ISSN:2231-0711
www.ijcset.net

Comparison of Contemporary Technology Acceptance Models and Evaluation of the Best Fit for Health Industry Organizations.

Arshia Khan
Assistant Professor
The College of St. Scholastica
School of Business and Technology
Duluth, MN 55811
akhan@css.edu
Telephone: (218) 723 6714

John M. Woosley
Southeastern Louisiana University
Department of Marketing and Supply Chain Management
College of Business
Hammond, LA 70402
John.Woosley@selu.edu
Telephone: 985-549-3072
Fax: 985-549-5010

An elaborate literature review was conducted in the area of technology acceptance identifying seminal authors and their views. Several models were examined and three out of theses were chosen based on the popularity in the health care industry. The findings will be presented in this paper, organized in two sections. The first part starts with brief definitions of basic terminology, descriptions and categorization of technology acceptance models. The three most popular contemporary technology acceptance models- (a) Technology Acceptance Model (TAM), (b) Diffusion of Innovation Theory (DOI), and (c) the Unified Theory of Acceptance and Use of Technology (UTAUT) are introduced here to lay the groundwork before they are compared and contrasted, which in turn forms the foundation for the second section. The second part delves into the evaluation of these three contemporary technology acceptance models. Literature in the area of technology acceptance in health care was examined to find the model that best fits in the health care industry.

Contemporary technology acceptance model comparison

Information technology (IT) as defined by March, & Smith (1995) is the use of technology in the collection of information and its purposeful use. Practical reasoning and experimental knowledge is used in the development of technology for specific task requirements. The purpose of technology is to assist in human requirements. *Technology Adoption* is the implementation of the software and hardware technology in an organization to increase productivity, competitive advantage, improve processing speed and make information readily available (Davis, Bagozzi &Warshaw, 1989). In the health industry IT adoption is the implementation of Health Information Technology (HIT) in the form of hardware and software to improve the quality of healthcare, the health of the people, and the efficiency of providing health care by reducing errors (Blumenthal, 2009). The acceptance of technology leads to the use of technology (Amoako-Gyampah, & Salam, 2004; Venkatesh, 1999).

Venkatesh (2000) recognizes the benefits of technology utilization as enhancement of productivity and also acknowledges the undesirable consequences of a failure in the system leading to dissatisfaction and financial losses. Although the technology is advancing its utilization is lacking (Davis et al., 1989; Johansen & Swigart, 1996; Moore & Benbasat, 1991; Norman 1993; Venkatesh 2000; Wiener 1993).

Information Technology (IT) adoption and implementation is expensive and the success rate is low making it imperative to study the adoption of IT. In an attempt to understand the adoption of IT, academic researchers are in pursuit of the determinants of IT implementations. In the seventies research efforts were put into identifying factors that impact the integration of IT into business (Legris, Ingham, & Collerette, 2003) and in the mid-eighties the scientists have focused onto development and evaluation of models that could help predict the IT adoption (Chau, 1996; Cheney, Mann, & Amoroso, 1986; Legris et al., 2003). Several theories for technology acceptance exist (Amoako-Gyampah, & Salam, 2004; Chau, & Jen-Hwa Hu, 2002; Taylor, & Todd, 1995). The underlying concept in the technology acceptance is based on the diffusion and adoption of innovation perceptions of the individuals on their adoption behavior (Moore, & Benbasat, 1991; Rogers, 1995; Davis, 1986, 1989) and the pro-innovation biases.

(Downs & Mohr, 1976; Kimberly, 1981; Rogers, 1962, 1983; Rogers & Schoemaker, 1971; Van de Ven, 1986; Zaltman, Duncan, & Holbeck, 1973). The pro-innovation biases are assumptions that the innovative technologies will benefit organizations and individuals (Kimberly, 1981).

The concept of acceptance is split into two streams reinforcing the pro-innovation bias (Abrahamson, 1991; Jiang, & Chen, 2010). One steam is based on rationalization and maximization of the utility while the other stream is built on irrational behavior due to social pressure and mimicking behavior, known as the *task-technology fit* (Goodhue, 1995; Venkatesh, Morris, Davis, & Davis, 2003). Some of the existing theories adopt both of the above mentioned thought concepts. An alternative way of classifying the existing technology acceptance theories is based on the applicability to an organization versus an individual, also known as firm level and individual level (Jiang, & Chen, 2010). To understand the contemporary technology acceptance models, one must delve into the history of acceptance concept development (Davis, 86).

Brief history of technology acceptance model

Fishbein & Ajzen (1975) adduced the Theory of Reasoned Action (TRA) that proposes individual's attitude influences their behavioral intentions towards their behavior to adopt as well as the subjective norms. Ajzen (1991) further extended the TRA model by proposing the Theory of Planned Behavior (TPB). The TPB posits an additional factor- individual's perception of control behavior, suggesting the individual's attitude influences not only the behavioral intentions towards the behavior and the norms but also the individual's perception of control behavior. Davis (1986, 1989) applied the TRA to the information technology (IT) field proposing the Technology Acceptance Model (TAM). The TAM suggests the acceptance of technology is influenced by perceived ease of use, perceived usefulness and subjective norm or perceived satisfaction. Roger (1962) proposed the Innovation Diffusion Theory (IDT), which was modified by Benbasat (1991) stating the ease of use; relative advantage and image influence the individual's technology acceptance. Parasuraman (2000) proposed the Technology readiness Index (TRI) that posits that drivers such as optimism and innovativeness, and inhibitors such as discomfort and insecurity, co-act in an individual's readiness to accept technology. The drawback of these models is that only personal factors are included and no social factors are considered.

