Exploring Acceptance of Technology-based Service Innovations: A Perspective of Social Learning Theory

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ABSTRACT

There were few studies focused on the acceptance of service innovations. A technology-based service innovation is usually more complicated, thus learning of this innovation is essentially required. We use the case of evidence-based medicine (EBM) realization, one kind of technology-based service innovations, to explore the acceptance of service innovations based on social learning theory. A total of 18 in-depth interviews were conducted with key informants and analyzed using the techniques of grounded theory. Finally, we propose a technology-based service innovation acceptance model and develop three propositions. The model concerns 'perceived advantage' and 'perceived anxiety' of users (antecedents), 'learning intention' (mediator), and 'learning infusion' (consequence). The 'perceived advantage' is the positive outcome observed by individuals and it includes perceived cognitive advantage and perceived emotional advantage. The 'perceived anxiety' is the negative outcome observed by individuals and it includes information anxiety, patient education, patient misunderstanding, colleague competitiveness and coercive force of institution. This study theoretically initiates the perspective towards accepting technology-based service innovations based on social learning theory and practically provides a more specific and complete viewpoint for the acceptance of technology-based service innovations.

Keywords: service innovation, human computer interaction, technology acceptance, evidence-based medicine, social learning theory, grounded theory

1. INTRODUCTION

Some viewpoints discussing service innovation focused on the categorization of service innovation (Gallouj and Weinstein, 1997; Hipp and Grupp, 2005; Rubalcaba, 2007) while others emphasized the way to generate service innovations (Leiponen, 2005; Maffei et al., 2005; Tether, 2005). Den Hertog, Broersma and van Ark (2003) proposed the four-dimension model to help understand and analyze service innovations. However, the above researches placed emphasis on the delivery end of service innovations. There were few studies focused on the acceptance of service innovations. Thus the realization performance of service innovations may be undermined if user perception and experience towards accepting service innovations are omitted.

A more complicated service innovation is usually regarded as a technology-based service innovation (den Hertog, Broersma and van Ark, 2003). Accordingly, the issue of human computer interaction is also a critical concern for users towards accepting a technology-based service innovation. In the human computer interaction (HCI) theme, the research focus is transformed from human factors to human actors and the paradigm is shifted from system orientation to user orientation (Banon, 1991). HCI will fall into nonsensical research if the HCI studies lack an understanding of human feelings (McCarthy and Wright, 2004). The researchers in this school emphasize the importance of human experience (Norman, 1988). Accordingly, the perception and experience of users are receiving more attention in the design of HCI (Hasswnzahl, Beu and Burmetester, 2001). Furthermore, the following studies concerning the acceptance of technology and innovation have insufficient discussions. Technology acceptance model (Davis, 1986; Davis et al., 1992) and diffusion of innovations (Rogers, 1995) place fewer emphasis on emotional and social-process perspectives. Therefore, the issue of the co-construction of users and technology should be deeply considered in the acceptance of technology-based service innovations.

We use the case of evidence-based medicine (EBM), one kind of technology-based service innovations in hospital, to explore physician acceptance of service innovations from a perspective of social learning theory (Bandura, 1977). The study uses the technique of the grounded theory approach (Glaser and Strauss, 1967) to analyze the collected data. Participant observation and in-depth interview methods are used to gather the physician experiences within the EBM realization. In addition data was collected from secondary sources, e.g. literature, documents, records, public data from websites etc. The invited physicians are either EBM team leaders or seeded teachers.

2. LITERATURE REVIEW

2.1 Service innovation

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Service innovation has distinct degrees of innovative activities concerning the introduction of new services, significant changes in services or their production or delivery and the reconfiguration or improvement of existing service (Eurostat, 1995; Gallouj and Weinstein, 1997; Miles, 1994). Service innovations are not new to the world, but they may still be new to your company, customers, or network partners (Gustafsson and Johnson, 2003).

