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PHYSICIAN ACCEPTANCE BEHAVIOR OF THE ELECTRONIC MEDICAL RECORDS EXCHANGE: AN EXTENDED DECOMPOSED THEORY OF PLANNED BEHAVIOR

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Abstract

In this study, we examined physician acceptance behavior of the electronic medical record (EMR) exchange. Although several prior studies have focused on factors that affect the adoption or use of EMRs, empirical study that captures the success factors that encourage physicians to adopt the EMR exchange is limited. Therefore, drawing on institutional trust integrated with the decomposed theory of planned behavior (TPB) model, we propose a theoretical model to examine physician intentions of using the EMR exchange. A field survey was conducted in Taiwan to collect data from physicians. Structural equation modeling (SEM) using the partial least squares (PLS) method was employed to test the research model. The results showed that the usage intention of physicians is significantly influenced by 4 factors (i.e., attitude, subjective norm, perceived behavior control, and institutional trust). These 4 factors were assessed by their perceived usefulness and compatibility, facilitating conditions and self-efficacy, situational normality, and structural assurance, respectively. The results also indicated that institutional trust integrated with the decomposed TPB model provides an improved method for predicting physician intentions to use the EMR exchange. Finally, the implications of this study are discussed.

1 INTRODUCTION

The rapid advancement of Internet technology enables electronic medical record (EMR) exchange transfers of electronic patient records between different hospitals on the Internet. The EMR exchange has played a vital and central role in health care to provide patient information for supporting numerous health care applications, such as diagnostics, treatment activity, and disease prevention. Thus, these exchanges offer various opportunities to achieve the six aims of improved care: (a) safety, (b) effectiveness, (c) patient centeredness, (d) timeliness, (e) efficiency, (f) and equity (Egea & Gonzalez 2011). The Bureau of National Health Insurance (BNHI) was tasked with establishing health care certification-authority integrated-circuit (IC) cards using public key encryption for the hospital and medical staff in Taiwan (Chang et al. 2009). Physicians can search for patient anamneses by using the IC card of the BNHI, the physician IC card, and electronic medical certificates on the Internet. However, for these information technology-enabled benefits to materialize (e.g., obtaining patient information from the EMR exchange website and providing health care), physicians must first adopt the EMR exchange.

EMR exchange adoption is an instance of information system (IS) acceptance and use in a setting that combines IS adoption with health care elements and thus requires distinct theorization within IS literature. Despite an emerging interest in the field of medical informatics and studies that have identified certain barriers to EMR adoption (Miller & Sim 2004; Sykes et al. 2011) and acceptance factors among physicians (Mohd & Mohamad 2005; Hennington & Janz 2007; Egea & Gonzalez 2011), the understanding of physician behavior regarding EMR contextual exchange is limited and fragmented. We posited and empirically tested a set of factors that integrate IS adoption with trust variables to enhance our understanding of physician acceptance behavior. Physician EMR exchange behavior has certain differences compared to typical user behaviour, including the following factors: (a) Health care is not only a type of service, but also a lifesaving mechanism by the EMR exchange. (b)Adopting the EMR exchange is not simple; a social and economic interactive process is required between health care organizations and their operating environment (Chang et al. 2009). (c) Concerns exist regarding the reliability of the open Internet infrastructure that EMR exchange providers employ to interface with physicians. To build physician trust, EMR exchange providers must implement more than only electronic linkages. These differences stress the uncertainty of the online environment and emphasize the importance of trust and the significance of IS adoption. EMR exchange providers affect physician perceptions of control, confidence, and effortlessness regarding health care activities, creating a barrier to EMR exchange adoption. Thus, compared to typical user behavior, perceived behavior control (PBC) as described by the theory of planned behavior (TPB) is likely to play a critical role in EMR contextual exchange.

The TPB is a well-researched model that has been shown to predict behavior across various settings. A decomposing TPB could effectively explain physician behavior (Hung et al. 2011). Because physicians who use the EMR exchange are a specific user group, the existing variables of the technology acceptance model cannot fully reflect the users and their motives, and consequently a study of other intrinsic motivational factors is required (Tung et al. 2008). Prior studies have suggested that researchers should examine other factors of intention to use, such as trusting beliefs (Lucas & Spilter 1999; Nicolaou & McKnight 2006). Various researchers have maintained that trust is essential for understanding interpersonal behavior in the field of medical informatics (Tung et al. 2008; Egea & González 2011). Institution-based trust is especially suited for EMR exchanges because EMR exchange providers predominantly exchange with other hospitals under the aegis of third parties who provide an institutional context. Prior empirical evidence has demonstrated the favorable effect of institutional trust on physician usage intentions (Egea & González 2011). Thus, the role of institutional trust is critical for adequately capturing physician behavior regarding EMR exchanges. Because of the limited application of trust factors to the analysis of physician technology acceptance, we created an extended version of the decomposed TPB to predict physician behavior by integrating institutional trust. We predicted physician behavior by examining the major constructs of decomposed TPB with institutional trust, and the most important antecedents. Our study objectives are as follows: (a) to investigate whether institutional trust significantly affects physician behavioral intentions of

adopting the EMR exchange; (b) clarify which factors are more influential on the decision to use the EMR exchange; and (c) to evaluate whether integrating the decomposed TPB with institutional trust provides a solid theoretical basis for examining EMR-exchange adoption.

2   BACKGROUND

A survey by Shapiro et al. (2007) indicated that 97% of physicians believed that health information exchanges improve care safety and quality. However, 85% of physicians believed that obtaining relevant clinical information from external sources is difficult. IS use among health care personnel has been a key issue in the field of medical informatics. Previous studies have investigated the factors influencing IS acceptance of physicians by using several information technologies, such as the Medline system (Hung et al. 2011), bedside computer technology (Moores 2012), EMRs (Chang et al. 2009; Mohd & Mohamad 2005; Hennington & Janz 2007; Egea & Gonzalez 2011), and clinical decision support systems (Chang et al. 2007). Compared with previous studies, we specifically stress the factors driving physician usage intentions of EMR exchanges. Guided by integrating the decomposed TPB with the trust-belief framework, we examined this issue in a sample of Taiwan hospitals.

