaching hospitals in Taiwan. The questionnaire included questions along six dimensions of knowledge management which are defined in **Table 1**.

In order to test the initial validity of this instrument, six domain experts were invited to discuss and revised the content of this instrument, in order to provide content validity. In addition, descriptive analysis was performed to explain the characteristics of study samples; a reliability analysis was used to explain internal consistency; and an exploratory factor analysis was used to confirm the validity of research instrument. A one-way ANOVA was used to recognize which factors of KM and OI were related to demographic variables. All these statistical procedures were performed by using SPSS 15.0 statistical software package. In addition, path analysis was adopted to explore the relationships between KM on OI (10 hypotheses) by using AMOS 7.0 statistical software package.

4. Result

This study was conducted at 25 teaching hospitals in Taiwan; participants were requested to fill out the survey instrument anonymously. Of the 375 questionnaires that were distributed, 228 (60.8%) were completed during 1st to 21st October 2008. **Table 2** includes detailed demographic information of participants.

The reliability analysis indicated that all of the dimensions had good internal consistency (with a Cronbach's alpha of greater than 0.8 [12] (see **Table 3**).

An Exploratory Factor Analysis (EFA) was utilized to examine the validity of this instrument. Questions were determined to be valid (see **Table 4**) (Questions would be deleted if the value of community is less than 0.4, the value of Kaiser-Mayer-Olkin (KMO) is less than 0.70,

Table 1. Operational definition of each dimension in this study.

Aspect/ Dimension	Definition / Questions
Knowledge Management	KM as respondents' perception of acquire creation, circulation proliferation, storage internalize and application sharing.
Acquire Creation	It is tacit knowledge that the expertise is generated by experience whilst immersed in daily practice.
Circulation Proliferation	It is defined that tacit knowledge distribution is aided by the transfer of experiences to new workers by mentoring and coaching schemes and to established staff by regular opportunities to share their knowledge.
Storage Internalize	It is defined that tacit knowledge is stored in the brains of health care workers but may be made partly accessible to others once it has been codified.
Application Sharing	It is defined that sharing both explicit and tacit knowledge between individuals and applied to decision making
Management Innovation	It involves organizational structure and administrative process; such innovation is indirectly related to the basic work activities of an organization and is more directly related to its management.
Technical Innovation	It pertains to products, services, and production process technology; they are related to basic work activities; could be concerned either product or process.

Table 2. Characteristics of participants.

	Characteristic	Sample	Valid Percentage (%)
Gender	Male	49	21.5
	Female	179	78.5
Age	<30	58	25.4
	31 ~ 40	106	46.5
	41 ~ 50	56	24.6
	>51	8	3.5
Education	High school	3	1.3
	Junior college	47	20.6
	Bachelor	137	60.1
	Post-graduate	41	18.0
Position	Physicians	39	17.1
	Nurses	136	59.6
	Medical technologists	53	23.2

Table 3. Results of the reliability examination.

Dimensions	Cronbach's Alpha value	Corrected Item-Total Correlation	Cronbach's Alpha if item Deleted	Questions
Acquire Creation	0.87	0.52 ~ 0.71	0.84 ~ 0.86	7
Circulation Proliferation	0.90	0.60 ~ 0.75	0.87 ~ 0.88	7
Storage Internalize	0.86	0.61 ~ 0.70	0.82 ~ 0.84	5
Application Sharing	0.87	0.53 ~ 0.73	0.83 ~ 0.86	6
Management Innovation	0.94	0.67 ~ 0.81	0.92 ~ 0.94	12
Technological Innovation	0.93	0.64 ~ 0.74	0.91 ~ 0.92	13

Table 4. Results of the validity examination and one-way ANOVA analysis.

Validity analysis						
Dimensions	Communities	KMO	Bartlett's test of Sphericit	Factor Loading	Variance Explained (%)	Eigenvalues
A	0.402 ~ 0.645	0.83	0.000	0.634 ~ 0.808	55.60	3.89
B	0.492 ~ 0.687	0.88	0.000	0.701 ~ 0.829	60.45	4.23
C	0.625 ~ 0.682	0.84	0.000	0.747 ~ 0.826	63.73	3.19
D	0.432 ~ 0.689	0.86	0.000	0.657 ~ 0.830	59.98	3.60
E	0.498 ~ 0.725	0.94	0.000	0.706 ~ 0.852	61.33	7.36
F	0.467 ~ 0.624	0.89	0.000	0.683 ~ 0.790	53.53	6.96

