Factors Influencing the Success of National Healthcare Services Information Systems:
An Empirical Study in Taiwan

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ABSTRACT

By extending the updated D&M IS success model, this study examines the multi-dimensional aspects to identify influential factors and construct a suitable model for explaining NHSS success in Taiwan. Through the empirical results from the perspective of 1215 public healthcare workers, this study has arrived at several findings. First, eight salient factors were found which influenced NHSS success from the dimensions of user characteristics, organizational context, and system characteristics. Second, the factors of user experience, user training, information quality, service quality, and user satisfaction have a strong positive effect on system use, whereas user attitude and facilitating conditions have a significant and negative effect. Further, user attitude, user training, top management support, system quality, information quality, and service quality are also significantly correlated to user satisfaction. The results of this study can assist governments in other countries in developing more effective NHSS and better e-Government practices.

Keywords: *Healthcare Information Systems, IS Success Model, Multi-Dimensional Evaluation, National Healthcare Services Systems (NHSS), Structural Equations Modeling (SEM)*

INTRODUCTION

National healthcare services (NHS) is the management policy of healthcare services affairs that deals with the issues of long-term healthcare, disease prevention, and generic health services at the national level. It can be considered as a large scale application that can influence the well-being of people from different social levels. In the U.S., the healthcare expenditure consumed 16% ($1.9 trillion) of the nation's gross domestic product (GDP) in 2004; and is further projected to grow to 17.7% by 2012 (Bhattacherjee, Hikmet, Menachemi, & Kayhan, 2007; Smith Cowan, Heffler, & Catlin, 2006). In the U.K., £12-£20 billion was spent on the national programme for IS to facilitate

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the applicability of global healthcare and the performance of NHS (Avison & Young, 2007). Investment in IS for handling NHS affairs is prevalent in developed countries.

Likewise, in terms of the developing countries, for improving the quality and effectiveness of the national services to their citizens, the governments in most countries are raising a modern administration to conduct national information exchange (Ndou, 2004). The government in Taiwan, also, has invested a huge amount in NHS from 2000 to 2004, and the expenditure rapidly increased from $569,236 to $664,698 (in millions) (Bureau of Health Promotion, 2006). However, for governing such huge national healthcare expenses, the lack of IS assistance has caused many kinds of troublesome management issues (Avison & Young, 2007; Khoumbati, Themistocleous, & Irani, 2006).

Despite the information system having been commonly applied in many areas, with many failed applications, its development is relatively slow and difficult in the management of NHSS (Avison & Young, 2007; Hendy, Reeves, Fulop, Hutchings, & Masseria, 2005). National healthcare services systems (NHSS) is a type of e-Government information system in modern administrative practices for providing information needed by public healthcare workers, and helping the managers in NHS have better control (Jeffcott & Johnson, 2002; Khoumbati et al., 2006). Recently, there have been vast amounts of research concerning traditional admin/business IS and healthcare information systems (HIS) (Chang, Chang, Ho, Yen, & Chiang, 2011; Lee & Shim, 2007), but few of them focus on NHSS. To understand and measure the factors affecting the success of NHSS is becoming increasingly important for managing the government's national healthcare services affairs, and it is thus necessary to conduct research on this issue. Yet, measuring NHSS success is a complex and difficult task because the implementation of NHSS has the characteristics of user heterogeneity and inter-organizational features at different levels of public healthcare centers.

The development of NHSS is driven by the needs of public healthcare workers and the impact of complex organizational functions. Numerous studies suggest that the D&M model has become a prevalent and popular mean for measuring IS success (DeLone & McLean, 2003; Iivari, 2005; Wu & Wang, 2006). From the viewpoint of quality perspective, the DeLone and McLean IS success model (D&M model) seems to be a sound framework and the basis of measuring NHSS success. However, the implementation of NHSS is different from other IS in business and distinct from HIS in common hospitals since it possesses the NHSS feature of user heterogeneity and inter-organizational collaboration. Therefore, the assessment of NHSS success is more than the story of evaluation from a system characteristics, the ability of the updated D&M model in explaining the complex factors of NHSS success is questionable.

This study focuses on the multi-dimensional aspects because this can give managers a more comprehensive view of NHSS success. Scholars have suggested that both user personality and organizational contexts can significantly affect IS success (Holsapple, Wang, & Wu, 2006; Igbaria, Guimaraes, & Davis, 1995; Sabherwal, Jeyaraj, & Chowa, 2006). Similarly, in the circumstance of NHS, the user's characteristics, organizational condition, and information technology also have been considered highly relevant to NHSS success (Avison & Young, 2007; Hendy et al., 2005; Jeffcott & Johnson, 2002; Smith, 2002). In regard to the content of updated D&M model and the suggestions mentioned previously, researchers believe that in addition to the system characteristics, the individual and organizational determinants also make a significant impact on influencing NHSS success, and neither has been prudently examined.

The Foreign Origins Reproductive Health Management System (SFORHMS) is considered as one of the best NHSS among the e-Government initiatives in Taiwan and has been chosen for study. By extending the updated D&M IS success model, this study focuses on the multi-dimensional aspects to

identify the influential factors and construct a suitable model for explaining NHSS success. This study aims to identify the influential factors from three different dimensions (user characteristics, organizational contexts, and system characteristics) and construct a suitable model for explaining NHSS success from the perspective of public healthcare workers. Through the empirical results, this study provides noteworthy contributions which will be discussed later.

LITERATURE REVIEW

National Healthcare Services Research

National Healthcare Services (NHS) are centralized, mostly public, and comprehensive healthcare affairs that have a hierarchical and unified structure which provides a wide-ranging free service and long term care to patients (Higgs, Smith, & Gould, 2005). Such complicated national healthcare affairs and unforeseen events lead to the incursion of new costs and reduced efficiency in NHS management, thus using IS to deal with these situations is popular in advanced countries.

Use and implementation of IT/IS has been a notable issue in the healthcare research field due to the increasing number of healthcare service and administration activities performed in the practical world. Recently, a number of studies have investigated topics such as healthcare IT adoption and acceptance (Khoumbati et al., 2006; Chaua & Hu, 2002), health information exchange (Sicotte & Paré, 2010), and healthcare technology management (Katz & Rice, 2009; Wu & Wang, 2006). Among these, there is a strong focus on healthcare information technologies (HIT) and healthcare information systems (HIS) at an organizational level. Yet, due to the rising awareness of national health insurance services and the wide-spread application of information systems, the implementation of NHS systems (NHSS) may encounter a great number of managerial problems, which is a strong incentive for investigating the associated issues in the NHS.

A review of prior empirical studies relating to NHS shows several noteworthy findings. First, most recent studies addressed the issue of HIT/HIS and the sampling scopes were mostly targeted at small-scale, mid-size, or regional level hospitals. Second, very limited studies focus on the large-scale NHSS at an individual level. Third, relevant studies concerning the success of NHSS are rare. However, research on the issues relating to national healthcare services system at governmental level is still lacking. Thus, probing into the influential factors of NHSS use and user satisfaction in the sense of successful NHSS implementation is needed.

Multi-Dimensional Evaluation on NHSS Success

The use of IS in the practical field of NHS is important to prevent and control the spread of disease, to resolve public health problems, and to provide national level healthcare services in a country (Avison & Young, 2007; Jeffcott & Johnson, 2002; Khoumbati et al., 2006). Since IS plays an important role in managing NHS, ensuring its successful use is the next critical concern, although this is not an easy task. In order to carry out sound NHS management, it is essential for researchers to evaluate system performance and explore the factors affecting the success of NHSS from multi-dimensional aspects.