2.1   Electronic medical record exchange

Health IT, such as EMRs, has the potential to improve patient care quality by increasing care coordination, eliminating errors, and reducing costs. EMRs contain more than text and are related to the medical treatment aspects of personal information. Most patients visit several hospitals in a lifetime, and "hospital shopping" in Taiwan is relatively common. Therefore, the EMR exchange must allow physicians with different health care information systems to electronically interchange structured data. The EMR exchange electronically transfers patient-level clinical, demographic, and health-related information among disparate hospitals. The Department of Health (DOH) has established an EMR exchange center (EEC) with two identity certifications (i.e., the IC card and a medical personnel IC card) in Taiwan. The EEC has a centralized patient index repository containing a list of patients who have visited hospitals for medical services in the last 6 months. Certification encryption is used to improve EMR security, and certification decryption is employed to protect patient privacy and the integrity of the medical records. The major aims of the EEC include (a) supporting the continuity of care through the EMR exchange, (b) reducing redundant exams and over prescribing, and (c) improving the quality of care. Thus, the EEC focuses on promoting and advancing health information exchanges. Hospitals have increasingly implemented the EMR exchange for making decisions regarding individual patient care. Because of their advancement and dissemination, EMRs have recently become the focus of the DOH, the BNHI, and hospital managers and clinicians. However, EMR implementation involves considerable effort; prior research has identified certain barriers to EMR adoption (Miller & Sim 2004; Sykes et al. 2011) and acceptance factors (Mohd & Mohamad 2005; Hennington & Janz 2007; Egea & Gonzalez 2011) among physicians. For example, one study applied unified theory of acceptance and use of technology (UTAUT; Venkatesh et al. 2003) to physician adoption of EMR technology (Hennington & Janz 2007). However, studies that have examined the willingness of physicians to exchange EMRs are rare.

2.2   Information technology acceptance models

User acceptance is one of the most comprehensive directions of management IS research. Social psychological theories, such as theory of reasoned action (TRA; Fishbein & Ajzen 1975), the technology acceptance model (TAM; Davis 1989), and the TPB (Ajzen 1985), have been applied to study IS acceptance. Although TRA has been evaluated and supported in numerous contexts, it is weak in explaining the essence of behavior. Ajzen (1985) found that attitude and subjective norm determine intention, and further proposed that perceived behavioral control reflects the degree to which a person feels that successfully engaging in a behavior is completely under their control. Behavioral intention (BI) measures the strength of user willingness to exert effort when performing certain behaviors. Attitude (A) explains the assessment of favorable behavior for users, which directly

influences the strength of the behavior and beliefs regarding the likely outcome. Accordingly, attitude is equated with attitudinal beliefs that link a behavior to a certain outcome weighted by the desirability evaluation of that outcome. Subjective norm (SN) expresses the perceived social pressure of a person who intends to perform a behavior, and is related to normative beliefs regarding the expectations of other people. Perceived behavioral control (PBC) reflects the perception of a person regarding the ease or difficulty of implementing a behavior. PBC beliefs concerning resources and opportunities are the underlying determinants of PBC, and can be depicted as control beliefs. Ajzen (1991) proposed that TPB eliminates TRA limitations on managing behavior over which people have incomplete volitional control. To better understand the relationships between intention belief structures and antecedents, prior studies have examined approaches to decomposing beliefs into multidimensional constructs (Taylor & Todd 1995a; 1995b). The decomposed TPB model focuses on three key beliefs (i.e., A, SN, and PBC) and their antecedents.

Although the TAM and TPB have been the most popular models adopted to explain physician behaviour, TAM and TPB have been criticized because of numerous shortcomings. First, the TAM explains user IT acceptance behavior from the perspective of IT characteristics only. Second, prior study findings might not have explained physician acceptance behavior because their characteristics differ from those of typical technology users (Hung et al. 2011). Therefore, the TAM is not completely appropriate for examining IT acceptance among physicians. Third, a prior study evaluated the extent to which prevailing intention-based models, including the TAM, TPB, and a model that integrated them both, could explain individual physician IT-acceptance decisions (Chau & Hu 2002). Judging by the explanatory power and path coefficients, TPB and the TAM appear to be weaker than the integrated model. Moreover, prior studies have shown that the effort to introduce EMRs results in failure and unanticipated consequences when their technical aspects are over emphasized and their social factors, such as user acceptance and the diffusion of IS, are overlooked (Moore 1996; Gefen 2003). Fourth, the TPB model does not specify belief sets that are relevant to the specific behavior of IS acceptance, which cause difficulties in operationalizing the TPB model or comparing relevant beliefs across multiple acceptance contexts (Bhattacherjee 2000). Certain prior studies found that the decomposed TPB model has good explanatory power for predicting IS acceptance by individual professionals (Yi et al. 2006; Chau & Hu 2001; Hung et al. 2011). Hence, this study applies the decomposed TPB model to explain physician acceptance of the EMR exchange.

2.3   Institutional trust

The scope of application of the Taiwan Personal Information Protection Act (PIPA), which was implemented in October 2012, encompasses people as well as various industries. The PIPA was enacted to govern the collection, processing, and use of personal information to safeguard civil liberties, and to facilitate the proper use of personal information. Under these circumstances, physician concerns about sufficient security for protecting patient privacy are likely to slow the diffusion of IT such EMR. Our literature review revealed that further research is necessary to clarify the role of trust perceptions in physician acceptance of IT (Tung et al. 2008; Egea & González 2011). In EMR contextual exchange, physicians are the trustors and the EEC is the trustee because hospitals provide sensitive information, such as patient identifiers, computed tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), to physicians, and are hence vulnerable to the influence of the EEC. Physicians have limited ability to monitor or control the EEC use of their EMR exchange, which is why trust is required. Institution-based trust exists when trust is tied to the existence of third-party structures that are independent of dyadic actions (Pavlou & Gefen 2004). Shapiro (1987) described institutional trust as the belief that a trustor has regarding the security of a situation because of guaranteed safety procedures and other structures. Zucker (1986) suggested that institutional trust is the most crucial trust-creating mode in impersonal economic environments, where the sense of a common community with similar values is lacking. McKnight and Chervany (2002) distinguished two types of institution-based trust that are relevant for initial trust situations: (a) situational normality, defined as the belief that success is likely because a situation is normal, and (b) structural assurance, defined as the belief that success is likely because of guarantees, contracts, regulations, promises, legal recourse, processes, or procedures. This study uses measures of

institutional trust to address physician perceptions of the existence of favorable conditions (e.g., technical, legal, policy, and standards) that are conducive to situational success of using the EMR exchange.