One-way ANOVA						
Dimensions	Gender		Education		Position	
	F values	Sig	F values	Sig	F values	Sig
A	0.02	0.88	1.29	0.28	1.57	0.21
B	0.02	0.88	1.06	0.37	1.54	0.22
C	0.05	0.83	1.36	0.26	1.14	0.32
D	0.00	0.95	1.25	0.29	1,78	0.17
E	0.21	0.65	0.68	0.57	0.40	0.67
F	0.02	0.88	0.41	0.75	1.07	0.35

A: Acquire Creation; B: Circulation Proliferation ; C: Storage Internalize ; D: Application Sharing ; E: Management Innovation ; F: Technological Innovation ; *Sig. at 0.05 level

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and the value of Bartlett's Test is greater than 0.05) [13-16]. Results of the one-way ANOVA (**Table 4**) indicated that all dimensions of KM and OI were not significantly associated with demographic variables (gender, education, and position).

In this study, model fit of path analysis was evaluated by examining the chi-square statistic, the chi-square to degrees of freedom ratio, the comparative fit index (CFI) [16]. Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI) [17]. And the root-mean-square-error of approximation (RMSEA) [18]. Detailed examination of each hypothesis (see **Table 5**) indicates a significant positive association between circulation proliferation and management innovation – then list the other significant relationships (see **Figure 2**)

5. Discussion

Reliability and validity analysis indicated that the developed instrument was an appropriate tool that can be utilized for conducting studies of Taiwanese health professionals to determine the relationship between KM and OI [1-19]. This study also indicated that Management Innovation is significantly associated with Circulation Proliferation and Application Sharing. Technical Innovation is significantly associated with Circulation Proliferation, Application Sharing and the overall concept of management innovation. These results will be useful for health care administration as they explore knowledge and decision-making models for keeping up with the rapidly change of global healthcare system in the 21th century.

The path analysis relationships results indicate that Management Innovation is a moderator variable between Circulation Proliferation, Application Sharing, and Technological Innovation. Management Innovation is indirectly related to the basic work actives of an or-
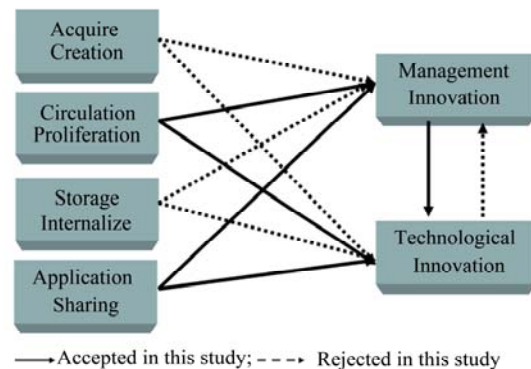
—— Accepted in this study; - - -▸ Rejected in this study

Likelihood ratio = 1.736 GFI = 0.990 AGFI = 0.948 CFI = 0.998 RMSEA = 0.057 P-Close = 0.358

Figure 2. Results of research hypotheses.

ganization while technological innovation is directly related to basic work activities. This finding is similar to Damanpour's study that demonstrated a "dual-core model" of organizational innovation; high professionalism, low formalization, and low centralization facilitate technical innovations [10]. In short, results of this indirect relationship relates to a real-world situations within Taiwanese hospitals because all activities within hospitals are controlled by organizational structure and administrative process. These results are similar to Su's finding indicating that a hospital's net benefits will be affected by its organizational behaviors in Taiwan [22].

6. Conclusions and Suggestion

Based on the results of reliability and validity examination, this study provided an appropriate instrument to explore the causal relationships between KM and OI within Taiwanese hospitals for further study in healthcare industry. Moreover, the present study demonstrated that KM was a factor which will affect OI directly based on

Table 5. The results of hypotheses examination.

Hypotheses	Standardized regression coefficient	Critical Ratio (C. R.)
H1	--	--
H2	--	--
H3	0.407**	5.104
H4	0.202**	3.465
H5	--	--
H6	--	--
H7	0.360**	4.516
H8	0.298**	5.518
H9	0.469**	10.184
H10	--	--

R^2 for Management Innovation was 0.537; R^2 for Technical Innovation was 0.777

-- Rejected in revised model; ** Statistically significant ($p < \alpha = 0.01$)

healthcare professionals' perspective in hospitals. The findings of this study have implications for healthcare administrators as they integrate knowledge management and organizational models that will develop learning organizations which reinforce sharing and application of knowledge throughout the hospitals.

Further research could identify whether this instrument could be used in different hospital levels or hospitals with different ownerships in Taiwan. In addition, further research could include qualitative studies to determine how hospitals are integrating knowledge management models and what successes and barriers they are experiencing.

7. Acknowledgements

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