The models discussed so far fall under the category of rational choice, highlighting the conscious willingness to make decisions of commonsense (Jiang, & Chen, 2010). Jiang, & Chen (2010) evidenced the emphasis on the individual's choice, forcing these models to fall under the individual level acceptance model category leading to a scarcity of firm level technology acceptance models. Tornazky & Fleisher (1990) proposed the firm level technology acceptance theory- *Technological-Organizational-Environment* (TOE) framework. This model deals not only with technology acceptance but also other dynamics related to organization and environment. The individual level models are not as comprehensive as the TOE due to the additional organizational and environmental factors included in the TOE. This model has been implemented in the Open source system (Chau, 1997), Electronic Data Interchange (Kuan & Chau, 2001), tourism and hospitality (Wai Mun, 2009), electronic procurement systems (Soares-Aguiar & Palma-dos-Res, 2008), and Internet (Forman, 2005). Although the TOE has been used in several areas, it is not as popular as the TAM, DOI and the UTAUT (Forman, 2005).

Contemporary Technology Acceptance Models

Technology Acceptance Model (TAM)

Understanding the technology acceptance has been a priority for a couple of decades. Several models have been proposed and suggested but TAM has been the most popular of these (Chuttur, 2009; Gefen, & Straub, 2000; Taylor & Todd, 1995). Davis proposed TAM in 1986 in a doctoral thesis (Legris et al., 2003). Davis's (1986) intention was to investigate new and better measures to predict and explore the use of technology in the form of *perceived ease of use* and *perceived usefulness*. Researchers have implemented theories from social psychology into IT (Swanson, 1982). The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) was adapted to the field of Information Systems (IS) by Davis (1986) and called the Technology Acceptance Model. TRA is an established and highly cited theory for the understanding of human behavior. This theory posits that an individual's behavior intention (BI) to act on a behavior is dependant on the person's attitude (A) and subjective norm (SN) in reference to the behavior in question (Fishbein, & Ajzen, 1975; Davis et al., 1989).

$$BI = A + SN.$$

Thus the TRA explained and predicted the behavior of an individual. One of the main changes Davis (1986) made to the TRA was the elimination of the subjective norm due to the lack of understanding of the concept (Ajzen, 1991; Davis et al., 1989). Several studies indicated the importance of perceived ease of use and *perceived usefulness* in the prediction of system usage (Bandura, 1977; Schultz & Slevin, 1975; Robey, 1979; Brown, Massey, Montoya_Weiss, & Burkman, 2002).

When an individual intends to use or not to use a technology to the extent that the belief the technology will help the individual perform better at the job is labeled *perceived usefulness*. On the other hand although an individual believes a technology is useful, the individual also believes that the technology is too hard to learn and that the effort to learn it is greater than the job benefit, it is labeled as *perceived ease of use*. A system that is perceived to be useful is more likely to be used than a system that is not perceived to be useful. Similarly a system that is perceived to be easier to use is more likely

to be used than one that is perceived to be difficult to use (Davis, 1986; Gefen, & Straub, 1997, 2000; Legris et al., 2003). Researchers found *perceived usefulness* to have a significant impact on system use providing a theoretical basis for its inclusion in system usage (DeSanctis, 1983; Robey, 1979; Schultz & Slevin, 1975). Bandura (1982) conducted an extensive literature review on self-efficacy, which is very similar to *perceived ease of use* forming the theoretical basic for the inclusion of *ease of use* in the system usage. Based on these theoretical findings measurement scales for the fundamental determinants of *use* were developed, tested and validated with .98 for reliability for *perceived usefulness* and .94 for reliability for *perceived ease of use*. Davis (1986) found the perceived usefulness to have a greater correlation with system use than perceived ease of use. There are other models such as the DOI that are based on the concept of use (DeSanctis, 1983).

Diffusion of Innovation (DOI) Model

DOI has played a role in understanding the process of social and technical change (Katz, Levin, & Hamilton, 1963). Several business initiatives involving IT tend to fail. This failure can be due to inefficient implementation rather than the failure of the innovation itself (Robertson, Sorbello, & Unsworth, 2011). Robertson et al. (2011) found technology diffusion agencies to play an important role in the diffusion of innovation. Roger included triability; complexity, relative advantage; compatibility; and observability (Rogers, 1995). Katz et al. (1963) defined diffusion as the acceptability over a period of time, of a specific idea or process by individuals or organizations associated with some communication mechanism with a social entity, with a set of values. Researchers have found a tremendous growth in the innovation diffusion modeling in the last decades (Skiadas, & Skiadas, 2011). Researchers modeling diffusion of innovation study the patterns of the diffusion of the innovation over a period of time across a certain population (Fichman, & Kemerer, 1999). The diffusion of innovation theory assumes innovation being communicated through channels to specific group of potential adopters of technology over a period of time. Individuals possess varying degrees of potential for adoption and can be categorized as innovators, early adopters, early majority, late majority, and laggards based on the extent to which they adopt a technology (Rogers, 1995). These varying degrees of adopters can be plotted over a period of time to generate the S curve. Rogers (1995) based this model on compatibility, trialability, observabilty, relative advantage, and complexity. The DOI is a popular model and has been implemented in several fields. Another contemporary technology acceptance model is the UTAUT (Venkatesh et al., 2003).

Unified Theory of Acceptance of Technology (UTAUT) Model

Venkatesh et al. (2003) examined eight technology acceptance models and based on these examinations formulated a model that integrates and unifies the characteristics and elements of these models. This proposal is labeled the UTAUT Model. The theories that were integrated into the UTAUT are the Theory of reasoned action (TRA), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), Combination of TPB and TAM, Motivational Model, Personal Computer (PC) Utilization, Diffusion of Innovation (DOI), and the Social Cognitive Theory. As evident from Fig 1 the UTAUT integrates the common elements of these eight theories. The validation of the UTAUT was conducted to conclude a 70% variance in usage intention (Venkatesh et al. (2003).