3   RESEARCH MODEL

This study examines the physician acceptance behavior of the EMR exchange. To achieve the purpose of this study, the investigated models applied behavioral intention, which has been regarded as the essential basis for examining individual physician ERM exchange behavior, as a dependent variable, for two reasons. First, numerous studies have reported a strong and significant causal link between behavioral intention and targeted behaviour (Sheppard et al. 1988; Venkatesh & Morris 2000). Because of this strong link between intention and behavior, using behavioral intention as a dependent variable to examine user behavioral intention is theoretically justifiable (Chang 1998; Chau & Hu 2001; Mathieson 1991). Second, Agarwal and Prasad (1999) argued that usage intentions are more appropriate than actual behavior because they are measured contemporaneously with beliefs. Certain studies have also chosen usage intention instead of actual usage as a dependent variable to investigate the IT acceptance of physicians (Chau & Hu 2001;Ryu et al. 2003;Yi et al. 2006; Hung et al. 2011).Therefore, we considered the application of physician intentions to use the EMR exchange as a dependent variable as adequate and desirable. Following Taylor and Todd (1995a; 1995b) we extended the TPB model by decomposing attitudinal, normative, and perceived control beliefs into multidimensional constructs to provide higher explanatory power and a more precise understanding of behavior antecedents. We then extended the decomposed TPB model by adding an institutional trust construct to the model. Similar to e-commerce, the EMR exchange is a platform for delivering services, and activities are performed online and processed virtually. Personal contact is absent, and can raise doubts as to whether the requested information exchanges were correctly processed. Personal data that hackers might steal are transmitted online. These concerns require a high level of institutional trust before people are willing to use the EMR exchange. The literature review indicated that numerous studies have provided empirical support indicating the significance of institutional trust as a direct influencing factor on the intentions of people to engage in online activities (McKnight et al. 2002; McKnight & Chervany 2002; Gefen et al. 2003; Pavlou & Gefen 2004). Figure 1 presents a pictorial depiction of the research model, which offers a description of the different dimensions and the development of theoretical arguments.

Attitude refers to the positive or negative evaluation of a physician regarding the EMR exchange. Based on the TRA model, attitude influences behavioral intentions, a relationship that has received substantial empirical support. People who form positive attitudes toward the EMR exchange have a stronger intention toward adopting it, and thus, are more likely to use it. Priors studies examining physician IS acceptance have also provided support for the "attitude-behavioral intention" link (Chau & Hu 2002; Ryu et al. 2003; Hung et al. 2011). Thus, we proposed a hypothetical relationship between attitude and usage intention as follows:

H1 .A greater positive attitude by physicians toward using the EMR exchange is positively associated with a greater usage intention toward that system.

In previous research, attitudinal belief has had three innovation characteristics that influence behavioral intentions: relative advantage, complexity, and compatibility (Taylor & Todd 1995a). Relative advantage refers to the degree to which an innovation provides benefits that supersede those of its precursor and might incorporate other factors, such as job benefits. Relative advantage is often considered as perceived usefulness in TAM. The complexity construct is similar to the perceived ease of use concept in TAM. Thus, three reasons exist for decomposing attitude into perceived usefulness, perceived ease of use, and compatibility in this study. First, the underlying causal relationships among perceived ease of use, perceived usefulness, and attitude toward use follow those specified by the TAM (Davis 1989). Second, compatibility refers to the degree to which an innovation is perceived as being consistent with existing values, previous experiences, and the needs of the potential adopter (Rogers 1995). Physicians who consider the EMR exchange to be compatible with their work style and all aspects of work must express a high willingness to use the EMR exchange. Third, the

perceived ease of use for individual physicians has a significant and direct effect on perceived usefulness when using new technologies (Hung et al. 2011). Thus, we proposed the following hypotheses:

H1a. A higher perceived level of usefulness of the EMR exchange by physicians is positively associated with a more positive attitude toward using it.

H1b. A higher perceived level of ease of use of the EMR exchange is positively associated with a more positive attitude toward using it.

H1c. A higher perceived level of compatibility with the EMR exchange is positively associated with a more positive attitude toward using it.

H1d. A higher perceived level of ease of use for the EMR exchange is positively associated with a higher perceived usefulness of it.
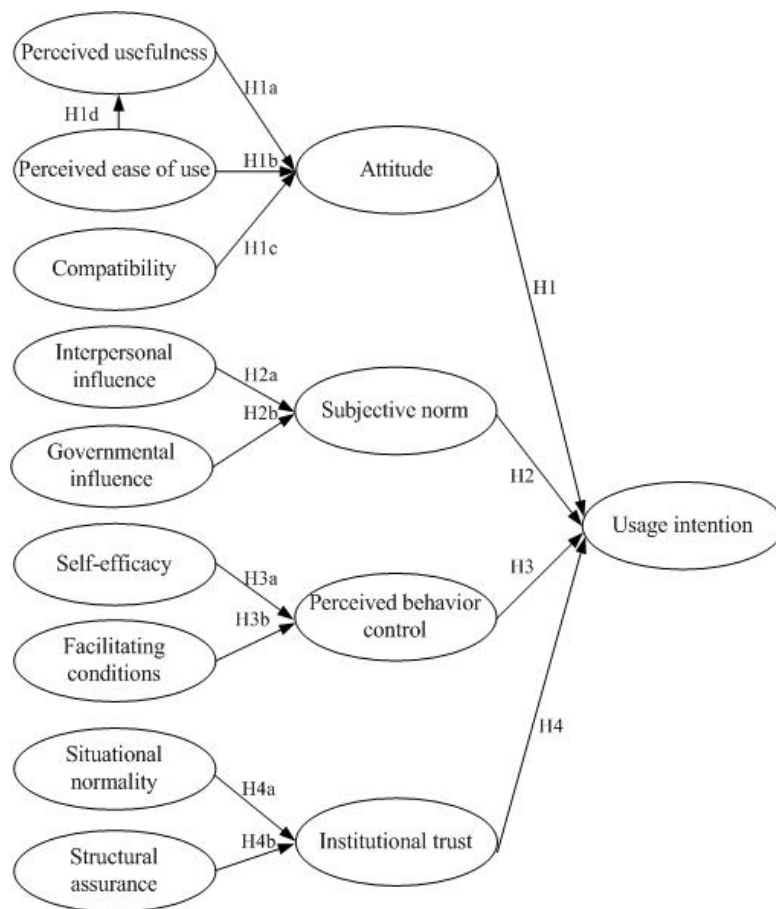

