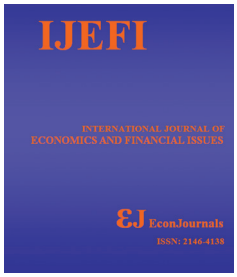

International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2015, 5(Special Issue) 172-182.

2nd AFAP INTERNATIONAL CONFERENCE ON ENTREPRENEURSHIP AND BUSINESS MANAGEMENT (AICEBM 2015), 10-11 January 2015, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia.

DeLone–McLean Information System Success Model Revisited: The Separation of Intention to Use - Use and the Integration of Technology Acceptance Models

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ABSTRACT

DeLone–Mclean model is an established and well-known information system (IS) model for assessing IS success. Based on some meta-analysis studies of DeLone–Mclean model, it is revealed that some relationships in the construct are not significant. As such, the construct validity is questionable and might lower the predicting power. A thorough literature review had been done to break down the underlying theoretical concept of DeLone–McLean model. Based on the literature review, several solutions are proposed including the separation between intention to use and use and the integration of technology acceptance models (TAMs) and unified theory of acceptance and use of technology (UTAUT). The integration of TAM and UTAUT into DeLone–McLean model is needed to provide proper antecedents for intention to use since TAMs has a stronger and sound theoretical background for predicting behavioral intention (BI). Further exploration into TAM and UTAUT literature has revealed that only perceived usefulness (PU), performance expectancy (PE), effort expectancy (EE), and social influence (SI) that significantly predict BI (intention to use). Based on these findings, PU, PE, EF and SI are integrated into DeLone–McLean model as the additional antecedents for intention to use.

Keywords: Information System Success, Delone–Mclean is Model, Technology Acceptance Models, Unified Theory of Acceptance and Use of Technology

JEL Classifications: M000

1. INTRODUCTION

In an information system (IS), the important indication of a success system, among other things, is system usage. This opinion is asserted strongly by (DeLone and McLean, 1992), (DeLone and McLean, 2003), and (Lyytinen and Hirschheim, 1987). Lyytinen and Hirschheim stated that a system that is not used (abandoned) by the users is considered having an interaction failure. Even though prolonged or heavy usage does not guarantee that the system is a success, but unused system does guarantee a failure. Before a user decides whether she/he will use the system, a psychological process happened in user mind whether which is intention. Predicting whether the system will be accepted (and used by users) is among the main subjects in IS research.

Several models for defining IS success have been introduced by some researchers, and DeLone–McLean model is the most prominent. It was build based on Shannon and Weaver's model of communication (Shannon, 1948) (Shannon and Weaver, 1949) and the extension by Mason (1978). DeLone–McLean took the idea of the model of communication to measure IS success based on the assumption that process in IS is similar to communication system. IS basically is a process of producing and conveying information and transmitting the information to the recipients. Shannon and

Weaver stated that the information transmission is considered success if it can overcome the three problems of communication, which are technical, semantic, and effectiveness problems. Technical problem arises when the communication system cannot deliver the information accurately and efficiently. Semantic problem concern whether the information that is transmitted by the system is understood by the recipients as is meant to be. The effectiveness problem arises when the information does not have the expected effect toward recipient's behavior. If those three problems fail to be handled properly, the result will be a failure of communication system.

Following Shannon and Weaver's postulates of three problems in communication system, DeLone–McLean (DeLone and McLean, 1992) built their framework upon three parts of instruments to measure IS success, which respectively are instruments for measuring technical success, semantic success, and effectiveness success. Technical success is measured through "system quality." "system quality" concern on the technical factors of the system, whether the system has the proper characteristic for producing good information. Semantic success is assessed through "information quality," and effectiveness success is measured through "use, user satisfaction, individual impact" and "organizational impact."

Based on the suggestions from some researchers, DeLone–McLean updated the model and several modifications had been made to accommodate the nature of IS changes (DeLone and McLean, 2003). The modifications include adding service quality based on service quality (SERVQUAL) (Parasuraman et al., 1988) for the antecedent of intention to use and user satisfaction; and the replacement of individual impact and organizational impact by net benefits. The last aforementioned modification is based on the view that "impact" could be positive or negative. Since IS success only concern about the positive impact, therefore net benefits is a more appropriate variable.

Since its inception, DeLone–McLean model had been tested and validated numerously. Some of those studies have shown the strong validity of the construct but some others have shown only partial validity (Petter et al., 2008), (Petter and McLean, 2009).

Therefore the goal of this paper is to evaluate DeLone–McLean Model based on some meta-analysis studies and find the least significant or weak supported relationships in the construct. Since DeLone–McLean model lacks of foundation theory for predicting intention to use, this paper proposed additional theory, expressed in the addtional variables, to provide a stronger supporting philosophical theory. In the end, the discussion concludes to build a more robust model of IS success based on the literature.