When considering the multi-dimensional nature of NHSS, Jeffcott and Johnson (2002) noted that in addition to the information technology, organizational issues and user aspect should not be ignored. Smith (2002) believed that improving healthcare system performance is becoming a key policy issue in most developed nations. He further suggested that an effective measure of systems performance depends on multiple key factors: the objectives of the system, the incentives for healthcare workers, and the culture of the organization. Similarly, by investigating the challenges in implementing the NPfIT (National Programme for Information Technology, a type of IT for NHS) project in England, Hendy et al. (2005) suggested that

managers need to address different key issues such as trust variation in their circumstances, understanding the process and responsibility for NHS implementation, continuous trust while facing uncertainties, and support of the local IT functionality to promote the technical performance.

Apart from the common nature of supplying information, the NHSS also possess multi-level characteristics, such as the system uniqueness in sustaining the specific healthcare business, the complexity functions in dealing with the operations of different social levels, and the supporting features for fulfilling the information needs of various healthcare workers. In summary, researchers believed that competent healthcare worker abilities (e.g., user experience, attitude, and training), effective organization environment (e.g., top management support, facilitating conditions), and useful information systems (e.g., system, information, and service quality) are significantly related to the success of NHSS.

DeLone and McLean IS Success Model

Since DeLone and McLean's (1992) IS success model (D&M model) was published, it has been utilized by many researchers to evaluate how IS can be successfully implemented and used in performing organizational functions or individual activities (Chang et al., 2011; Rai, Lang, & Welker, 2002; Sabherwal et al., 2006; Wu & Wang, 2006). By reviewing previous studies from the period 1981 to 1988, DeLone and McLean proposed their original IS success model and conceptualized the framework with six interrelated constructs: system quality, information quality, system use, user satisfaction, individual impact, and organizational impact. Additional suggestions were also considered in their model, such as considering system quality as a component of the technical level, positioning information quality at the semantic level, and including the construct of IS use, user satisfaction, individual impact, and organizational impact in the effectiveness level (DeLone & McLean, 1992; Rai et al., 2002). Recently, the D&M model has been widely discussed within public and government contexts. For example, Elpez and Fink (2006) studied the information systems' success from the perspectives of several stakeholders in the public sector. Based on the D&M mode, Scott, DeLone, and Golden (2011) proposed the empirical assessment of e-Government success from the citizens' perspective. Wang and Liao (2008) proposed a comprehensive and multi-dimensional model in accordance with DeLone and McLean (2003) to assess eGovernment systems success. The hypotheses testing results revealed that the relationships between the six constructs are significantly or marginally supported by the data.

Researchers also adapted the D&M model to study various issues in the healthcare sector. For example, Jen and Chao (2008) employed an augmented D&M model to study how to measure mobile patient safety from the perspective of IS success where as Chatterjee, Chakraborty, Sarker, Sarker, and Lau (2009) examined the success factors for mobile work. For the purpose of examining the implementation success of clinician information systems, Raghavan, Zhang, and Jeyaraj (2010) suggested that when constructing the research model for particular issues in healthcare contexts, the D&M model can provide a sound basis and be used to evaluate a typical IS success. These studies show that the D&M model is a notable framework for researchers to systematically find the relevant success factors and develop more appropriate evaluation models in the healthcare realm. However, when studying the issues of healthcare, public, and government sector in IS success, scholars noted that in addition to technological factors, environmental factors and social influences should be discussed (Avison & Young, 2007; Elpez & Fink, 2006; Jeffcott & Johnson, 2002; Sabherwal et al., 2006).

SFORHMS for Foreign Spouses Management

For the purpose of improving national healthcare service quality, the government in Taiwan

designed the SFORHMS, one type of the NHSS, to integrate the foreign wives' information for supporting public healthcare workers in national healthcare service operations. The system was adopted in November 2004 to manage the information of foreign spouses and their newborn infants, and support the provision of the specific public healthcare communication for public healthcare workers. Recently, the system has become vitally important in fostering the healthcare operations and facilitating the performance of staff employed by Community Health Centers. A total of 372 offices were dispersed and the services manpower was more than 4,764 (Bureau of Health Promotion, 2009). Today, the Community Health Centers in villages, towns, and cities play a major role in carrying out healthcare-related tasks in Taiwan's NHS. Focusing on the evaluation of usability of SFORHMS and individual benefits can improve the government's NHS affairs directly (Bouaziz, 2008; Ndou, 2004). The results of investigating the influential factors for NHSS success and identifying implications can provide significant research contributions for academia and practices.

RESEARCH DESIGN

Research Framework Development

The nature of NHSS is a complex national level application, and therefore it should be carefully investigated from a comprehensive perspective to create a research framework for evaluating the NHSS success. Since the SFORHMS is used by many public healthcare users and is a kind of national level IS, the study of its success is important in investigating both user characteristics and organizational context in addition to system characteristics. According to a review of the literature, the construct of user characteristics has been reported as a group of important determinants for IS success (Guimaraes & Igbaria, 1997; Holsapple et al., 2006; Igbaria et al., 1995; Sabherwal et al., 2006). Concerning the SFORHMS features and user heterogeneity of public healthcare workers, this study includes three critical factors, user experience, user attitude, and user training to represent the user characteristics that can influence SFORHMS use and user satisfaction. In regard to the characteristics of inter-organizational features at different levels of Community Health Centers, this study chose two critical factors, top management support and facilitating conditions to be included in the aspect of organizational context for studying SFORHMS' success.

Furthermore, based on NHSS features and the updated D&M model, this study includes other influential factors from three different dimensions (user characteristics, organizational context, and system characteristics) to construct the NHSS success model. A hypothesized framework is illustrated in Figure 1.

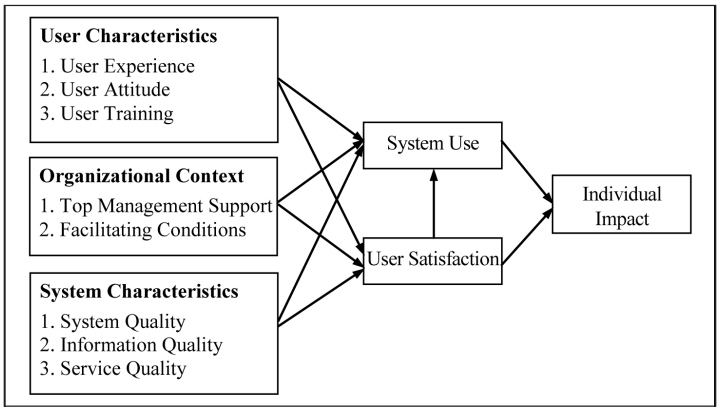
Research Hypotheses

User Characteristics

Users' personal experience, feelings, and beliefs are critical in the system use and design. A number of researchers provided strong encouragement to treat those factors as a vital measure of user characteristics which can positively relate to system use (Au, Ngai, & Cheng, 2002; Igbaria et al., 1995; Sabherwal et al., 2006). When considering the construct of user characteristics, three factors were included: user experience, user attitude, and user training. According to prior studies (Guimaraes & Igbaria, 1997; Sabherwal et al., 2006; Venkatesh, Morris, Davis, & Davis, 2003), this research defines these factors as follows: user experience is the duration or level of an individual's prior use of SFORHMS; user attitude is a user's affection or liking for using SFORHMS; and user training is the degree to which an individual is familiar with using SFORHMS through training courses.