Figure 1.   Research framework

Subjective norms are the extent to which people feel that others desire them to perform the behavior (Fishbein & Ajzen 1975). The more they perceive that others think that they should engage in a behavior, the greater their motivation to comply. Prior studies have found that the SN perceived by physicians significantly influences their behavioral intention (Chau & Hu 2002; Hung et al. 2011). In our study, TPB states that physician intentions of using the EMR exchange are simultaneously determined by their perception of the opinions of others on whether to use the technology. Therefore, we proposed the following hypothesis:

H2. A higher perceived level of the subjective norm of using the EMR exchange is positively associated with a greater usage intention toward it.

Previous studies have adopted interpersonal and external environmental influences as determinants of subjective norm (Bhattacherjee 2000; Lin 2007; Hsieh et al. 2008). Interpersonal influence indicates

the word-of-mouth influence by friends, colleagues, and superiors, whereas external influence indicates mass media reports, expert opinions, and other non-personal information considered by people when performing a behavior. In the health care context, physician intentions regarding EMR exchanges for a health care service are shaped by interpersonal influences (i.e., patients, friends, peers, and superiors), and by the opinions of the DOH and BNHI, as disseminated by governmental policies. Government institutions are particularly essential for facilitating the EMR exchange. For example, the DOH and BNHI allocated incentive money to encourage hospitals and physicians to implement EMR systems and exchange EMRs. Although researchers have suggested the necessity of studying such effects (Hsieh et al. 2008), the subjective norm measures of this study consider both interpersonal and governmental influences. Thus, we proposed the following hypotheses:

H2a. A higher perceived level of interpersonal influence is positively associated with a higher perceived level of subjective norm related to EMR exchange usage intention.

H2b. A higher perceived level of governmental influence is positively associated with a higher perceived level of subjective norm related to EMR exchange usage intention.

In the TPB model, PBC is a construct that has a direct effect on behavioral intentions. PBC describes individual perceptions of the availability of knowledge, resources, and the opportunities necessary for using IS (Ajzen 1985). People who have substantial resources for performing a particular behavior have higher levels of PBC, which positively influences behavioral intentions. Therefore, physicians have greater intentions to use the EMR exchange because they possess adequate resources. Therefore, we proposed the following hypothesis:

H3. A higher perceived level of behavioral control is positively associated with greater usage intention toward the EMR exchange.

Ajzen (1991) extended the TPB model by dividing the PBC component into two dimensions: self-efficacy and facilitating conditions. Self-efficacy is the judgement of people on their capabilities of using IT. In the health care context, self-efficacy refers to physician self-assessments of their own capabilities to access patient information. Facilitating conditions reflect the resource availability required to perform particular behaviors. Thus, we focused on assessing the facilitating conditions for the EMR exchange, including three vital resources: Internet equipment, time, and available assistance for use. Therefore, we proposedthe following hypotheses:

H3a. A higher perceived level of self-efficacy is positively associated with a higher perceived level of behavioral control of EMR exchange usage.

H3b. A higher perceived level of resource-facilitating conditions is positively associated with a higher perceived level of behavioural control of EMR exchange usage.

The integration of institutional trust (McKnight & Chervany 2002; Gefen et al. 2003) within the TRA nomological structure (Fishbein & Ajzen 1975) is central for predicting usage intentions (McKnight & Chervany 2002; Pavlou & Gefen 2004). Prior studies have widely documented the relationship between trust and intention in online settings (McKnight & Chervany 2002; Gefen et al. 2003). Trust has been identified as a stronger predictor of usage intention (Gefen et al. 2003; Pavlou & Gefen 2004). In the health care context, physician use of health information technology is subject to uncertainty and risk, which require developing the trust of health information providers (e.g., the EEC). However, the risks of physicians using the EMR exchange are lower than the potential opportunistic behavior of another party (Egea & Gonzalez 2011). Hence, we proposed the following hypothesis:

H4. Institutional trust in the EEC is positively associated with greater usage intention toward the EMR exchange.

Institution-based trust has two sub-constructs: situational normality and structural assurance. Situational normality refers to the beliefs of people that the situation in a venture is normal, favorable, or conducive to success (McKnight & Chervany 2002). Gefen et al. (2003) stated that users feel greater trust when interactions are according to what they consider to be typical and anticipated. If a website has a suspicious interface or it requires users to conduct unexpected procedures or provide

atypical information, physicians are more inclined to distrust the website provider. Structural assurance refers to an assessment of potential success because of the safety nets, such as legal recourse, guarantees, and regulations, existing in a specific context (McKnight & Chervany 2002). In the EMR exchange context, physicians have a structural assurance for believing that legal and technological Internet safeguards (e.g., encryption) protect them from privacy or identity loss. A high level of structural assurance regarding the Internet fosters confidence in the ethics of EMR exchange providers because structural assurances engender feelings of security. Based on prior studies, situational normality and structural assurance regarding Internet settings affect institutional trust in website providers (McKnight & Chervany 2002; Gefen et al. 2003). Thus, we proposed the following hypotheses:

H4a. Perceptions of situational normality positively affect institutional trust in the EEC.

H4b. Perceptions of structural assurance built into a website positively affect institutional trust in the EEC.

4 RESEARCH METHODS

All measures of each construct in Fig. 1 were adopted from previous studies and were measured using a 7-point Likert scale; the anchors ranged from *strongly agree* to *strongly disagree*. Although the instrument had been validated by previous studies, we examined it to ensure the content validity and reliability was within acceptable range. We conducted pretests by requesting several physicians and information management professors to evaluate the instruments. To ensure validity and reliability, a pilot test was conducted with samples of representative respondents. Table 1 presents the construct definitions and sources. We conducted SEM using PLS estimations for data analysis because the PLS method has minimal sample size and residual distribution requirements model validation (Chin et al. 2003).