Comparing TAM, DOI, and UTAUT

Several models for the technology acceptance have been proposed that include attitude, social and other control factors (Davis, 1986, 1989; Hartwick & Barki, 1994; Mathieson, 1991). Hu, Chau, Liu Sheng, & Yan Tam (1999) described the study of the acceptance of technology as one of the most mature areas of research in the field of contemporary IT. Most of these models have roots in sociology, psychology and IT (Venkatesh, 2000). The three contemporary models- TAM, DOI and the UTAUT will be compared and contrasted in the based on their origins, popularity, authors, categorization, theoretical backgrounds, variables, implementations and limitations.

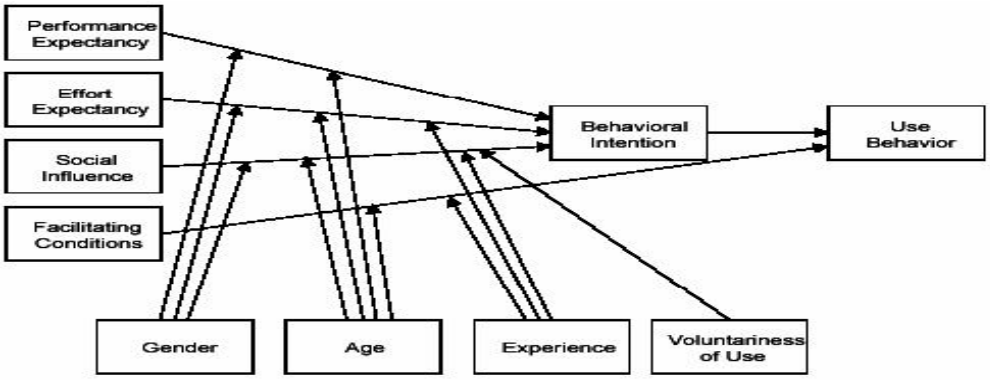

Fig 1. The UTAUT Model. Adapted from "User acceptance of information technology: Toward a unified view," by V. Venkatesh, M. G., Morris, G. B. Davis, & F. D. Davis, 2003, *MIS Quarterly*, *27*, p 454.

Authors and proposition of the models

The seminal author of the technology acceptance model is Davis (1986), while the seminal articles of the Diffusion of innovation theory are Lazarsfeld, Berelson, & Gaudet (1949); Rogers (1962); Rogers and Shoemaker (1971); Rogers (1995). The Unified Theory of Acceptance and Use of Technology was presented by Venkatesh et al. (2003). Each of these models is popular in the IT field (Taylor & Todd, 1995).

Popularity contest

Although the TAM, DOI and the UTAUT have been implemented in several studies, the TAM has been referenced and implemented to a larger extent (Chuttur, 2009; Gefen, & Straub, 2000; Taylor & Todd, 1995). The TAM is the most popular. Although the DOI has been implemented in areas other than IT, in the IT field it is the second most popular model (Lyytinen, & Damsgaard, 2001; Prescott & Conger 1995). The UTAUT is a fairly newer model and has the least number of implementations. The fields of origins of the TAM, DOI and the UTAUT have influenced their popularity (Prescott & Conger 1995).

The fields and areas of origins

The fields of origin for TAM are information systems and technology adoption (Davis, 1986). The fields of origin for the DOI are anthropology, education, sociology, communication and marketing (Katz et al., 1963; Dingfelder & Mandell, 2011; Bishop, Shumway, & Wandschneider, 2010; Katz et al., 1963). The UTAUT was developed in the information technology field. Although the TAM, DOI and the UTAUT have different fields of origin they can be categorized based on their application (Venkatesh et al., 2003).

Categorizing TAM, DOI and the UTAUT

DOI fits under the group, organization as well as the individual level (Katz et al., 1963; Roger, 1995), while TAM and UTAUT are an individual level adoption models. The TAM, DOI and UTAUT can also be categorized as belonging to the stream of thought that is based on intention of usage as the dependant variable, while the other stream of thought is based on *task-technology fit*. The categorization indicates an overlap of theoretical foundations in the TAM, DOI and the UTAUT (Goodhue, 1995; Venkatesh, et al. 2003).

Theoretical background- Factors and constructs involved.

The TAM is based on behavioral intention to use a system as the dependent factor, while perceived ease of use and perceived usefulness as the independent constructs (Davis, 1986). In the DOI implementation success or adoption of technology is the dependant factor, while compatibility of technology, complexity of technology, and relative advantage are the independent factors (Robertson et al., 2011). In the UTAUT the main dependant construct is the behavioral intention or the usage behavior, while the performance expectancy, effort, social influence, facilitating conditions, gender, age experience and voluntariness of use are the independent factors (Venkatesh et al., 2003).

The TAM is more basic and involves perceived ease of use, perceived usefulness as the main constructs of the theory and focuses mainly on behavioral attitudes, while DOI adds additional factors to the behavioral attitudes and includes the dimension of time. The overlap of the factors between the two theories is evident. Researchers consistently find that technical complexity (ease of use), technical compatibility, and relative advantage (perceived usefulness) play a significant role in the adoption of innovation (Bradford & Florin, 2003; Taylor, & Todd, 1995; Crum, Premkumar, & Ramamurthy, 1996; Tornatzky, & Fleischer, 1990). While TAM and UTAUT focus on behavioral attitude (Davis, 1986; Venkatesh, et al. 2003), the DOI (Rogers, 1995) focuses on longitudinal changes of diffusion rates and the sequence in which adoption occurs.