Igbaria et al. (1995) indicated that both computer experience and user training are found to be positively associated with system use. Guimaraes and Igbaria (1997) researched the client/server system (CCS) success and pointed out that the two factors user experience

Figure 1. NHSS success model



and user training play a vital role in influencing end-user beliefs and usage. Further, Sabherwal et al. (2006) considered that the context of user characteristics such as user experience, user attitude, and user training are the critical factors in user-related constructs and play an important role in influencing system use and user satisfaction.

Studies from Taiwan also agree with this contention. Lee, Mills, Bausell, and Lu (2008) found when healthcare workers gain more computer experience, their technostress tends to be reduced at the same time and they are also more willing to spend more time on using Nursing Information System (NIS). Lee et al. also suggested a correlation between a positive attitude of users and the use of the system. The reason comes from the creation of the sense of belonging and the involvement in the system development when users are committed with a positive attitude. User training under the Taiwan context also shows a positive impact on system use according to Lee (2005) and Liu, Yang, Yen, and Wang (2006). Once users are well trained, they can not only become more familiar with system operations, but also solve unforeseen or contingent problems. These benefits contribute to the willingness to use the system. Liu et al. (2006) revealed that a lack of training will cause Taiwan healthcare workers to experience technostress and consequently increase their workload in the use of smart card systems. Thus, providing appropriate training or an educational program can effectively help healthcare workers use the new technology to complete work tasks. Thus, based on the discussions, this research proposes hypotheses H1 to H3.

H1: User experience has a positive influence on NHSS use.
H2: User attitude has a positive influence on NHSS use.
H3: User training has a positive influence on NHSS use.

NHSS is a computer-based system which provides integrated information to assist healthcare workers in the national healthcare program. Users' computer experience, positive attitude, and educational training are considered to significantly enhance the user's satisfaction. In an early study, Igbaria and Nachman (1990) investigated the correlation between end-user computing and user satisfaction, and found that the user's computer background and user attitudes are positively related to user satisfaction. In a study of Web-based virtual learning environments, Piccoli, Ahmad, and Ives (2001) noted that previous experience and skills training in information technology are important factors which affect the learners' satisfaction. Further, in studying the topic of IS success, Sabherwal et al. (2006) indicated that

user-related constructs (user experience, user attitude, user training, and user participation) pertain to user satisfaction.

However, this study includes user computer experience, attitude, and training as components of user characteristics that can be enhanced by individual skills, affection, and expertise which were found to be correlated to user satisfaction in microcomputer usage and IS success (Igbaria & Nachman, 1990; Guimaraes & Igbaria, 1997; Sabherwal et al., 2006). Elpez and Fink (2006) conducted a study in the public sector in Australia, and also found that user attitude can impact user satisfaction. Seliem, Ashour, Khalil, and Millar (2003) explained the correlation by using Egyptian data. When users perceive the importance of the IS, they tend to become involved more in the system development process and feel the system is highly related to their work. Such a positive attitude will reduce resistance to the system, and thus create more user satisfaction. Based on the discussions above, hypotheses H4 to H6 are proposed.

H4: User experience has a positive influence on NHSS user satisfaction.
H5: User attitude has a positive influence on NHSS user satisfaction.
H6: User training has a positive influence on NHSS user satisfaction.

Organizational Context

With regard to the construct of organizational context, top management support and facilitating conditions were adopted for studying the NHSS. By adapting the definitions in prior studies (Sabherwal et al., 2006; Igbaria & Iivari, 1995; Thompson, Higgins, & Howell, 1991), this study defines top management support as the favorable attitude of managers toward SFORHMS and the facilitating conditions as the processes and resources that can facilitate an individual's ability to utilize SFORHMS. Since the NHSS is a type of highest level and national scale system, suitable support by administrative levels can not only encourage healthcare workers' favorable beliefs but also directly improve NHSS operations. On the other hand, sound facilitating conditions in the organizational context can also strengthen healthcare workers' ability in using the NHSS and smooth the healthcare running processes by achieving more effective resource distribution.

Holsapple et al. (2006) noted that a successful IS implementation is not only a system issue but also requires organizational intervention. A number of researchers suggested that the essence of an information system can be treated as a mix of highly technical and complex functional activities involved with resources, which needs adequate top management support and organizational resources investment (Avison & Young, 2007; Khoumbati et al., 2006; Thatcher, Loughry, Lim, & McKnight, 2007; Wu & Wang, 2006). Sabherwal et al. (2006) proposed that both top management support and facilitating conditions are the critical factors in determining system use when investigating organizational determinants on IS success.

Results from the research projects carried out in Taiwan also demonstrate that top management support and facilitating conditions have a positive impact on system use. Chang, Hwang, Yen, and Lian (2006) explained that strong decision power and leadership are shown when the top management support is ensured. Under such circumstances, hospitals tend to adopt the picture archiving and communication system (PACS). Chang, Hung, Yen, and Lee (2010) focused on the enterprise resource planning (ERP) adoption by small and medium enterprises (SMEs) in Taiwan and found the same result. Yet, they believed that Taiwanese culture may play a critical role in creating the relationship. In comparison with foreign culture, Taiwanese are more worried about risks involved in the adoption and use of new IT. With top management support, organizations, therefore, can stimulate a comfortable environment to reduce users' worries and encourage users to use the new technology. Lee (2005) revealed the reason why facilitating conditions are critical to healthcare workers' use of NIS. Where they have insufficient facilitating resources,

healthcare workers need to queue, waiting for available computers or other equipment in order to perform caring tasks, and this can reduce their willingness for using the system.

In summary, in line with prior studies (Au et al., 2002; Guimaraes & Igbaria, 1997; Igbaria et al., 1995; Sabherwal et al., 2006; Sanders & Courtney, 1985) and NHSS contexts in Taiwan, top management support and facilitating conditions are considered the determinants of the system use in NHS practices. Hypotheses H7 to H8 are proposed.

H7: Top management support has a positive influence on NHSS use.
H8: Facilitating conditions has a positive influence on NHSS use.

User satisfaction has long been identified as an individual's affective reaction, which can be regarded as a critical factor in measuring IS success. After studying the applications of decision support systems (DSS), Sanders and Courtney (1985) indicated that the level of top management support, user training, and length of DSS use are importantly related to decision-making satisfaction and further enhance DSS success. Guimaraes and Igbaria (1997) noted that management support includes top management encouragement and resource allocation. Particularly, within the complicated contexts of IS implementation, appropriate management support can positively induce user's affective reaction towards high user satisfaction. Au et al. (2002) presented a critical review on IS research relating to end-user satisfaction, and suggested that top management support, organization support, and end-user support are associated with IS user satisfaction.