Construct	Definition	Reference
Perceived usefulness	The extent to which the physician believes that using a specific application increases his or her job performance.	Davis 1989
Perceived ease of use	The extent to which the physician believes that performing a behavior of interest is free of effort.	Davis 1989
Compatibility	The extent to which the physician believes the system is consistent with their existing values, previous experiences, and current needs.	Rogers 1995
Attitude	Physician's evaluation of the behavior of interest.	Taylor & Todd 1995b
Interpersonal influence	Perceived expectation from patients, peers, and supervisors for physician's performance of particular behaviors.	Taylor & Todd 1995b
Governmental influence	Perceived expectation from government institutions for physician's performance of particular behaviors.	Hsieh et al. 2008
Subjective norm	Perceived expectation from physician's key referents to perform the behavior of interest.	Ajzen 1991
Self-efficacy	The belief in physician's capabilities to execute the course of action required to perform particular behaviors.	Taylor & Todd 1995b
Facilitating conditions	The extent to which the physician reflects the available resources needed to perform particular behaviors.	Taylor & Todd 1995b
Perceived behavior control	Physician's perception of existing resources and opportunities to perform particular behaviors.	Ajzen 1991 Taylor & Todd 1995b
Situational normality	Physician's perception that success is likely because the situation is normal.	McKnight et al. 2002; Gefen et al. 2003
Structural assurance	Physician's perception that success is likely because of guarantees, regulations, legal recourse, or procedure.	McKnight et al. 2002; Gefen et al. 2003
Institutional trust	Physician's belief that favorable conditions are in place that are conducive to situational success.	McKnight & Chervany 2002
Usage intention	The extent to which physicians intend to use in EMR exchange.	Davis 1989

4.1   Sample and data collection

The target participants were physicians experienced with using the EMR exchange in Taiwan. Because the resources necessary to use this system differ among hospitals, we classified the medical institutions into three categories (i.e., medical centers, regional hospitals, and local hospitals) and four locations (i.e., north, central, south, and east) to for the sampling. Twelve medical institutions were successfully contacted to secure their collaboration. A total of 300 questionnaires were distributed through an administrator of the hospital, and 224 questionnaires were returned. We collected questionnaires from four medical centers, four regional hospitals, and four local hospitals; after discarding 39 incomplete questionnaires, 185 were available for analysis.

5   RESEARCH RESULTS

5.1   Respondent characteristics

The 185 valid responses constituted a response rate of 61.67%. Demographics for the physicians are presented in Table 1.Most of the questionnaire respondents were men (88.1%) between the ages of 31 and 40 years (33.5%). Approximately 77.3% of the respondents possessed more than 5 years of experience in the IS department, and 76.2% were attending physicians (Table 2).

Respondent characteristics		Frequency	Percent (%)
Gender	Male	163	88.1
	Female	22	11.9
Age	21-30	33	17.8
	31-40	62	33.5
	41-50	55	29.7
	51-60	24	13.0
	>61	11	5.9
Work experience	$\leqq 5$	42	22.7
	6-10	49	26.5
	11-15	33	17.8
	16-20	21	11.4
	>21	40	21.6
Position	Attending physician	141	76.2
	Chief resident	7	3.8
	Resident	25	13.5
	Intern	12	6..5

Table 2.   *Respondent demographics*

5.2   Reliability and validity analysis

Reliability and validity were assessed for the model. Reliability was assessed by adopting a construct reliability used by Chin (1998) that was greater than 0.80. Convergent validity was assessed by using three criteria: (a) item loading (λ) greater than 0.70, (b) a composite construct reliability greater than 0.80, and (c) average variance extracted (AVE) greater than 0.50 were considered statistically significant (Fornell & Larcker 1981). Discriminant validity between constructs was assessed by using the following criterion: The square root of AVE for each construct should be greater than the correlations with the other constructs (Fornell & Larcker 1981). In this study, the construct reliabilities were all greater than 0.90. Regarding the convergent validity, the item loadings were all greater than 0.70, and the AVE ranged from 0.75 to 0.96. For discriminant validity, the square root of the AVE for a construct should be greater than its correlations with other constructs. Descriptive statistics of the principal constructs are shown in Table 3, and the correlation matrix is presented in Table 4. These results indicated that the reliability, convergent validity, and discriminant validity were

at an acceptable level. Multiple regression analysis was conducted to assess the effects of 13 predictor variables on the usage intention for EMR exchange. None of the variance inflation factors (VIFs) were greater than 5, which indicated that a serious multicolinearity problem did not occur (Hair et al. 1992; Henseler & Fassott 2005).

Construct	Mean	Standard deviation	Loading	Construct reliability	Average variance extracted
Perceived usefulness (PU)	5.24~5.46	1.15~1.27	.91~.95	.96	.86
Perceived ease of use (PEOU)	3.99~4.31	1.26~1.41	.88~.94	.95	.82
Compatibility (CO)	4.77~4.96	1.25~1.36	.94~.96	.97	.90
Attitude (ATT)	5.51~5.65	1.08~1.23	.88~.96	.95	.86
Interpersonal influence (II)	4.32~4.62	1.22~1.29	.76~.93	.92	.75
Governmental influence (GI)	4.99~5.07	1.23~1.27	.97~.98	.99	.96
Subjective norm (SN)	4.69~4.95	1.21~1.33	.81~.93	.92	.79
Self-efficacy (SE)	4.06~4.74	1.25~1.49	.85~.93	.92	.80
Facilitating conditions (FC)	3.72~4.07	1.49~1.54	.87~.92	.93	.81
Perceived behavior control (PBC)	4.13~5.01	1.21~1.49	.86~.93	.93	.78
Situational normality (SIN)	4.23~4.38	1.17~1.22	.93~95	.96	.88
Structural assurance (SA)	3.58~3.91	1.37~1.52	.91~.94	.96	.86
Institutional trust (IT)	4.25~4.27	1.27~1.32	.94~.96	.95	.90
Usage intention (UI)	4.51~4.88	1.38~1.40	.93~.97	.97	.91

Table 3.   Descriptive statistics

Construct	PU	PEOU	CO	ATT	II	GI	SN	SE	FC	PBC	SIN	SA	IT	UI
PU	.93													
PEOU	.36	.90												
CO	.58	.48	.95											
ATT	.59	.33	.52	.93										
II	.48	.40	.52	.39	.87									
GI	.18	.21	.23	.26	.49	.98								
SN	.44	.36	.44	.29	.54	.59	.89							
SE	.45	.64	.54	.40	.46	.28	.39	.89						
FC	.32	.58	.37	.37	.40	.26	.31	.54	.90					
PBC	.38	.59	.52	.37	.47	.28	.42	.57	.53	.88				
SIN	.42	.58	.45	.34	.47	.33	.45	.62	.59	.57	.94			
SA	.47	.60	.42	.42	.42	.17	.28	.60	.58	.54	.58	.93		
IT	.56	.45	.52	.55	.41	.20	.33	.58	.56	.51	.57	.58	.95	
UI	.48	.51	.49	.50	.47	.48	.51	.50	.49	.47	.51	.48	.50	.95
Note: The shaded numbers in the diagonal row are square roots of the average variance extracted.														