Due to dynamics and displaying features, service innovation requires new theories and instruments (Djellal and Gallouj, 2001). In addition, it is necessary for the service industry to take a broad view of innovation and innovation processes (Damanpour, Walker and Avellaneda, 2009; Gallouj and Weinstein, 1997). To improve the understanding of innovative activities in service industries, den Hertog, Broersma and van Ark (2003) proposed the four-dimension model. The four dimensions are 'new service concept', 'new client interface', 'new service delivery system' and 'technological options' and any service innovation involves a specific combination of the four dimensions. There are some other viewpoints discussing the service innovation model: Tether (2005) contended that it would be better for service firms to innovate through collaborating with customers and suppliers; Leiponen (2005) found that innovation in service firms is affected by external knowledge, especially from customers and competitors; Maffei et al. (2005) proposed a model based on the source of service innovation, i.e. from the company itself, the competitors, the customers and the suppliers.

However, the above models focus on the delivery end of service innovation. That is they concentrate how to generate and provide service innovation. They do not consider user mindset towards accepting service innovation. This may influence the diffusion of service innovation in the acceptance end.

2.2 Social Learning Theory

A technology-based service innovation is usually more complicated (den Hertog, Broersma and van Ark, 2003), thus learning of this innovation is essentially required. Social learning theory proposed by Bandura (1977) is the theory that people learn new behavior through overt reinforcement or punishment, or via observational learning of the social factors in their environment. If people observe positive, desired outcomes in the observed behavior, then they are more likely to model, imitate, and adopt the behavior themselves. In this study, both the positive and negative observation outcomes resulted in learning behavior of individuals are explored.

2.3 Evidence-based Medicine

The idea of EBM was initiated by clinical epidemiologists at McMaster University in Canada (Haynes, 2002). Cohen et al. (2004) pointed out that the core concepts of EBM originated by applying the principles of epidemiology to the practice of patient care during the 1970s and 1980s. EBM is a tool used to integrate the best research evidence, clinical expertise and patient values into the practice of patient care (Cohen et al., 2004; Delvenne and Pasleau, 2003; Haynes, 2002; Sackett, et al., 2000).

The basic scenario for the usage of an EBM system is described as follows. An EBM server, which consists of a knowledge database system, a management system and medical knowledge sources, functions as a platform of knowledge management. It mainly provides a medical knowledge database for any linked user (or client). Users can access the EBM system to acquire medical information and knowledge through a search engine. Furthermore, suggested solutions can be provided to support decision-making in medical treatment (Cheng et al., 2009). The practice of EBM is a rigorously systematic and scientific way of learning and applications. The operational steps (Gambrill, 1999; Delvenne and Pasleau, 2003) are: 1. Convert information needs into answerable clinical questions; 2. Find the best evidence with maximum efficiency; 3. Critically appraise that evidence; 4. Apply this appraisal to developing solutions; 5. Constantly evaluate the performance.

Evidence-based medicine's (EBM's) potential to support medical research, improve medical quality and reduce costs has galvanized clinicians, policy-makers, insurers and others in health care to speed its implementation in hospitals (Scalise, 2005b). Although the concept of EBM has been around for three decades, hospital leaders have paid serious attention to EBM only within the last three years (Scalise, 2005a). In Taiwan, EBM is new to many hospitals so it is viewed as one kind of technology-based service innovation within the hospital industry.

2.4 Related human-technology studies

2.4.1 Human computer interaction (HCI)

In recent research HCI studies have concentrated on user experience (McCarthy and Wright, 2004). The main stream in HCI issues has a trend for emphasizing the perceptual and experienced sensitivity of users. The researchers in this school place emphasis on the relationship between human and technology from the perspective of esthetics. They emphasize the importance of human experience and further contend that the human experience is fed back to technological design (Norman, 1988). For the HCI design issues, there are some studies concentrating the viewpoint of usability. Usability consisting of certain quality indicators is used to evaluate whether the technology is ease of use and whether the technology can make users definitely, directly, sensitively and effectively carry out their work (Ferreira and Pithan, 2005). However, the emotion and aesthetic experience of users are receiving more attention on the design of human-machine interaction (Hasswnzahl, Beu and Burmetester, 2001). The designers also transfer their focus to the emotional reactions of general users (Shneiderman, 2004). Moreover, McCarthy and Wright (2004) contended that the interaction between humans and the environment becomes a way of participation and communication when humans completely experience and grasp the existent situation.