Consistent with the studies above, Sabherwal et al. (2006) presented a comprehensive theoretical model for investigating the critical determinants in the organizational context, and also concluded that both top management support and facilitating conditions provide key influences on user satisfaction. This relationship is confirmed in the research in different countries. Seliem et al. (2003), using Egyptian data, explained that top management normally control the decisions on resources allocation and IT investment. A higher degree of top management support is more likely to provide necessary resources required while using the system, and consequently the user satisfaction is more likely to be ensured. Lee (2005) researched the adoption of NIS in Taiwan hospitals and revealed that without sufficient facilitating conditions, healthcare workers need to wait for available computers and other kinds of resources in order to perform day-to-day operations. Such interruption can easily reduce working efficiency, and reduce user satisfaction.

Since NHSS is a kind of nation-wide system, the characteristics of users can vary. Support from the senior management level in the government and available facilitating conditions are thus considered as important and helpful to enhance healthcare workers' satisfaction across different levels of public healthcare centers. Thus, hypotheses H9 to H10 are proposed.

H9: Top management support has a positive influence on NHSS user satisfaction.
H10: Facilitating conditions have a positive influence on NHSS user satisfaction.

System Characteristics

System characteristics have been proposed as the essential constructs which can influence user's beliefs and play an important role in determining system use (Igbaria et al., 1995; Iivari, 2005; Wu & Wang, 2006). Based on the updated D&M IS success model (DeLone & McLean, 2003), this study includes three critical factors, system quality, information quality, and service quality, to construct the NHSS characteristics. By adapting the definition used in previous studies (Petter, DeLone, & McLean, 2008; DeLone & McLean, 2003; Pitt, Watson, & Kavan, 1995), system quality is defined here as the degree to which the SFORHMS is perceived easy, friendly, and accessible by the user; information quality as the degree to which information produced has the attributes of accuracy, format, completeness, understand-

ability, and report timeliness by the SFORHMS user; and the service quality as the healthcare worker's perception of how the SFORHMS provider delivers the service to the user.

Rai et al. (2002) compared the IS success model with D&M's (1992) and Seddon's (1997) framework, and indicated that both system quality and information quality have an essential impact on IS use. A number of researchers suggested that service quality is a significant component which plays an important role in the continuing development of an IS system (Pitt et al., 1995; Petter et al., 2008). Importantly, DeLone and McLean (2003) categorized and updated the IS success model for measuring e-commerce business. They concluded that the constructs of system, information, and service quality can significantly affect system use and user satisfaction.

As NHSS is a nationwide healthcare system, the applications for supporting healthcare services have been widely dispersed to hospitals or Community Health Centers in villages, towns, and cities. A sound quality-tendency system can effectively arouse healthcare workers' positive attitude toward system use. As a result, systems with a sound IS quality are likely to be used more satisfyingly and frequently than those with lower quality. Jang's (2010) study also confirms that this is true in the case of adopting the Electronic Government Procurement system in the Taiwan public sector. The stable and quality system makes users feel that the system is user-friendly while accurate information content allows users to trust that the system is useful for completing their tasks. Both kinds of quality contribute to the use of the system. Based on the discussions above, hypotheses H11 to H13 are proposed.

H11: System quality has a positive influence on NHSS use.
H12: Information quality has a positive influence on NHSS use.
H13: Service quality has a positive influence on NHSS use.

In the research of a respecification and extension of the D&M IS success model, Seddon (1997) noted that the measures of information and system quality have a positive effect on user satisfaction. Additionally, DeLone and McLean (2003) summarized that system, information, and service quality are the fundamental factors which can simultaneously contribute to the increase of user satisfaction. Wu and Wang (2006) provided a reason for justifying the correlation based on measuring knowledge management systems (KMS) in Taiwan. The more ease-of-use interface, simplified functions, and stable system environment allowed users to experience the system as being user friendly and fitting their anticipation. Therefore, user satisfaction has increased.

Similarly, the healthcare workers rely on SFORHMS to support the information for foreign spouses' management. Therefore, a stabilized system, usable information, and better services quality delivered by the system providers are noteworthy and cannot be ignored in evaluating NHSS success. In line with the D&M model, the relevant factors of IS characteristics mentioned above are suggested as being significantly associated with user satisfaction. According to the findings of previous studies and the suggestions of IS field scholars (Seddon, 1997; Rai et al., 2002; DeLone & McLean, 2003; Petter et al., 2008), hypotheses H14 to H16 are proposed.

H14: System quality has a positive influence on NHSS user satisfaction.
H15: Information quality has a positive influence on NHSS user satisfaction.
H16: Service quality has a positive influence on NHSS user satisfaction.

Satisfaction, System Use, and Individual Impact

Within the context of IS implementation, user satisfaction has been demonstrated as a critical affective attitude towards system use, and can be treated as the most useful assessment in measuring IS success (Au et al., 2002; Guimaraes &

Igbaria, 1997). System use is about the user's actual behavior or manner in utilization of the IS (Igbaria et al., 1995; Guimaraes & Igbaria, 1997; DeLone & McLean, 2003). Regarding individual impact, it is closely related to the degree of individual performance such as the quality of work, job and decision-making performance (DeLone & McLean, 1992; Etezadi-Amoli & Farhoomand, 1996).

Based on previous research, this study defines user satisfaction as the measured degree of user satisfaction with the SFORHMS (e.g., system interface, functional completeness, timeliness, hardware reliability, and overall satisfaction); the system use as the measured degree for frequency of use, number of uses, regularity of use, and number of functions used; and the individual impact as the measured degree of individual performance (e.g., reduplicate data input, efficiency of effort, time savings, worth of information system, improved personal effectiveness) when evaluating the level of SFORHMS effectiveness.

Regarding the relationships between these factors, Etezadi-Amoli and Farhoomand (1996) developed an instrument to evaluate user performance, and proposed six attitudinal dimensions (documentation, ease of use, system functionality, output quality, support, and security) for measuring end-user computing satisfaction. They further revealed that user satisfaction has a significant effect on individual user performance. Currently, there are several researchers focused on the topics of healthcare IS success (Chatterjee et al., 2009; Jen & Chao, 2008; Raghavan et al., 2010; Wu & Wang, 2006) and these healthcare IS studies found that the relationships between user satisfaction, system use, and individual impact are significant. Accordingly, hypotheses H17 to H19 are proposed.

H17: User satisfaction has a positive influence on NHSS use.

H18: The use of NHSS has a positive influence on individual impact.

H19: User satisfaction has a positive influence on individual impact.

Definition of Variables and Measurement

In this study, all variables were measured using multiple items which were developed based upon the theoretical considerations and suggestions in prior studies. In regard to the SFORHMS' characteristics, the questionnaire was further adapted and modified. Several scholars in the fields of accounting and information technology and MIS were invited to review the content of questionnaire. In addition, a group of public healthcare workers were employed to revise and examine the questionnaire for ensuring the suitability and appropriateness of every measurement item. A five-point Likert scale from "strongly disagree (1)" to "strongly agree (5)" in a structured questionnaire was used to measure each variable in the model. The operational definition of variables, measurement items, and corresponding reference resources are presented in Table 1.

Survey Methods

To conduct validity testing, the common method biases need to be considered and addressed in the research design. Measurement error is a type of problematic and systematic error of common method biases for observing the relationships between measures of different constructs (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Sharma, Yetton, & Crawford, 2009). Bagozzi and Yi (1991) pointed out that method variance is one of the main sources of systematic measurement error. In this study, an exhaustive research design was conducted to reduce the potential effect of method biases.