The TAM, DOI and the UTAUT all are based on the premise that adopters make rational, independent and technically savvy decisions. This thought process is dominant among the theories and forms the imperious bias in these proposals (Abrahamson, 1991; Rogers, 1962,1983). Writers have labeled the technology diffusion and adoption as “fad” or “fashion”. On one hand this can be a disadvantage by promoting the adoption of technologies that may not increase productivity and on the other hand this “fad” or “fashion” can promote innovativeness in businesses. Thus by presenting an image of innovativeness the organization can seek additional collaborations, attract customers and capital from potential stakeholders. From the theoretical foundations of the TAM, DOI and the UTAUT models it is evident that there is an overlap between their variables (Abrahamson, 1991, Nystrom & Starbuck, 1984).

Comparative analysis of variables involved in TAM, DOI and UTAUT

Performance Expectancy from the UTAUT, which can be defined as the extent to which an individual believes the technology will help improve job performance is the same as the perceived usefulness from the TAM and the relative advantage from the DOI. This variable is also the main predictor of intention in the three models (Davis et al. 1989, 1992; Moore & Benbasat, 1991; Venkatesh et al., 2003). *Effort Expectancy* can be defined as the extent to which the technology is perceived to be easy to use. The *ease of use* variable from the TAM and the DOI capture the essence of this construct (Davis et al. 1989; Moore & Benbasat, 1991; Venkatesh et al. 2003). *Social Influence* can be defined as- the extent to which an individual’s decision to use a technology is impacted by another individual. This variable is represented as the subjective norm and the image variable in the DOI. The TAM does not include subjective norm but the second version of the TAM does include this subjective norm. Each of the three models has been broadly implemented and has limitations (Davis et al., 1989; Moore & Benbasat, 1991; Venkatesh et al. 2003).

Implementations and Limitations

Literature corroborates TAM has been extensively used and implemented (Adams et al. 1992; Chin and Gopal, 1993;Chin and Todd 1995; Chau, 1996; Davis, 1993; Davis, & Venkatesh 1996; Gefen & Straub 1997; Hendrickson et al. 1993; Igbaria et al. 1997; Legris et al., 2003; Malhotra and Galletta, 1999; Mathieson 1991; Segars and Grover 1993; Subramanian, 1994; Taylor & Todd, 1995; Venkatesh 1999; Venkatesh and Davis 1996; Venkatesh et al., 2003). Although TAM is a remarkable model and has been cited over 700 times (Bagozzi, (2007) there are concerns related to this model. Legris et al. (2003) conducted an extensive meta-analysis of the existing literature on TAM and its applications and found several concerns. The first concern was that most of the studies validating the TAM involved students and there was lack of business environment in most of these studies. The second concern was that the types of applications studied were mostly introduction of office software or development applications rather than business applications. The last concern was the issue of self-reporting. TAM measures the variance in self-reported use, which is not necessarily precise (Davis, 1993; Subramanian, 1994). Another limitation of Tam is that the factors considered in the adaption of IT are also influenced by organization dynamics not included in TAM (Legris et al., 2003). Some researchers indicate a lack in rigor and relevance in TAM (Chutter, 2009; Gefen, & Straub, 1997, 2000), and inadequate implementation of social factor considerations have been identified by some others (McCarthy, Aronson, & Petrausch, 2004; Jiang, &Chen, 2010; Venkatesh et al., 2003). Studies show that TAM explains only about 40% of IT usage (Hu et al., 1999; Legris et al., 2003) and although TAM is a useful model it needs to be expanded to include social and human factors (Agarwal, & Prasad, 1997; Hu et al., 1999; Legris et al. 2003). The DOI on the other hand is a good predictor of social and technical change (Katz et al., 1963) and has been implemented in multiple fields besides IT, such as mental health and educations system (Dingfelder & Mandell, 2011); in environment issues of waste management and diary farms (Bishop et al., 2010); in sociology, anthropology (Katz et al., 1963). Researchers have consistently found that technical complexity, technical compatibility, and relative advantage play a significant role in the adoption of innovation (Bradford & Florin, 2003; Taylor, & Todd, 1995; Crum et al., 1996; Tornatzky, & Fleischer, 1990). Although the DOI has been extensively implemented, it has some limitations. The technology adoption can be influenced by other factors besides the five listed by Rogers (1995) (Moore & Benbasat, 1991). According to Wolfe (1994) DOI is based on the innovation characteristics and the social system surrounding it. Due to this the constructs are limited and any variations are restricted to the variables in the model. The limitation in variables indicates inadequate constructs in the adoption behavior. Another drawback is that the technology under consideration does not make a difference. In essence DOI requires reconsiderations (Lyytinen, & Damsgaard, 2001; Prescott & Conger 1995; Wolfe, 1994). Christensen, & Remler (2009) indicated the limitations of the TAM, DOI and the UTAUT have not impacted their usage in areas of sociology, psychology, economics, anthropology and IT but the field of health care is lagging behind in IT implementations although several incentives are being offered to promote Health Information Technology (HIT).

Incentives and Barriers to the implementation of IT in health care

According to Hamelburg (2009) HIT is vital in the management of patient care, introducing secure mechanisms for the sharing and handling of health information to improve patient care, reduce medical errors, reduce patient recovery time, reduce costs and provide better care. There is a strong vigor in encouraging IT adoption in the healthcare industry. Politicians, stakeholders and the government are encouraging IT implementation in healthcare by providing financial incentives (Christensen, & Remler, 2009; Holden, 2011; Mohd. & Mohamed, 2005). Lack of user acceptance has been observed to be one of the impediments in the health industry (Dillon & Morris, 1996). Other studies indicate lack of adoption is due to poor design of the application, inadequate use by clinicians, and socio-organizational factors such as lack of support from colleagues. Some social barriers present are user variance such as gender, education, age and user experience (Burton-Jones & Hubona, 2006; Kaplan, 2001; Yi, Wu & Tung, 2005). The seven barriers identified by Henninton and Janz (2007) are- (a) concern about financial return, (b) misalignment of IT application with the existing processes, (c) concern about quality of care, (d) effort requirements (e) cost issues, (f) clinician –employer relationship, and (g) time constraints.