2.4.2 Acceptance of technology

Technology Acceptance Model

TAM proposed by Davis (1986) is used to explain usage behavior of computer technology. The model is based on theory of reasoned action (TRA) developed by Fishbein and Ajzen (1975). TAM replaces many of TRA's attitude measures with the two technology acceptance measures—perceived usefulness (PU), and perceived ease of use (PEOU) (Davis, 1989). Davis defined PU as "the degree to which a person believes that using a particular system would enhance his or her job performance" and PEOU as "the degree to which a person believes that using a particular system would be free from effort". Both PU and PEOU influence attitude towards using the system. Except for extrinsic motivation, TAM is further modified by taking the intrinsic motivation *enjoyment* into consideration (Davis et al., 1992).

Diffusion of innovations

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. The perceived attributes of an innovation that influence an individual's decision to adopt or reject an innovation are relative advantage, compatibility, complexity, trialability and observability (Rogers, 1995). Rogers defines the five main characteristics as follows: 1. The relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes; 2. Compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters; 3. Complexity is the degree to which an innovation is perceived as relatively difficult to understand and use; 4. Trialability is the degree to which an innovation may be experimented with on a limited basis; 5. Observability is the degree to which the results of an innovation are visible to others.

2.4.3 Summary

The studies of HCI have evolved from the technological supply end to the acceptance end. The trend encourages researchers to explore the acceptance of service innovations. In addition, TAM and diffusion of innovations pay little attention to the negative outcomes observed by individuals. Thus this study supplements the above research gap.

3. METHOD

In this section, we describe the subjects, the process of data collection and the outcomes of data analysis.

3.1 Subjects

There were total 10 physicians accepting our invitations. Five physicians are from hospital A, which is a district teaching hospital and has close cooperation with us. Four physicians are from some medical center called hospital B. And one physician is from another medical center called hospital C. The personal information of the interviewees is shown in Table I. The invited physicians have gotten in touch with EBM at least five years. Besides, they are either EBM team leaders or seeded teachers for promoting EBM.

Table I The personal information of the interviewees

Hospital	Code name	Gender	Age range	Department
A	A01	Male	30~40	Pediatrics
A	A02	Female	Below 30	Internal medicine of kidney
A	A03	Female	40 ~ 50	Nutrition
A	A04	Male	40~50	Cardiac surgery
A	A05	Male	30~40	General surgery
B	B01	Male	40~50	Internal medicine of chest
B	B02	Male	Below 30	Family practice
B	B03	Male	Above 50	Endocrinology and Metabolism
B	B04	Male	Above 50	Psychiatry
C	C01	Male	40~50	Breast surgery

3.2 Data collection

In the study, the in-depth interview procedure is divided into four stages. It took about 40~50 minutes for each interview. The secondary data mainly came from historical files, documents, meeting records, website data and so on. In initial stage, we interviewed with one physician, one pharmacist and two nursing staffs in hospital A. Except for the interview with the physician, the other three interviews give less information about the issues of EBM realization. Therefore, we decided to focus on the subsequent interviews only with physicians. In the second stage, the EBM team leader and three seeded teachers in hospital A accepted my invitations for interviews. To enhance the trustworthiness of the study by data triangulation, we further invited three physicians employed in another hospital, called hospital B, in the third stage. Hospital B is a medical center and especially it is a benchmark hospital in EBM realization. We found that the statement of the last interviewee in the stage has been almost covered by the previous seven physicians. In other words, the aspects of EBM realization are theoretically saturated. In the final stage, after practicing peer debriefing and interviewee checking, the preliminarily collected and analyzed data was confirmed by the EBM team leaders of hospital B and C to meet the requirement of investigator triangulation. Therefore, the in-depth interview process is accomplished in this stage.

3.3 Data analysis

A qualitative data analysis is employed to develop a framework of concepts or a preliminary theory through a coding strategy. The in-depth interviews are concentrated on the perception and experience of physicians interacting with an EBM system. The interview transcripts are the principal data source for exploring the physician acceptance of EBM since the approach of grounded theory is concerned with individual meanings. The data analysis is through an iterative coding process. That is, the codes derived from the collected data should be modified again and again. The analysis process goes along with the data collection stages. Initially the interview transcripts are converted to a series of simplified codes. We noticed that certain codes are related to a specific subject. These common codes are accumulated and hence categorized under a meaningful label. The coded outcome organizes the diverse

meanings of EBM realization and hence the physician mindsets towards interacting with EBM system are induced. The induced axial codes under the context of EBM realization are shown in Table II.