A paper-based survey was conducted for the current study. The data was collected from different levels of public Community Health Centers in Taiwan. The public healthcare workers who were using the SFORHMS to engage in foreign spouses' healthcare management were selected in order to obtain their individual perceptions. In terms of the sampling procedure, to ensure that all participants had a clear and consistent view, a cover letter which described

Table 1. Definition of variables and measurement

Variables	Definition	Items	References
User Characteristics			
User experience	Duration or level of an individual's prior use of computers and SFORHMS	6	Goodhue and Thompson (1995)
User attitude	User's affection, or liking, for SFORHMS and for using them	3	Venkatesh et al. (2003)
User training	Extent to which an individual has been trained about SFORHMS through courses, training, manuals, and so on	2	Goodhue and Thompson (1995)
Organizational Context			
Top management support	Top-management support for, and favorable attitude toward, SFORHMS in general	3	Igbaria and Iivari (1995)
Facilitating conditions	Processes and resources that facilitate an individual's ability to utilize SFORHMS	3	Thompson et al. (1991)
System Characteristics			
System quality	Degree to which the SFORHMS is friendly and accessibility	7	Seddon and Kiew (1996)
Information quality	Degree to which information produced has the attributes of accuracy, format, completeness, understandability, and report timeliness for the user	6	Seddon and Kiew (1996)
Service quality	Perception of how a SFORHMS provider delivers the service to user	4	Brady, Cronin, and Brand (2002)
Intermediate Variables			
User satisfaction	Degree of user satisfaction with the SFORHMS	6	Guimaraes and Igbaria (1997)
System use	Degree of frequency of use, numbers of use, regularity of use, number of functions used	4	Guimaraes and Igbaria (1997)
Dependent Variable			
Individual impact	Degree of individual performance with the use of SFORHMS	7	Etezadi-Amoli and Farhoomand (1996)

the purpose of this study and the definition of NHSS was also included. A pre-test and a pilot test on the instruments were conducted to ensure that the items were appropriate from the view of practitioners.

The SFORHMS was launched in November 2004 to support the healthcare information management of foreign spouses and their new-born babies for public healthcare workers. Generally speaking, during an IS implementation in its initial stage, resistance behaviors emerge from users' individual behaviors and are threatening to the consequences of information technology adoption. Lapointe and Rivard (2005) revealed that this time period is the ideal and appropriate time to adapt and improve the system. Therefore, the sample collection was conducted from August 1, 2006 to September 30, 2006, two years after SFORHMS was implemented, for studying the factors influencing the NHSS success. This study mailed the questionnaires with gifts to the healthcare workers in the Community Health Centers in villages, towns, and cities in Taiwan. Because one of our co-authors is a high level manager of the Bureau of Health Promotion, she provided much help in the assistance of questionnaire distribution and collection.

In terms of the data analysis techniques, the data was analyzed in two stages. First, SPSS was used to analyze the characteristics of data, generalize the demographic information, and test reliability and validity of the sample. Second, a structural equations modeling (SEM) technique was applied to test the model, including assessment of the relationships among the constructs. In recent years, the analytic approaches of SEM such as AMOS, LISREL, EQs, and Partial Least Squares (PLS) are the second generation multivariate data analysis techniques that can be used to estimate the multiple and interrelated dependence relationships and give an explanation for measurement error in the estimation process (e.g., Gefen, Straub, & Boudreau, 2000; Hair, Black, Babin, Anderson, & Tatham, 2006; Sharma et al., 2009). Among them, AMOS is covariance-based SEM software which can provide powerful and easy-to-use functions for assisting researchers to present a research model in an intuitive path diagram, and illustrate hypothesized relationships within related constructs (Gefen et al., 2000).

RESULTS AND DISCUSSION

Return of Questionnaires and Test of Normality

A total of 3000 questionnaires were mailed, 1728 of which were returned and 1215 valid responses were collected for further analysis. The overall valid return rate was 40.50%. The demographic characteristics of the sample are summarized in Table 2.

Multivariate analysis requires the assumptions of normality test for examining the normal distribution of data of the variables. To test normality of independent variables, the empirical measures of Skewness and Kurtosis are widely used. Scholars indicate that the distribution values of the variables should not be more than the threshold value (|±2.58|) when using a significance level of 0.01 (e.g., Hair et al., 2006). This study conducted the normality test with SPSS software, the analytical result shows that the data are demonstrated to be normally distributed.

Tests of the Reliability and Validity

This study assessed the entire scale with Cronbach's alpha for testing the internal consistency reliability of a scale. Generally, the value of coefficients above 0.70 is considered adequate (e.g., Cooper & Schindler, 2001; Hair et al., 2006, p. 137). The test results show that all the reliability coefficients of the constructs are greater than the recommended value of 0.7, which are above the thresholds for statistical significance (Table 3).

To ensure the content validity of the constructs, five scholars from the information technology domain as well as eight practitioners of public healthcare work were invited to revise the questionnaire. In addition, the convergent validity of items was examined using an exploratory factor analysis (EFA). A principal components analysis was employed for factor abstraction. For observing that a variable persists in having a cross factor loading, after the orthogonal rotation method, an oblique method was further used to simplify the columns of a factor matrix. Only the factors having eigenvalues greater than 1.0 and loadings exceeding 0.5 are considered significant (e.g., Hair et al., 2006, p. 128; Cooper & Schindler, 2001, p. 591). The result showed that one item in system quality, user satisfaction, and individual impact respectively should be eliminated due to the loadings being smaller than 0.5. The remaining items all contribute significantly to their nomological hypothesized constructs. The factor analysis results of individual item loadings are shown in Table 3.

Discriminant Validity Test

After the factor analysis test, Pearson's correlations matrix was used to examine the discriminant validity to recognize any multicolinearity problems with the variables. The value of average variance extracted (AVE) and composite reliability of the constructs was used to determine adequate discriminant validity among the

Table 2. Demographic characteristics of the sample

Items	Characteristics	Frequency	Percent
Gender	Male	3	0.25
	Female	1212	99.75
	Total	1215	100.00
Age (years)	< 30	188	15.50
	31-40	451	37.10
	41-50	403	33.20
	51-60	134	11.00
	Other	39	3.20
Education Level	High School	209	17.20
	Junior College	974	80.20
	Graduate Degree	16	1.30
	Other	16	1.30
Organizational Level	Senior nursing officer	80	6.60
	Nurse	837	68.90
	Nursing staff	226	18.60
	Other	72	5.90
Urbanization Level of Public Health Center	Municipality	173	14.24
	City	161	13.25
	Town and Village	733	60.33
	Other	148	12.18

constructs. The result shows that all the AVEs are greater than the threshold value (>=0.5) (e.g., Hair et al., 2006) and the composite reliability leads to better internal consistency. In addition, the square root of the AVEs is also greater than the correlation estimated of each element. Thus, the data produces evidence that multicollinearity is not significant among the constructs; the discriminant validity of measurement theory is supported. Table 4 summarizes the test result of composite reliability, AVEs, and correlation coefficients.

Model Testing

To ensure the validity of the model, the items with a lower factor loading were estimated and eliminated in the first stage. Thereafter, for creating estimated values of the model testing, a path diagram of the research model was constructed for conducting a path analysis in the second stage. Based on the criteria of heuristics for SEM statistical validity (e.g., Gefen et al., 2000; Hair et al., 2006) (Table 5), the research model and hypotheses were estimated by referencing recommended values (such as X^2/df, NFI, CFI, GFI, RMR, RMSEA). The results of model fit indices are significantly within acceptable thresholds: X^2/df=3.039, NFI=0.944, CFI=0.961, GFI=0.906, RMR=0.027, RMSEA=0.041.