Although the literature review conducted by Buntin, Burke, Hoaglin, and Blumenthal (2011) reported a 92% positive literature on the HIT implementation, Miller and West (2009) observed that the HIT usage was less prevalent in health care compared to other areas. As stated by Dente (2011) the eventual goal of the IT implementation is to capitalize on the cutting edge technology in safe and secure Health Insurance Portability and Accountability Act (HIPAA) compliant data sharing in real-time. The benefits of HIT implementation go beyond the traditional, reduction in medical error, reducing costs and improving patient care. The prosperity can be witnessed in cases from individual emergencies to national disasters, shrinking geographical boundaries, fostering information exchange and facilitating research and reporting at the very least. Several studies indicate that there is resistance in the technology usage by clinicians (Bhattacherjee, Hikmet, 2007). The attitude of the health care providers and their satisfaction can play an important role in the adoption of HIT. By understanding the attitudes and satisfaction of the physicians the adoption of HIT can be increased. The need for further

research in the adoption of IT by health care systems is evident in the literature (Bhattacherjee, Hikmet, 2007; Holden, 2011; Laerum et al., 2004).

Best fit for healthcare industry

A study conducted by Mohd. & Mohamed (2005) identified the factors affecting the IT implementation as the interface of the system, perceived usefulness, perceived ease of use and user behavior. Based on these factors all the three major models discussed here, namely the TAM, DOI and the UTAUT will fit well for the adoption of technology in healthcare. Another study conducted by Chau and Jen-Hwa Hu (2002) investigated the factors involved in IT adoption and the best-fit model for technology acceptance in health care. The authors studied the TAM and the TPB in the adoption of IT and found TAM to be a better fit in the adoption of IT in health care. The limitation of this study was that a particular type of IT application was used which may not be the same in other IT implementations.

The TAM and DOI fall under the category of rational choice, highlighting the conscious willingness to make decisions of commonsense (Jiang, & Chen, 2010). Abrahamson (1991) defined these types of models as rational thinking process path followed in a systematic manner based on perfect information, while House & Singh (1987) disagree with the systematic rational thought process and believe it often leads to abuse of practice. While Jiang, & Chen (2010) argue there is no such thing as perfect information and this notion can jeopardize the decision. Bandura (1977), Fadil, Smatt, Segrest, & Owen (2009) and Granovetter (1973) undermine the concept of rational thinking by suggesting that environmental factors play an important role in molding individual's likes and dislikes, influencing their choices consistent with their beliefs.

Ward, Stevens, Brentnall, & Briddon, (2008) conducted an extensive literature review of the literature on IT in healthcare with articles that were published between 2000 and 2005. The papers for the literature review were from 16 different countries. 52% of these were from the USA. The authors identified several factors that impact the adoption of IT in health care. The literature corroborated that the attitude of the practitioners, the efficiency of use (ease of use) of the system, usability, confidence, education and training played a major role in the adoption of IT in healthcare industry. The primary focus of the studies in the literature was on the attitude of the practitioners. The themes emerged from this literature review matched the UTAUT model. Some of these themes were attitudes, efficiency of use, and usability, which were covered in the TAM, DOI and the UTAUT. Another theme was the social aspect that was covered in the DOI and UTAUT eliminating the TAM and the DOI from the choice of technology acceptance models fit for health care (Ward et al., 2008).

Another factor that played a role in the selection of the UTAUT was the comprehensiveness of the model. The UTAUT incorporated the elements of eight of the most relevant technology acceptance models. This made it a comprehensive model for the technology adoption in health care (Venkatesh, et al., 2003). Tung, Chang, & Chou (2008) conducted a study to find a best-fit technology acceptance model in the health care industry. The factors that play a role in the acceptance of IT in healthcare were examined and the findings revealed that *compatibility, perceived ease of use, perceived usability*, and *trust* influence the *behavioral intention to use*, indicating that UTAUT is a better match for studying the adoption of IT in healthcare.

Another study conducted by Yen (2010) examined the existing literature on acceptance model in the health care industry. The study evaluated the barriers in the IT adoption and classified them as subjective and objective. The TAM and DOI are mainly subjective and include mostly subjective factors, whereas the UTAUT includes both subjective and objective factors as indicated in the Fig 2.

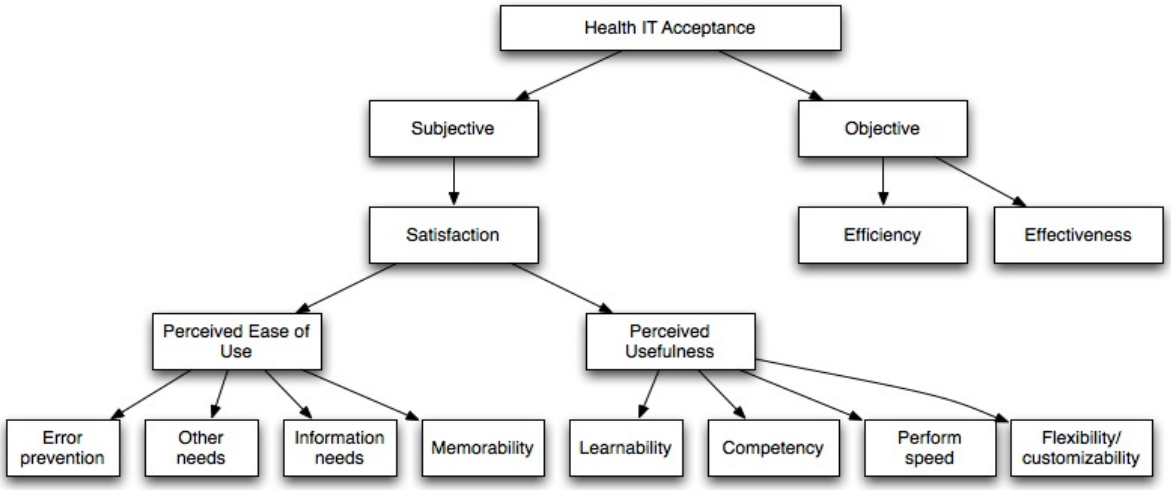

Fig 2. Health IT acceptance evaluation model. Adapted from "Health information technology usability evaluation: Methods, models, and measures," by P. Yen, 2010, *ProQuest Dissertations and Theses, p 89.*