Table II The induced axial codes under EBM realization

Axial codes	Open codes
Perceived advantage	
● Perceived cognitive advantage	➢ Supportiveness ➢ Efficiency ➢ Quality
● Perceived emotional advantage	➢ Fashion ➢ Confidence ➢ Pride ➢ Enjoyment ➢ Embodiment
Perceived anxiety	➢ Information anxiety ➢ Patient education ➢ Patient misunderstanding ➢ Colleague competitiveness ➢ Coercive force of Institution
Innovation learning	➢ Learning intention ➢ Learning infusion

4. RESEARCH FINDINGS AND PROPOSITIONS

Based on social learning theory we establish the EBM service innovation acceptance model shown in Figure 1. According to the conceptual diagram, the induced constructs and corresponding propositions are described as follows.

4.1 The relationship between perceived advantage and learning intention

The perceived advantages of physicians towards accepting the EBM system are induced as 'perceived cognitive advantage' and 'perceived emotional advantage'. The two constructs are described as follows.

4.1.1 Perceived cognitive advantage

The perceived cognitive advantages of physicians towards accepting the EBM system are induced as 'supportiveness', 'efficiency', and 'quality'. The examples of quotations are shown in Table III.

4.1.2 Perceived emotional advantage

The perceived emotional advantages of physicians towards accepting the EBM system are induced as 'fashion', 'confidence', 'pride', 'enjoyment' and 'embodiment'. The examples of quotations are shown in Table IV.

4.1.3 Propositions

The following propositions are developed based on social learning theory.

Proposition 1: The perceived advantage is positively related to learning intention towards EBM service innovation.

Proposition 1.1: The perceived cognitive advantage is positively related to learning intention towards EBM service innovation.

Proposition 1.2: The perceived emotional advantage is positively related to learning intention towards EBM service innovation.

4.2 The relationship between perceived anxiety and learning intention

The perceived anxiety of physicians towards accepting the EBM system are induced as 'Information anxiety', 'Patient education', 'Patient misunderstanding', 'Colleague competitiveness', and 'Coercive force of institution'. The examples of quotations are shown in Table V. We establish the following proposition:

Proposition 2: The perceived anxiety is positively related to learning intention towards EBM service innovation.

4.3 The relationship between learning intention and learning infusion

Innovation learning plays an important role in the process of accepting a technology-based service innovation. In the study, the innovation learning is induced as two stages: 'learning intention' and 'learning infusion'. The higher learning intention is, the higher learning infusion becomes. For examples: "It (perceived advantage) can promote my desire to learn and hence I actually devote myself in the EBM training courses." "This (perceived anxiety) initiates my intention to learn it (EBM) … So I have to participate in the training courses." There are many conversations showing the same viewpoints. Therefore,

Proposition 3: Learning intention towards EBM service innovation is positively related to learning infusion towards EBM service innovation.

Proposition 3 is partly matched with the theory of planned behavior proposed by Ajzen (1985). Behavioral intention is an indication of an individual's readiness to perform a given behavior. It is assumed to be immediate antecedent of behavior, which means an individual's observable response in a given situation with respect to a given target (Ajzen, 2002).

5. CONCLUSIONS

This study uses the case of EBM realization to propose a technology-based service innovation acceptance model based on social learning theory. The model concerns 'perceived advantage' and 'perceived anxiety' of users (antecedents), 'learning intention' (mediator), and 'learning infusion' (consequence). The 'perceived advantage' is the positive outcome observed by individuals and it includes perceived cognitive advantage and perceived emotional advantage. The 'perceived anxiety' is the negative outcome observed by individuals and it includes information anxiety, patient education, patient misunderstanding, colleague competitiveness and coercive force of institution. Besides there are three propositions induced from the study. This study theoretically initiates the perspective towards accepting technology-based service innovations based on social learning theory. As for the practical contribution, this study provides a more specific and complete viewpoint towards accepting technology-based service innovations.