The results of path findings are summarized in Table 6. Sixteen out of the nineteen paths exhibit a p-value less than 0.05, and the remaining three are not significant at the 0.05 level of significance. The constructs explain 55.7% of the variance (R-square) contained in system use, 65.4% contained in user satisfaction,

Table 3. Results of reliability and validity testing

Construct		Cronbach's α	Factor Loadings	Variance Extracted Estimate (%)
User experience		**0.77**		**39.86**
UE1	I have extensive experience in working with computers.		0.804	
UE2	I am sophisticated in applying computer.		0.793	
UE3	I have many opportunities to use computers in my job.		0.542	
UE4	I often attend computer-related training.		0.690	
UE5	I often attend computer-related seminars.		0.628	
UE6	I often use a computer to manage the daily affairs of life.		0.695	
User attitude		**0.86**		**56.98**
UA1	I believe computer technology can promote work efficiency.		0.887	
UA2	I believe computer technology can improve work quality.		0.893	
UA3	I support the implementation of this system (SFORHMS).		0.728	
User training		**0.76**		**70.07**
UT1	I consider the training used for this system (SFORHMS) is adequate.		0.849	
UT2	I completely accept the training approach of this system.		0.803	
Top management support		**0.85**		**50.52**
TMS1	My managers support the application of information technology in business.		0.932	
TMS2	My managers support the implementation of this system (SFORHMS).		0.935	
TMS3	My managers provide the necessary assistance for using this system.		0.718	
Facilitating conditions		**0.70**		**70.34**
FC1	My organization has sufficient computer software and hardware equipment for this system (SFORHMS).		0.819	
FC2	My organization has paid ample attention in integrating and managing the related information technology.		0.779	
FC3	My organization has IT experts who can sort out the problems of operating SFORHMS.		0.681	
System quality		**0.94**		**57.28**
SQ1	This system is easily used.		0.742	
SQ2	This system (SFORHMS) can easily upload files.		0.828	
SQ3	The data and statistical result of this system can be downloaded easily.		0.809	

continued on the following page

Table 3. Continued

SQ4	This system can conveniently access files.		0.813	
SQ5	This system has a quick response.		0.789	
SQ6	This system is very stable.		0.739	
Information quality		**0.92**		**69.89**
IQ1	This is a very secure system protected by password authentication and priority control system.		0.593	
IQ2	The data presented by this system is correct.		0.802	
IQ3	This system (SFORHMS) can completely present all data required.		0.839	
IQ4	This system has clear online assistance or prompt wizard function.		0.759	
IQ5	The output data format of this system is satisfactory.		0.770	
IQ6	This system can instantly provide the necessary statistical reports and data.		0.733	
Service quality		**0.91**		**76.83**
SEQ1	The provider of this system is very professional.		0.863	
SEQ2	The provider is very sophisticated with this system.		0.895	
SEQ3	The provider of this system is able to rapidly solve the operating problems.		0.870	
SEQ4	Generally, the provider of this system treats its customers with courtesy.		0.767	
System use		**0.86**		**78.48**
SU1	I have frequently used this system		0.797	
SU2	This system is used by my organization mostly in managing the affairs of foreign spouses.		0.769	
SU3	I have many opportunities to use this system (SFORHMS) in my work.		0.838	
SU4	My organization uses the data of this system for multiple purposes (e.g., associated cases requirement analyzing, children's vaccine tracking, and decision-making).		0.600	
User satisfaction		**0.94**		**70.05**
US1	I am satisfied with the operating interface of this system.		0.789	
US2	I am satisfied with the software function of this system.		0.833	
US3	I am satisfied with the operational speed of this system (SFORHMS).		0.869	
US4	I am satisfied with the computer hardware and auxiliary equipment of this system.		0.832	
US5	Overall, I am satisfied with this system.		0.795	
Individual impact		**0.90**		**60.44**
II1	This system can reduce duplication of data entry.		0.726	

continued on the following page

Table 3. Continued

II2	This system can simplify the process of managing foreign spouses' affairs.		0.798	
II3	This system can reduce time in the processing of foreign spouses' affairs.		0.817	
II4	This system is helpful in creating a complete foreign spouse database.		0.746	
II5	This system (SFORHMS) is helpful in increasing efficiency for the entire work.		0.832	
II6	This system is helpful for the general management of foreign spouses' affairs.		0.807	
Note. Factor loadings are from exploratory factor analysis (EFA)				

and 59.9% contained in individual impact. The standardized path coefficients for the research model are shown in Figure 2.

In addition, to ensure the effects of an indirect influence of the exogenous variables on the endogenous variables, the estimates for each of the hypotheses were also calculated by multiplying the direct effects by each other (e.g., Hair et al., 2006). The result shows that each indirect effect includes insignificant value of relationship (less than 0.08). Therefore, the indirect effects have rarely contributed to each of the hypotheses.

Research Findings

After conducting the data collection and statistical analysis, this study demonstrates that most of the hypotheses are supported, yet, a small part is not. In terms of the significant and positive influences, the results show that user experience, user training, information quality, service quality, and user satisfaction display a strong positive effect on system use (H1, H3, H12, H13, and H17); also, user attitude, user training, top management support, system quality, information quality, and service quality have a strong positive influence on user satisfaction (H5, H6, H9, H14, H15, and H16). Additionally, as expected, both system use and user satisfaction are significantly correlated to individual impact (H18 and H19). In terms of the significant but negative influences, the paths between user attitude and system use (H2), facilitating conditions and system use (H8), as well as facilitating conditions and user satisfaction (H10) show unexpected opposite results. More specifically, this research finds that there is no correlation between these pairs of variables: user experience and user satisfaction (H4), top management support and system use (H7), and system quality and system use (H11).

Discussion

This study extended the updated D&M IS success model from multi-dimensional aspects to identify the factors influential on NHSS success. By surveying grass-roots public healthcare workers, this study suggested a model that includes eight salient factors contributing to NHSS success. Despite the factors and interrelationships in the model being consistent with the D&M IS success literature, the paths of insignificantly correlated (H4, H7, H11) and the negative and significant correlations (H2, H8, H10) are also observed that suggest several cultural implications.