Hennington, and Janz (2007) conducted a study to evaluate the physician adoption of IT in healthcare using the UTAUT model. By means of literature review they concluded that the UTAUT model is the best fit for studying the adoption of IT in health care industry. The reasons for the preference of UTAUT over other acceptance models according to Hennington and Janz (2007) are: (a) The TAM is self reporting and can introduce biases in the study, (b) TAM and DOI lack objective variables, (c) the UTAUT emphasizes contextual factors (d) all the barriers in the adoption of IT in healthcare, indicated in literature were captured only in UTAUT framework and not the TAM or the DOI (Hennington, & Janz, 2007).

Yarbrough, and Smith (2007) conducted a study evaluating the existing technology acceptance models and the barriers in the technology acceptance in health care, proposing the inadequacy of the TAM model and suggesting an enhanced model similar to the UTAUT. The study indicated the TAM supported partial acceptance factors but lacked the support of other factors that involved social, organizational and other external factors.

Based on the above literature it is evident that the UTAUT will provide a comprehensive statistically efficient model for technology acceptance in health care (Hennington, & Janz, 2007; Tung et al., 2008; Venkatesh, et al., 2003; Ward et al., 2008; Yen, 2010).

Summary

The goal of this paper is to articulate a comparative analysis of the popular contemporary technology acceptance models while evaluating the models with the intention to find the model with the highest potential to predict and understand technology acceptance in health care industry. The contemporary models discussed in this paper are TAM, DOI and UTAUT. The paper started with basic definitions of IT and technology acceptance, followed by a brief introduction to the history of technology acceptance concepts developments. The three contemporary acceptance models that are most widely used were introduced to lay the groundwork for the comparative analysis of the three models. The comparative analysis and limitation of the three models lead into the discussion of the best-fit model for health care along with supporting literature.

References

Abrahamson, E. (1991). Managerial fads and fashions. The diffusion and reflection of innovations. *Academy of Management Review*, *16*(3), 586-612. Doi:10.5465/AMR.1991.4279484

Adams, D. A., R. R. Nelson, P. A. Todd. (1992). Perceived usefulness, ease of use, and usage of information technology: Application. *MIS Quarterly*, *16*(2), 227–250.

Agarwal, R., & Prasad, J. (1997). The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Sciences 28* (3), 557–582.

Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the technology acceptance model in an ERP implementation environment. *Information & Management*, *41*(6), 731.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior & Human Decision Processes*, *50*(2), 179-211.

Bagozzi, R. P. (2007). The legacy of the technology Acceptance Model and a proposal for a paradigm shift. *Journal of the Association for Information Systems*, *5*(4), 244-254.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological review*, *84*(2), 191-215.

Bhattacherjee, A., & Hikmet, N. (2007). Physicians' resistance toward healthcare information technology: a theoretical model and empirical test. *European Journal of Information Systems*, *16*(6), 725-737.

Bishop, C. P., Shumway, C., & Wandschneider, P. R. (2010). Agent heterogeneity in adoption of anaerobic digestion technology: Integrating economic, diffusion, and behavioral innovation theories. *Land Economics*, *86*(3), 585-608.

Blumenthal, D. (2009). Stimulating the adoption of health information technology. *New England Journal of Medicine*, *360*, 1477-1479.

Bradford, M., & Florin, J. (2003). Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. *International Journal of Accounting Information Systems*, *4*(3), 205-225.

Brown, S. A., Massey, A. P., Montoya_Weiss, M. M., & Burkman, J. R. (2002). Do I really have to? User acceptance of mandated technology. *European Journal of Information Systems*, *11*, 283-295.

Buntin, M. B. Burke, M.F., Hoaglin, M. C., Blumenthal, D. (2011). The benefits of health information technology: A review of the recent literature shows predominantly positive results. *Health Affairs*, *30(*3*).*

Burton-Jones, A., & Hubona, G. S. (2006). The mediation of external variables in the technology acceptance model. *Information and Management*, *43*(6), 706-717.

Chau, P. Y. K. (1996). An empirical investigation on factors affecting the acceptance of CASE by systems developers, *Information and Management*, *30*, 269–280.

Chau, P. Y. K., & Tam, K. Y. (1997). Factors affecting the adoption of open system adoption: An exploratory study. *MIS Quarterly*, 21(1), 1-21.

Chau, P. Y. K., Jen-Hwa Hu, P. (2002). Investigating healthcare professionals' decisions to accept telemedicine technology: An empirical test of competing theories. *Information & Management 39*, 297–311.

Cheney, P. F., Mann, R. I., & Amoroso, D.L. (1986). Organizational factors affecting the success of end-user computing, *Journal of Management Information Systems 3* (1), 65–80.

Chin, W. W., & Gopal. A. (1993). An examination of the relative importance of four belief constructs on the GSS adoption decision: A comparison of four methods. *Proceedings 26th Hawaii International Conference System Sci.*, 548–557.