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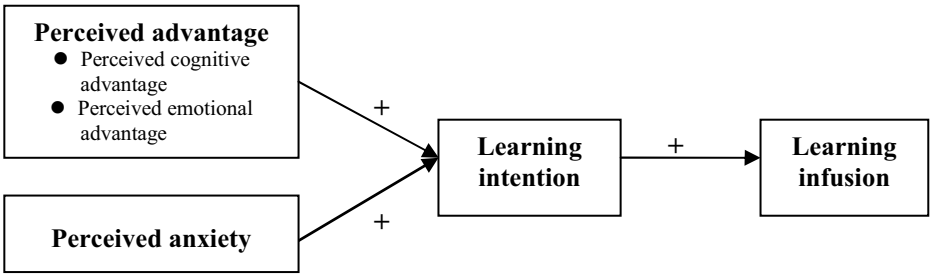

Figure1 The acceptance of technology-based service innovations: A perspective of social learning theory

Table III The examples of quotations concerning 'Perceived cognitive advantage'

Dimensions	Partial Quotations
Supportiveness	"Now, I clearly know how to acquire medical knowledge." "Network becomes my textbooks." "There exist some good and prefiltered databases in some websites."
Efficiency	"The way of learning EBM makes me solve some clinical problems in time." "Some powerful search engines can rank the papers you retrieve. Thus this saves more time for you." "It is easier for you to acquire the knowledge you want." "Since I touch the systematic learning way, I can readily filter papers and efficiently appraise papers."
Quality: Breadth	"Even a daily and ordinary issue is investigated by a serious experiment design and subsequently formed as a valuable evidence. It really breaks my traditional viewpoints on research."
Quality: Depth	"Most of the published papers in EBM databases possess a rigorous and complete experiment design. By realizing the experiment steps and protocols, the research result is valuable for supporting my clinical decision."
Quality: Correctness	"I think EBM can provide objective and correct solutions for some clinical problems." "EBM papers have high validity." "If you refer EBM papers, your solutions are viewed as more standard and correct ones." "Some databases, e.g. Cochrane library, further provide a prefiltered literature."

Table IV The examples of quotations concerning 'Perceived emotional advantage'

Dimensions	Partial Quotations
Fashion	"EBM is an unchangeable trend for medical development, especially in advanced countries." "EBM provides a novel learning way." "EBM is continuously developed in these years and becomes a hot issue today."
Confidence	"When my medical knowledge is continuously updated from EBM learning, I actually feel confident in clinical decisions and patient care." "I can follow new evidences and medical trend and hence enhance my professional confidence."
Pride	"I give progressive impression to my colleagues because I devote myself to EBM researches." "When I make evidence-based explanation for my patients, they sincerely trust me and praise me as a professional doctor."
Enjoyment	"I feel so happy to find out the solutions of my problems." "When I browse EBM websites, this is as if I travel in a knowledge palace." Another physician said, "To my surprise, this case lets me feel so fancy and funny!"
Embodiment	"When I come upon any clinical problem, the first step is to retrieve EBM researches. In daily work, I cannot do without EBM." "I have high tendency of usage because I need." "I can immediately solve some clinical problems, thanks to EBM learning way."

Table V The examples of quotations concerning 'Perceived anxiety'

Dimensions	Partial Quotations
Information anxiety	"Due to information popularization, I worry about whether my knowledge is obsolete." "I have no choice but face the endless learning because of rapid change of medical knowledge."
Patient education	"More and more patients download lots of medical researches and question me clinical problems in more detail … I have to learn and understand more medical knowledge in order to educate them." "Now patients have more their own opinions, and then I have to make effort to explain my clinical treatment."
Patient misunderstanding	"They can acquire considerable medical information, but they cannot entirely understand the professional knowledge. On the contrary, they further misunderstand the information … So I intend to learn more to guide them."
Colleague Competitiveness	"Sometimes I don't know what recent researches are, and then my colleagues laugh at my obsolete knowledge … This competitive stress pushes me to learn it."
Coercive force of Institution	"Taking EBM training courses becomes an essential qualification for promotion in our institution."