Firstly, in terms of user characteristics, the results show that the path of user attitude and system use has a negative and significant correlation (H2) and the path of user experience and user satisfaction has an insignificant correlation (H4). A number of studies found that user attitude and user experience normally have a positive relationship to IS use and user satisfaction (Igbaria & Nachman, 1990; Piccoli et al., 2001; Sabherwal et al., 2006). However,

Table 4. Pearson correlations matrix of independent variables

Construct	CR	AVE	1	2	3	4	5	6	7	8
1. User experience	0.849	0.487	0.698							
2. User attitude	0.877	0.705	0.405	0.839						
3. User training	0.811	0.683	0.362	0.297	0.826					
4. Top management support	0.900	0.753	0.273	0.426	0.347	0.868				
5. Facilitating conditions	0.805	0.580	0.388	0.359	0.326	0.420	0.762			
6. System quality	0.907	0.620	0.300	0.332	0.460	0.503	0.420	0.787		
7. Information quality	0.886	0.568	0.308	0.369	0.439	0.467	0.398	0.763	0.753	
8. Service quality	0.912	0.723	0.348	0.300	0.460	0.380	0.503	0.506	0.477	0.850

CR: Construct reliability, AVE: average variance extracted.
The off-diagonal elements are the correlations among constructs.
The diagonal elements in bold are the square root of the AVE. The value of each element should be larger than the off-diagonal elements.

from a cultural point of view, the culture factor is an influential parameter in the process of e-Government implementation. Different cultures may influence the perceived values of the individuals when considering the use of IT/IS and its applications provided by the government for public services. In Taiwan, the public healthcare workers usually have traditional and conservative characteristics. Given the cultural characteristics, when the users face problems in using e-Government applications, they quickly experience more working stress and produce negative emotions toward information technology (IT) such as computer anxiety, Internet anxiety, and technology stress. Therefore, more user experiences do not guarantee more satisfaction with the IT; conversely, these may lead the users' attitude toward creating a negative effect on NHSS use.

Secondly, in terms of organizational context, the results demonstrated that top management support has an insignificant effect on NHSS use (H7) and the facilitating conditions of Community Health Centers do have a negative and significant effect on NHSS use (H8). Many prior studies indicated that top management support (Igbaria & Iivari, 1995; Thompson et al., 1991) and facilitating conditions (Sabherwal et al., 2006) are the major determinants in influencing system usage. In the research of cross-cultural analysis, Arslan (2009) stated that the cross-cultural differences can be regarded as a source of the acceptable norms and behaviors that may influence the

Table 5. Fit indices for structural model

Index	Recommended value	Results
X^2/df	≦3.00	3.039
Normed Fit Index, NFI	≧0.90	0.944
Comparative Fit Index, CFI	≧0.90	0.961
Goodness of Fit Index, GFI	≧0.80	0.906
Root Mean Square Residual, RMR	<0.05	0.027
Root Mean Square Error of Approximation, RMSEA	≦0.08	0.041

Table 6. Results of path analysis

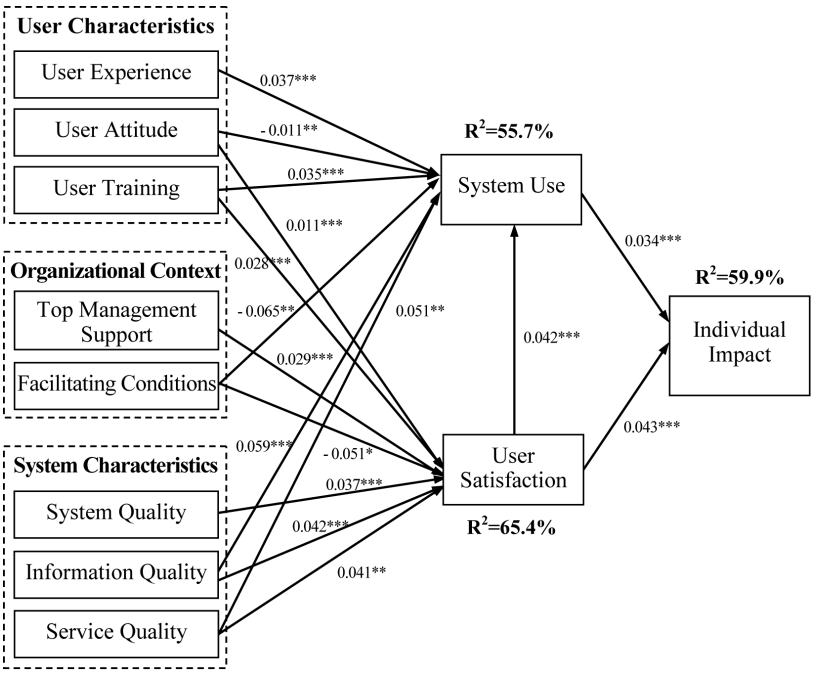
Path Link	Estimate	S.E.	C.R.	P-value	Results
H1: User Experience → System use	0.097	0.037	2.597***	0.009	S
H2: User attitude → System use	-0.027	0.011	-2.400**	0.016	S
H3: User Training → System use	0.206	0.035	5.881***	0.000	S
H4: User Experience → User satisfaction	-0.035	0.030	-1.151	0.250	NS
H5: User attitude → User satisfaction	0.050	0.010	4.954***	0.000	S
H6: User training → User satisfaction	0.169	0.028	6.092***	0.000	S
H7: Top management support → System use	-0.037	0.036	-1.045	0.296	NS
H8: Facilitating condition → System use	-0.141	0.065	-2.157**	0.031	S
H9: Top management support → User satisfaction	0.085	0.029	2.919***	0.004	S
H10: Facilitating conditions → User satisfaction	-0.090	0.051	-1.762*	0.078	S
H11: System quality → System use	-0.042	0.046	-0.918	0.359	NS
H12: Information quality → System use	0.511	0.059	8.617***	0.000	S
H13: Service quality → System use	0.114	0.051	2.239**	0.025	S
H14: System quality → User satisfaction	0.172	0.037	4.677***	0.000	S
H15: Information quality → User satisfaction	0.509	0.042	12.147***	0.000	S
H16: Service quality → User satisfaction	0.102	0.041	2.518**	0.012	S
H17: User satisfaction → System use	0.203	0.042	4.812***	0.000	S
H18: System use → Individual impact	0.242	0.034	7.054***	0.000	S
H19: User satisfaction → Individual impact	0.718	0.043	16.656***	0.000	S

Note: C.R. for construct's standard regression weights possesses the following level of statistical significance *p<0.1 (C.R.>1.64), **p< 0.05 (C.R.>1.96), ***p<0.01 (C.R.>2.58); S: supported; NS: not supported

civil service attitudes toward e-Government adoption. When implementing a typical case of NHSS in the hierarchical organizations such as a Community Health Center, power distance (a kind of culture difference) could be an important factor that causes the result to be insignificant. High power distance is one of the characteristics of Asian culture. With no exceptions, Taiwanese usually have a higher power distance and higher uncertainty avoidance value than Americans (Wu, 2008). Within the government in Taiwan, higher power distance may cause a lack of burden transmission or information distortion between the top management level and end users. Thus, the relationship between top management support and NHSS use shows no significant correlation. Furthermore, concerning the negative relationship between facilitating conditions and NHSS use, Sabherwal et al. (2006) noted that the process and resources of IS can facilitate an individual's ability. However, the SFORHMS is a specific IS and operated in the conservative environment in Taiwan. When the government is enhancing facilitating conditions on IT/IS, this may cause the public healthcare workers feel a greater need to know about new technology and increase their workload to face the changes in the working environment. Thus, it is not surprising that facilitating conditions have both a negative and a positive effect on NHSS use.

Thirdly, in terms of system characteristics, the results show that the relationship between facilitating conditions and user satisfaction (H10) has a negative and significant effect, and system quality and system use (H11) were

Figure 2. SEM analysis of research model



not significantly correlated. As noted from the literature, the more facilitation conditions on IT/IS, the more increased performance outcome and personal outcome are expected (Bandura, 1986). In general, the public healthcare workers in Taiwan are in a low competitive environment in comparison with the workers in private sectors, and they tend to get used to a constant environment. Therefore, when they are forced to spend more time on learning a new technology, this will create resistant and lead to unsatisfactory results. Similarly, the system quality of SFORHMS would not have a significant impact on system use in such circumstance.