Table 4.   Discriminant validity of constructs

5.3   Hypothesis testing

The structural model was used to examine the causal structure of the proposed model. The standardized PLS path coefficients and explained variances for the research model are presented in Fig.2. We found the path coefficients for the hypothesized relationships and the coefficients of determination (R^2) for the endogenous variables. The explanatory power of each principal construct is greater than 0.45, including usage intention ($R^2 = 0.50$), attitude ($R^2 = 0.54$), subjective norm ($R^2 = 0.51$), PBC ($R^2 = 0.60$), and institutional trust ($R^2 = 0.51$). The ratio of the perceived ease of use to perceived usefulness explained 13.3% of the variance. The statistical results of all path coefficients were positive and significant, except the path from the perceived ease of use to attitude. Of the 14 path coefficients, 13 were significant at the .001 significance level, and one coefficient (i.e., the path from perceived ease of use to attitude) was >.05, indicating that it was not significant. The results indicated that all hypotheses were supported, except for H1b. Thus, attitude, subjective norm, PBC, and institutional trust were significantly related to usage intentions. Perceived usefulness and

compatibility to attitude were also significant. Interpersonal and governmental influences were significant predictors of SN. Self-efficacy and facilitating conditions were significantly related to PBC. Situational normality and structural assurance were significantly related to institutional trust.
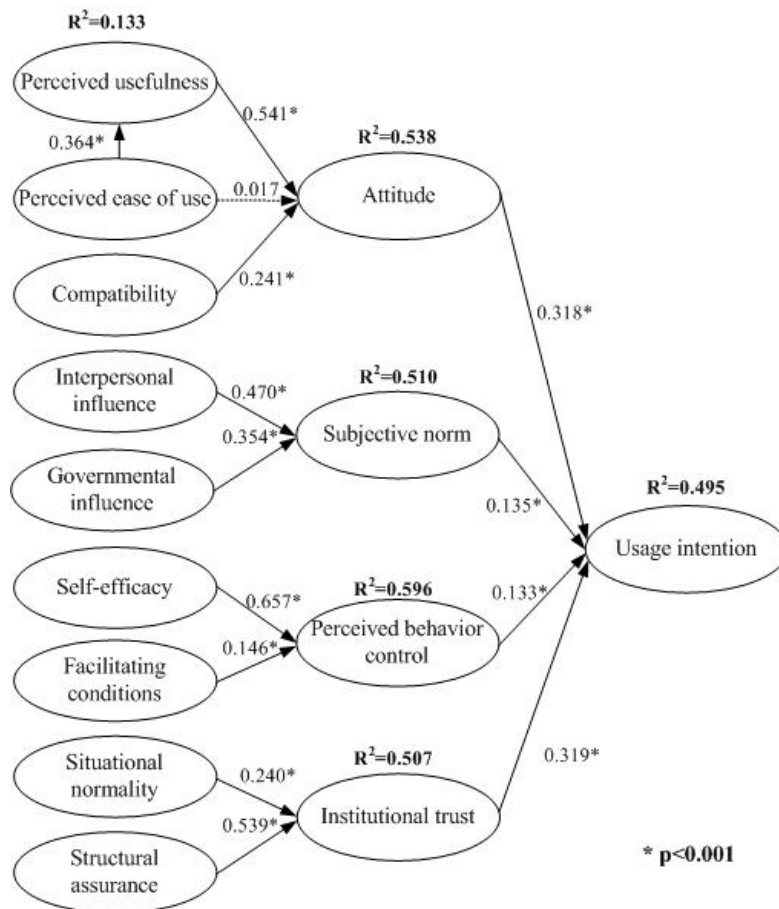

Figure 2.   Structural model results.

6   DISCUSSION

We explored how the variables affected physician intention to use the EMR exchange. Therefore, we extended the deconstructed TPB model by adding one belief construct (institutional trust) and its two antecedent variables (situational normality and structural assurance) to understand whether our proposed extended model is a better model. The study results indicated that the decomposed TPB model integrated with institutional trust provides a superior explanation of physician intentions toward using IS because the r-square of usage intention is 0.50. This implied that the decomposed TPB model integrated with institutional trust might be a robust research model for predicting physician usage intention toward information systems.

6.1   Deconstructed TPB and EMR exchange intention

The results indicated that attitude, subjective norm, and PBC are key determinants in physician usage intentions. These findings are consistent with the results obtained by Ryu et al. (2003) and Hung et al. (2011). The effects of these usage intention variables were significant in explaining physicians' EMR exchange behavior by conforming to Ajzen (1991), who maintained that the relative importance of attitude, subjective norm, and PBC in predicting usage intention varies across behaviors and situations. The results indicated that perceived usefulness and compatibility are important determinants of physician attitudes toward the EMR exchange. The perceived ease of use variable also has a positive direct effect on perceived usefulness, which was consistent with the findings of Hung et al. (2011).

However, perceived ease of use did not significantly affect usage intention. Because the EMR exchange has the potential to improve patient care quality by increasing care coordination and eliminating errors, physicians did not consider whether the system was easy to use.