Chin, W. W., Todd, P.A. (1995). On the use, usefulness, and ease of use of structural equation modeling in MIS research: A note of caution. *MIS Quarterly*, *19*(2), 237–246.

Christensen, M., & Remler, D. (2009). Information and communications technology in U.S. health care: why is adoption so slow and is slower better?. *Journal of Health Politics, Policy & Law*, *34*(6), 1011-1034. Doi: 10.1215/03616878-2009-034

Chuttur, M. M. (2009). Overview of the Technology Acceptance Model: Origins, Developments and Future Directions. *Sprouts: Working Papers on Information Systems*, *9*(37).

Crum, M. R., Premkumar, G., & Ramamurthy, K. (1996). An assessment of motor carrier adoption, use, and satisfaction with EDI. *Transportation Journal*, *35*(4), 44-57.

Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. Doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology.

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

Davis, F. D. (1993). User acceptance of information technology: System characteristics, user perceptions and behavioral impacts. *International. J. Man-Machine Stud*, *38*(3), 475–487.

Davis F, Bagozzi R, Warshaw P. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science [serial online], 35*(8), 982-1003.

Davis, F. D. & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: Three experiments. *International J. Human-Computer Study, 45*(1), 19–45.

Dente, M. (2011). EHR benefits in action. *Health Management Technology, 32*(3), 32-32.

DeSanctis, G. (1983). Expectancy theory as an explanation of voluntary use of a decision support system. *Psychological Reports, 52*, 247-260.

Dillon, A., Morris, M. G. (1996). User acceptance of information technology: theories and models. *Annual Review of Information Science and Technology, 31*, 3-32.

Dingfelder, H. & Mandell D. (2011) Bridging the Research-to-Practice Gap in Autism Intervention: An Application of Diffusion of Innovation Theory. *Journal of Autism and Developmental Disorders*. *41*(5), 597-609

Downs, G. W., & Mohr, L. B. (1976). Conceptual issues in the study of innovations. *Administrative Science Quarterly, 21*, 700-714.

Fadil, P., Smatt, C., Segrest, S., & Owen, C. (2009). The moderating effects of technology on career success: can social networks shatter the glass ceiling? *Journal of International Technology and Information Management, 18*(3), 409-426.

Fichman, R. G., & Kemerer, C. F. (1999). The illusory diffusion of innovation: An examination of assimilation gaps. *Information Systems research. 10*(3), 255-275.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Forman, C. (2005). The corporate digital divide: determinants of Internet adoption. *Management Science, 51*(4), 641-654.

Gefen, D., & Straub, D. W. (1997). Gender differences in the perception and use of e-mail: An extension to the technology acceptance model. *MIS Quarterly, 21*(4), 389–400

Gefen, D. & Straub, D. (2000). The relative importance of perceived ease of use in IS adoption: A study of E-Commerce adoption. *Journal of the Association for Information Systems, 1*(8).

Goodhue, D.L. (1995). Understanding user evaluations of information systems. *Management Science, 41*(12). 1827-1844.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology, 78*(6), 1360-1380.

Hamelburg, M. (2009). EHR and HIT incentives in the American recovery and reinvestment act. *Intellectual Property & Technology Law Journal, 21*(6), 7-13. doi: 1769842331.

Hartwick, J. & Barki, H. (1994). Explaining the role of user participation in information system use. *Management Science, 40*(4), 440-465.

Hendrickson, A. R., Massey, P. D., Cronan, T. P. (1993). On the test retest reliability of perceived usefulness and perceived ease of use scales. *MIS Quarterly, 17*(2), 227–230.

Hennington, A. H., & 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 AIS, 19*, 60-80.

Holden, R. (2011). Beliefs about health information technology: An investigation of hospital physicians' beliefs about and experiences with using electronic medical records. Ph.D. dissertation, The University of Wisconsin - *Dissertations & Theses*: Full Text. (Publication No. AAT 3367820).

House, R. J., & Singh, J. V. (1987). Organizational behavior: some new directions for I/O psychology. *Annual Review of Psychology, 38*, 669-718.

Hu, P. J., Chau, P. Y. K., Liu Sheng, O. R., & Yan Tam, K. (1999). Examining the technology acceptance model using physician acceptance of telemedicine technology, *Journal of Management Information Systems, 16* (2), 91–112.

Igbaria, M. A., Zinatelli, N., Cragg, P., & Cavaye, A. L. M. (1997). Personal computing acceptance factors in small firms: A structural equation model. *MIS Quartertly, 21*(3), 279–305.

Jiang, Y. & Chen, D. (2010). Technological-Personal-Environment (TPE) framework: A conceptual model for technology acceptance at the individual level. *Proceedings. International Information Management Association*, Inc.

Johansen, R., R. Swigart. (1996). *Upsizing the individual in the downsized organization: Managing in the wake of reengineering, globalization, and overwhelming technological change*. Reading, MA: Addison-Wesley.

Kaplan, B. (2001). Evaluating informatics applications—some alternative approaches: theory, social interactionism, and call for methodological pluralism. *International Journal of Medical Informatics, 64*(1), 39-56.

Katz, E., Levin, M. L, & Hamilton, H. (1963). Traditions of research on the diffusion of innovation. *American Sociological review. 28*(2).

Kimberly, J. R. (1981). *Managerial innovation*. In P. C. Nystrom & W. H. Starbuck (Eds.), Handbook of organizational design, *1*, 84-104. New York: Oxford University Press.

Kuan, K., & Chau, P. (2001). A perception-based model for EHR adoption in small businesses using a technology-organization-environment framework. *Information & Management, 38*(8), 507-521.

Laerum, H., Karlsen, T. H., and Faxvaag, A. (2004). Use of and attitudes to a hospital information system by medical secretaries, nurses and physicians deprived of the paper-based medical record: A case report. *BMC Med. Inform. Decision. Making, 4*(18).