CONCLUSION

The purpose of this study is to identify the influential factors that contribute the success of NHSS. By extending the updated D&M model, this study adopted the multi-dimensional perspectives to construct a hypothesized model for testing. Through the empirical survey on public healthcare workers, the model was examined and this study has arrived at several noteworthy findings. First, eight salient factors were found which influenced NHSS success from the dimensions of user characteristics, organizational context, and system characteristics. Second, the factors of user experience, user training, information quality, service quality, and user satisfaction have a strong positive effect on system use whereas user attitude and facilitating conditions have a significant and negative effect. Third, user attitude, user training, top management support, system quality, information quality, and service quality are also significantly correlated to user satisfaction. When considering the NHSS in use, utilizing the multi-dimensional perspectives to assess its success is important to enhance quality assurance in national healthcare service delivery. The results of this study can assist governments in other countries to develop more effective NHSS and better e-Government practices. Based on the data analysis result, implications

for researchers, the government, and NHSS providers are proposed.

Implications for Researchers

In accordance with the research findings, this study has three noteworthy implications for researchers to probe the study of NHSS success. First, a result opposite from prior studies is that user attitude has a significant and negative correlation with system use (H2). The mandatory and uniqueness feature is suspected as the major reason for this. The SFORHMS is a system that NHSS designed to support the regular healthcare affairs, and is a compulsory non-optional system used by the public healthcare workers for their routine work. Thus, a poorly designed system is likely to irritate users when the functions fail to meet their requirements. Accordingly, this study suggests that researchers should carefully explore the factors that could create a more enjoyable user experience for those users who are unwilling to use NHSS, thereby promoting their acceptance.

Second, the results show that facilitating conditions have a significant and negative effect on system use (H8). As noted, an appropriate facilitation (e.g., streamlined processes, adequate computer hardware and software equipment, as well as efficient network communication environment) is more essential in a highly computerized organization for supporting the use of NHSS. The overly complex operation processes and information resources can increase the problem of systems integration and training workload. In the current circumstances, it makes users more prone to resist technology and suffer psychological anxiety, and further reduces system usage. This may be the reason for explaining a strong and negative correlation between facilitating conditions and system use. Therefore, this study suggests that researchers need to investigate this issue for the development of NHSS.

Third, this study also found that facilitating conditions have a strong and negative effect on user satisfaction (H10). As noted, IT/IS has been implemented extensively throughout the NHS. However, public healthcare service projects regularly have high failure rates of around 30% (Jeffcott & Johnson, 2002; Hendy et al., 2005), and the main reason is the lack of user satisfaction. In terms of the ideas on the NHSS implementation, the negative correlation may be explained from the perspective of task-technology fit. Goodhue and Thompson (1995) stressed that the technology must be utilized and a good fit with, and support the users' task. Yet, this study shows that the facilitating conditions of NHSS do not completely fit healthcare workers' tasks. This study suggests that it is necessary for researchers to adopt a broad and deep insight to gain more understanding on how facilitating conditions are negatively related to user satisfaction and system use in order to help achieve NHSS success.

Implications for the Government

E-Government refers to the use of information and communication technologies to provide public administrations and services to the people who need them more efficiently and effectively (Arslan, 2009; Bouaziz, 2008; Ndou, 2004). Brown University in the United States conducted a series of global surveys on e-Government assessment in 198 countries. The results show that Taiwan was ranked first in 2002, 2004, and 2005 and second in 2008 (RDECEU, http://www.rdec.gov.tw/mp110.htm). In recent years, the government in Taiwan has actively and heavily invested in the strengthening of the national health insurance service, universal healthcare network, and care of disadvantaged groups in medical care and management. The SFORHMS for foreign spouses' management is considered one of the best practices in e-Government implementation in the world. The present study provides three implications for the government in regard to NHSS success.

First, this study found that the public healthcare workers of Community Health Centers have received much less IS training from their IS service provider than the hospital staff. This study suggests that the government

should provide adequate regular course training and have a promotion policy to enhance the public healthcare worker's computer capability for NHSS success. The user's IS training is the critical external cause in increasing the user's computer capability and psychological status in NHSS usage and satisfaction. Based on the inference of Social Cognitive Theory (e.g., Bandura, 1986), the user's psychological state can be affected by external information resources and the change of environment such as prior experience, situational support, and degree of professional orientation. Thus, sufficient IS training is related to NHSS success, and more attention should be paid to this in order to obtain that success.

Second, this study shows a surprising result, that is, facilitating conditions have a significant and negative correlation with system use (H8). Also, a negative correlation exists between facilitating conditions and user satisfaction (H10). As discussed previously, within the typical context of NHSS implementation, a possible reason to explain these unusual results is technology anxiety. Thatcher et al. (2007) explained that the source of Internet anxiety stems from the lack of social support in IT usage. This study suggests that when the government develops a convenient environment for facilitating the conditions of IT/IS, the problems of relieving users' technology anxiety and bridging an urban-rural digital divide cannot be ignored in accessing e-Government service.

Third, the result shows that top management support is a critical factor of organizational context in determining NHSS user's satisfaction (H9). NHSS is typically considered as an important healthcare application among Community Health Centers, and higher user satisfaction could induce a better system usage and move the individual users toward NHSS success. More top management support leads to the higher user satisfaction. Therefore, this study suggests that the top managers in various levels of government's healthcare department or Community Health Centers should be sympathetic to the staff and cultivate a friendly attitude to encourage the public healthcare workers so as to ensure NHSS user's satisfaction.

Implications for NHSS Providers

In terms of NHSS quality assurance, this study has two implications for the NHSS providers who are the software vendor and the professionals in a central information systems department of Bureau of Health promotion that manages the system operations and provides services to users. First, the results demonstrate that information quality is the most critical factor in influencing system use (H12) and user satisfaction (H15). The use of this system is different from a common system so that IS providers ought to put more effort into designing an easy-to-use system. The NHSS is not a typical type of IS, since it is designed to provide accurate health information to support the routine NHS activities, and this is what NHSS providers should pay attention to. Thus, this study suggests that the NHSS providers should continue to enhance the quality of information produced, such as the attributes of accuracy, format, completeness, understandability, and report timeliness, to increase the system use and user satisfaction.

Second, this study found that service quality also has a strong and positive effect on system use and user satisfaction. In the network of NHSS, the healthcare workers often lack support from the information center for real-time assistance and consulting service. In a larger NHS project, delivering friendly IS services can effectively assist healthcare workers in building up their confidence and also can reduce their technology anxiety in regard to system use. To increase system use and user satisfaction, this study suggests that the NHSS provider should communicate closely with its users to gather information about their needs and preferences, and pay more attention to each individual for providing quality service.

Limitations and Future Research

This research has two limitations. First, data were gathered from Community Health Centers.

However, the use of NHSS is not limited to this group only because different levels of public hospitals are also implementing the system. Therefore, this should be considered when generalizing the findings to a broader population. Second, this study only focused on certain influential factors from user characteristics, organizational context, and system characteristics when studying the topic of NHSS success, but it did not consider all determinants. Future research needs to discover how different NHSS systems are operated in different circumstances and at various levels (e.g., individual, organizational, or social) in order to understand the critical factors from a more broad perspective.

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