Subjective norm was the most influential factor on the usage intention for the EMR exchange, but its effect was smaller than those of attitude or PBC. This finding was consistent those of Ryu et al.(2003) and Hung et al.(2011), but not with that of Chau and Hu (2001), who studied IT adoption in health care settings and claimed that the specialized training physicians under go in their highly autonomous profession does not have a significant effect on their adoption of IT or telemedicine. Interpersonal and governmental influences significantly affected the subjective norm. This finding was consistent with the results of Taylor and Todd (1995b), whose research decomposed the subjective norm into the influence of peers and superiors, and with the results obtained by Bhattacherjee (2000), whose research decomposed the subjective norm into interpersonal influence and external influence (i.e., governmental institutions). Regarding public health and insurance policies, most Taiwanese physicians experience tough institutional environments (i.e., patients, peers, superiors, and governmental requirements). Thus, although physicians are likely to develop independent evaluations, they also consider the opinions of peers, patients, superiors, and government institutions. Managers of government institutions and hospitals can employ the influence wielded by peers and insurance institutions to enhance physician intentions to use the EMR exchange for practicing clinical care.

The PBC of physicians was the most influential factor on usage intentions toward the EMR exchange. This result coincided with the findings of previous studies on IT adoption (Ryu et al. 2003; Hung et al. 2011), and suggests that physicians are likely to engage in EMR exchanges when they believe they have the ability to use the technology. Decomposition of PBC indicated that two significant factors affected physician perceptions of their own abilities to use the EMR exchange (i.e., self-efficacy and resource-facilitating conditions). A plausible explanation for the significant but moderate effect is that website operations might not be particularly complex, especially when considering the general competence of physicians, their learning capabilities, and nurse and technologist staff support.

6.2   Institutional trust and EMR exchange intention

Institutional trust significantly and directly impacted usage intentions toward the EMR exchange. This result coincided with the findings of previous studies on IT adoption (McKnight et al. 2002; Gefen et al. 2003). We found that structural assurances and situational normality had the greatest impact on institutional trust. An example of situational normality in the ERM exchange is that the employed communication infrastructure is perceived to be compliant with legal and regulatory mandates, and perceived common expectations are guaranteed. By conforming to normality, the EEC reassures physicians that the situation is orthodox. For structural assurance, similar to initial interactions, physicians might judge the EEC through perceived security, which refers to physician perceptions on the ability of the EEC to fulfil security requirements, such as authentication, integrity, and encryption. In addition, perceived privacy refers to physician perceptions on the ability of the EEC to protect the collected personal information of patients from unauthorized use or disclosure.

6.3   Practical implications

Our research has several implications. First, research examining the relationship between the deconstructed TPB model and institutional trust in a health care context has been scant. We provided theoretical insight to researchers, and might help them encourage physicians to use EMR exchanges. By examining its antecedents, we also identified institutional trust as a crucial factor of achieving usage intention. Without the role of institutional trust, the driving forces would not have a positive effect on usage intention of EMR exchanges. This finding is noteworthy and encouraging for researchers building an EMR exchange acceptance model. However, future studies could extend this model by considering additional variables, such as cultural differences and institutional mechanisms, which might be vital in determining the use of EMR exchange tools. Finally, we conceptualized the constructs of EMR exchanges and defined their underlying dimensionalities to develop a standardized instrument with desirable psychometric properties and measure the acceptance of EMR exchanges.

This reliable and valid instrument provides researches with a tool that effectively measures system success and explains, justifies, and compares differences among the results.

Our study findings provide useful recommendations for hospitals and managers wishing to enhance physician usage intentions regarding the EMR exchange. Because higher perceived levels of usefulness, ease of use, and compatibility encourage physicians to have a more positive attitude, the EMR exchange should be designed in a more user-friendly manner that is consistent with current needs. Physicians who are able to use the EMR exchange easily and find that it enables them to efficiently search for information will develop a better attitude toward it and increase their usage intentions. Hospital managers should focus on creating an environment in which physicians have a positive attitude, experience subjective norms, and receive sufficient resources to encourage their use of the EMR exchange. The EEC should focus on creating a secure and normal environment in which physicians have positive attitudes toward the EMR exchange. To increase EMR exchange acceptance, EEC managers must develop strategies to improve trust in the underlying technology.

7   LIMITATIONS AND CONCLUSION

Although this study produced useful results, it contains numerous limitations. First, the relevance of this study is confined to the EMR exchange behavior of one particular professional group: physicians. The findings and implications drawn from this study cannot be readily generalized to other groups, such as patients. A study targeting patients, who might have different information needs and different levels of computing support and abilities, could obtain different results. Second, we did not consider other factors, such as hospital task structures. Future research could focus on accumulating further empirical evidence and data to surmount the limitations of this study.

The main contribution of this study is that it is the first to explore physician EMR exchange behavior by using existing social psychology theories and the decomposed TPB model. The decomposition approach adopted for the model provides a more complete set of antecedents that better explain the intention to employ a specific technology (i.e., the EMR exchange), thereby enhancing the practical contributions of this study. We extended the model by incorporating institutional trust and examined its influence on physician intentions of adopting an IS. All main constructs, including the new construct (i.e., institutional trust), were found to have a significant effect on physician intentions to use the EMR exchange. The results indicated that the model provides a good understanding of the factors that influence the intention to use the EMR exchange. Decomposing the main beliefs revealed specific factors that influence behavior. We offered implications regarding medical practice and academic research that were based on our findings. We hope to encourage future researchers to (a) further examine the relative effectiveness of the existing, legally binding, and personal information protection act, (b) improve the effectiveness of EMR-exchange mechanisms, and (c) understand and promote the nature and role of IT-enabled institutional mechanisms to facilitate EMR-exchange relationships in the health care context.

References

Agarwal, R. and Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies? *Decision Sciences*, 30 (2), 361-391.

Ajzen, I. (1985). From intentions to actions: a theory of planned behaviour. In *Action-Control: From Cognition to Behavior* (Kuhl, J., and Beckmann, J. Ed.), p. 11-39, Heidelberg Germany: Springer.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, 50 (2), 179-211.

Bhattacherjee, A. (2000). Acceptance of e-commerce services: the case of electronic Brokerages. *IEEE Transactions on systems, Man, and Cybernetices - Part A: Systems and Humans*, 30 (4), 411-420.

Chang, M.K. (1998). Predicting unethical behavior: A comparison of the theory of reasoned action and the theory of planned behavior. *Journal of Business Ethics*, 17 (16), 1825-1834.