Lazarsfeld, P.F., Berelson, B. & Gaudet, H. (1949). *The people's choice: How the voter makes up his mind in a presidential campaign.* New York: Columbia University Press.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & Management, 40*(3), 191.

Lyytinen, K. K., & Damsgaard, J. J. (2001). What's wrong with the diffusion of innovation theory?. *International Federation for Information Processing – Publications – IFIP*, 173-190.

Malhotra, Y. & Galletta, D.F. (1999). Extending the technology acceptance model to account for social influence: theoretical bases and empirical validation. *Paper presented at 32nd Hawaii International Conference on System Sciences*, IEEE, Hawaii.

March, S. T., & Smith, G. F. (1995). Design and natural science research on information technology. *Decision Support Systems, 15*(4), 251-266.

Mathieson, K. (1991). Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior. *Inform. Systems Res, 2*(3), 173–191.

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

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perception of an information technology innovation. *Information Systems Research*, 2 (3). 192–223.

McCarthy, R. V., Aronson, J. E., & Petrausch, R. (2004). Building relationships that last: Integrating public relations into web design. *Journal of International Technology and Information Management, 13*(1), 1-12.

Miller, E. A. & West, D. M. (2009). Where's the revolution? Digital technology and health care in the Internet age. *Journal of Health Politics, Policy and Law, 34*(2). doi: 10.1215/03616878-2008-046

Norman, D. A. (1993). *Things that make us smart: Defending human attributes in the age of the machine*. Reading: Addison-Wesley.

Nystrom, P. C, & Starbuck, W. H. (1984). Organizational facades. *Academy of Management Proceedings*: 182-185.

Parasuraman, P. (2000). Technology readiness index (TRI): A multiple-item scale to measure readiness to embrace new technologies. *Journal of Service Research (JSR), 2*(4), 307-320.

Prescott, M.B. & Conger, S.A. (1995). Information technology innovations: A classification by IT locus of impact and research approach. *Database Advances, 26*(20), 20-41.

Robertson, J., Sorbello, T., & Unsworth, K. (2008). Innovation implementation: The role of technology diffusion agencies. *Journal of Technology Management & Innovation*, *3*(3), 1-10.

Robey, D. (1979). User attitudes and management information systems use. *Academy of Management Journal*, *22*(3), 527-528.

Rogers, E. M. (1962). *Diffusion of innovation*. New York: Free Press.

Rogers, E. M. (1983). *Diffusion of innovation* (2nd ed.). New York: Free Press.

Rogers, E.M. (1995). *The diffusion of innovation*. (4th ed.). Free Press, New York.

Rogers, E. M., & Schoemaker, F. F. (1971). *Communication of innovations: A cross-cultural approach.* New York: Free press.

Schultz, R. L. & Slevin, D. P. (1975). *Implementation and organizational validity: An empirical investigation. Implementing Operations Research/Management Science.* New York, NY: Elsevier.

Segars, A. H., V. Grover. (1993). Re-examining perceived ease of use and usefulness: A confirmatory factor analysis. *MIS Quarterly*, *17*(4), 517–525.

Skiadas, C. H., & Skiadas, C. (2011). Innovation diffusion modeling: The deterministic, stochastic and chaotic case. *Nonlinear Dynamics, Psychology, and Life Sciences*, *15*(2), 285-305.

Soares-Aguiar, A., & Palma-dos-Reis, A. (2008). Why do firms adopt e-procurement systems? using logistic regression to empirically test a conceptual model. *IEEE Transactions on Engineering Management*, *55*(1), 120-133.

Subramanian, G. H. (1994). A replication of perceived usefulness and perceived ease of use measurement. *Decision Sci., 25*(5/6), 863– 874.

Swanson, E. B. (1982). Measuring user attitudes in MIS research: A Review. *OMEGA, 10*, 157-165.

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

Tornatzky, L., & Fleischer, M. (1990). *The processes of technological innovation*. Lexington, MA: Lexington Books.

Tung, F. C., Chang, S. C., & 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.

Van de Ven, A. H. (1986). Central problems in the management of innovation. *Management Science*, *32*, 590-607.

Venkatesh, V. (1999). Creation of favorable user perceptions: Exploring the role of intrinsic motivation, *MIS Quarterly*, *23*(2), 239–260.

Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research, 11*(4), 342.

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

Wai Mun, L. (2009). Alternative models framing UK independent hoteliers' adoption of technology. *International Journal of Contemporary Hospitality Management*, *21*(5), 610-618.

Ward, R., Stevens, C., Brentnall, P., & Briddon, J. (2008). The attitudes of health care staff to information technology: a comprehensive review of the research literature. *Health Information And Libraries Journal*, 25(2), 81-97

Weiner, L. R. 1993. *Digital Woes: Why We Should Not Depend on Software*. Reading, MA: Addison-Wesley.

Wolf, R.A. (1994). Organizational innovation: review, critique and suggested research directions. *Journal of Management Studies*, *31*(3), 405-431.

Yarbrough, A. K., & Smith, T. B. (2007). Technology acceptance among physicians: A new take on TAM. *Medical Care Research and Review, 64*(6), 650-672.

Yen, P. (2010). *Health information technology usability evaluation: Methods, models, and measures.* Columbia University. *ProQuest Dissertations and Theses*, Retrieved from http://search.proquest.com

Yi, Y. D., Wu, Z., & Tung, L. L. (2005). How individual differences influence technology usage behavior? Toward an integrated framework. *Journal of Computer Information Systems*, *46*(2), 52-63.

Zaltman, G., Duncan, R., & Holbeck, J. (1973). Innovation and organizations. New York: Wiley.