Chang, I.C., Hwang, H.G., Hung, W.F. and Li, Y.C. (2007). Physicians' acceptance of pharmacokinetics-based clinical decision support systems. *Expert Systems with Applications*, 33 (2), 296-303.

Chang, I.C., Hwang, H.G., Hung, M.C., Kuo, K.M. and Yen, D.C. (2009). Factors affecting cross-hospital exchange of Electronic Medical Records. *Information & Management*, 46 (2), 109-115.

Chau,P.Y.K. and Hu, P.J.H. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision Sciences*, 32 (4), 699-719.

Chau,P.Y.K. and Hu, P.J.H. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: an empirical test of competing theories. *Information & Management*, 39 (4), 297-311.

Chin, W.W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly*, 22(1), 7-16.

Chin, W.W., Marcolin, B.L. and Newsted, P.R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: results from a monte carlo simulation study and an electronic-mail emotion/adoption study. *Information Systems Research*, 14 (2), 189-217.

Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management information System Quality*, 13 (3), 319-340.

Egea, J.M.O. and González, M.V.R. (2011). Explaining physicians' acceptance of EHCR systems: An extension of TAM. *Computers in Human Behavior*, 27, 319-332.

Gefen, D., Karahanna E. and Straub D.W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 27 (1), 51-90.

Fishbein, M. and Ajzen, A.J. (1975). *Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading:Addison-Wesley, MA.

Fornell, C. and Larcker, D.F. (1981). Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 18 (3), 382-388.

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (1992). *Multivariate Data Analysis with Readings*. 3nd Edition. Macmillan, New York.

Avison, D.E. and Fitzgerald, G. (1995). *Information Systems Development: Methodologies, Techniques and Tools*. 2nd Edition. McGraw-Hill, London.

Hennington, A.H. and Janz, B.D. (2007). Information systems and healthcare XVI: Physician adoption of electronic medical records: applying the UTAUT model in a healthcare context. *Communications of the Association for Information Systems*, 19, 60-80.

Henseler, J. and Fassott, G. (2005). Testing moderating affects in PLS path models: An illustration of available procedures, 4th International Symposium on PLS and Ralted Method, Barceiona.

Hsieh, J.J.P., Rai, A. and Keil, M. (2008). Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged. *MIS Quarterly*, 32 (1), 97-126.

Hung, S.Y., Ku, Y.C. and Chien, J.C. (2011). Understanding physicians' acceptance of the Medline system for practicing evidence-based medicine: A decomposed TPB model. *International Journal of Medical Informatics*, 81 (2), 130-142.

Lin, H.F. (2007). Predicting consumer intentions to shop online: An empirical test of competing theories. *Electronic Commerce Research and Applications*, 6 (4), 433-442.

Lucas, H.C. and Spitler, V.K. (1999). Technology use and performance: A field study of broker workstations. *Decision Sciences*, 30, 291-311.

Mathieson, K. (1991). Predicting user intention: comparing the technology acceptance model with theory of planned behavior. *Information Systems Research*, 2 (3), 173-191.

McKnight, D.H. and Chervany, N. L. (2002). What trust means in e-commerce customer relationships: An interdisciplinary conceptual typology. *International Journal of Electronic Commerc*e, 6 (2), 35- 53.

McKnight, D.H., Choudhury, V. and Kacmar, C. (2002). Developing and validating trust measures for e-commerce: An integrative typology. *Information Systems Research*, 13 (3), 334-359.

Miller, R. H. and Sim, I. (2004). Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs*, 23 (2), 116-126.

Mohd, H. and Mohamad, S.M.S. (2005). Acceptance model of electronic medical record. *Journal of Advancing Information and Management Studies*, 2 (1), 75-92.

Moore, M.B. (1996). *The Acceptance of Information Technology by Health care Professionals*. ACM Digital Library.

Moores, T.T. (2012). Toward an integrated model of IT acceptance in healthcare. *Decision Support Systems*, 35 (3), 507-516.

Nicolaou, A.I. and McKnight, D.H. (2006). Perceived information quality in data exchanges: Effects of risk, trust, and intention to use. *Information Systems Research*, 17 (4), 332-351.

Pavlou, P. and Gefen, D. (2004). Building effective online marketplaces with institution-based trust. *Information Systems Research*, 15 (1), 37-59.

Rogers, E.M. (1995). *The Diffusion of Innovations*. 4 nd Edition. Free Press, New York.

Ryu, S., Ho, S.H. and Han, I. (2003). Knowledge sharing behavior of physicians in hospitals. *Expert Systems with Applications*, 25 (1), 113-122.

Shapiro, S.P. (1987). The social control of impersonal trust. *American Journal of Sociology*, 93 (3), 623-658.

Shapiro, J.S., Kannry, J., Kushniruk, A.W. and Kuperman, G. (2007). Emergency physicians' perceptions of health information exchange. *Journal of the American Medical Informatics Association*, 14 (6), 700-705.

Sheppard, B.H., Hartwick, J. and Warshaw, P.R. (1988).The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research*, 15 (3), 325-343.

Sykes T.A., Venkatesh V. and Rai A.J. (2011). Explaining physicians' use of EMR systems and performance in the shakedown phase. *American Medical Informatics Association*, 18 (2), 125-130.

Taylor, S. and Todd, P. (1995a). Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intention. *International Journal of Research in Marketing,* 12 (2), 137-155.

Taylor, S. and Todd, P.A. (1995b). Understanding information technology usage: A test of competing models, *Information Systems Research*, 6 (2), 144-176.

Tung, F.C., Chang, S.C. and Chou, C.M. (2008). An extension of trust and TAM model with IDT in the adoption of the electronic logistics information system in HIS in the medical industry. *International Journal of Medical Informatics*, 77 (5), 324-335.

Venkatesh, V. and Morris, M.G.C. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS Quarterly*, 24 (1), 115-137.

Venkatesh, V., Morris, M. G., Davis, G.B. and Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 (3), 425-478.

Yi, M.Y., Jackson, J.D., Park, J.S. and Probst, J.C. (2006). Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & Management*, 43 (3), 350-363.

Zucker, L.G. (1986). Production of trust: Institutional sources of economic structure. In *Organizational Behavior* (Staw B.M. and Cummings L.L. Ed.), p. 1840-1920. Vol.6. Greenwich, CT: JAI Press.