2. BEHAVIORAL INTENTION (BI) IN DELONE–MCLEAN MODEL

In the updated DeLone–McLean model (DeLone and McLean, 2003), BI is expressed by variable intention to use which is the antecedents for use. Intention to use is preceded by is information quality, system quality, service quality. The aforementioned three variables came from the technical aspect of IS while intention to use (BI) stems from psychological theory. Some studies have tried to tap the underlying cause of BI. Most of these studies are conducted in technology acceptance research, such as (Jackson et al., 1997), (Baker-eveleth and Stone, 2008), (Ceccucci et al., 2010), and (Lu et al., 2010). Table 1 shows some of the aforementioned studies. It is shown that besides affected by information quality, system quality, service quality, and user satisfaction, BI (intention to use) is also affected by several other variables including perceived usefulness (PU) and perceived easy to use. Both variables are commonly used and proven to be the antecedents for BI in technology acceptance research.

Even though DeLone–McLean (DeLone and McLean, 2003) suggested that system usage is the most appropriate variable for measuring the success of IS, nevertheless intention to use is also an important part of system success since psychologically a user will not use the system if he/she does not have an intention to use beforehand. The theoretical philosophy underlying this assumption is based on theory of reasoned action (TRA) (Fishbein and Ajzen, 1975). In the TRA, people intend to behave in certain way that will give benefits to them and raise the approval of others, especially the important others.

Table 1: Some studies on BI in IS

Study	Description of the study	Factors influencing BI
(Lu et al., 2010)	Investigating the factors affecting employee acceptance toward KMS in a company in Taiwan	PU, perceived ease of use, perceived information quality
(Jackson et al., 1997)	Validating an extended TAM model to test the factors affecting BI foe using information system	Situational involvement, attitude, intrinsic involvement
(Ceccucci et al., 2010)	Investigating what factors that affect BI toward text messaging	Attitude, compatibility, ease of use, satisfaction, and visibility
(Baker-eveleth and Stone, 2008)	Testing BI of 154 faculty members toward Digital Measures software	Ease of use, self-efficacy, outcome expectancy/usefulness
(Roca et al., 2006)	Investigating BI toward e-learning service	Satisfaction (which determined by PU, information quality, confirmation, service quality, system quality, perceived ease of use, and cognitive absorption)
(Fagan et al., 2008)	Studying the intention to use computers among first line managers in a mid-size company	Extrinsic motivation, perceived ease of use

TAM: Technology acceptance model, KMS: Knowledge management system, IS: Information system, BI: Behavioral intention, PU: Perceived usefulness

3. DELONE–MCLEAN MODEL: THE NEED FOR SEPARATION BETWEEN INTENTION TO USE AND USE

DeLone–McLean (DeLone and Mclean, 2002) and (DeLone and McLean, 2003) stated that the addition of intention to use into DeLone–McLean model is based on the premises that before a user use the system, their attitude shows the intention for using the system, while variable use itself is the behavior. After using the system, user will feel satisfy with the system (measure as "user satisfaction") and produce intention to use, then followed by actual use, and actual use will bring user satisfaction, and so on. But as shown in the DeLone–McLean model, intention to use and use is drawn connected to or stick to each other. It gives the sense that intention to use and use is alternation. The operationalization of the measurement will be difficult when the researcher does not know when to measure intention to use and when to measure the actual use. DeLone–McLean themselves admitted that measuring intention to use as an attitude is "notoriously difficult to measure" (DeLone and McLean, 2003). To get a clear picture on the internal validity of DeLone–McLean model, some meta-analysis studies that have been done for DeLone–McLean model were examined.

In a meta-analysis study of DeLone–McLean model (Petter et al., 2008), they found that some relationships in the DeLone–McLean model did not get a strong support at individual level. The summary of their findings is shown in Table 2. Petter et al. treated "intention to use" and "use" as a single variable of "system use" to avoid the complexity of the model. Besides, they argued that intention to use is only appropriate for individual level of analysis, while system use can be measured both at individual level and organizational level. Further, they stated that since intention to use involves subjective measurements, they suggest for avoiding such assessment in order to get an overall objective result. Table 2 shows that all relationships to "system use" are somewhat having a low support (at or below 50% of the studies), except the relationship between system use and user satisfaction which has moderate support. Petter et al. argue that the low support for the relationships to "system use" is caused by oversimplified of the context (ignoring the system setting, such as voluntary vs. mandatory) and poor measurements by researchers. To address the problem, they suggested another approach based on the technology acceptance point of view.

Table 2: The significance of relationships of DeLone-McLean model's variables at individual level (Petter et al., 2008)

Relationships	Overall results	Conclusion
Information quality - system use (use)	3 of 6 studies found a positive association	Mixed support (50%)
Information quality - user satisfaction	15 of 16 positive	Strong support
System quality - system use (use)	9 of 21 found positive association	Mixed support (<50%)
System quality - user satisfaction	21 of 21 positive	Strong support
Service quality - system use (use)	0 of 3 positive (due to insufficient data)	Insufficient data
Service quality - user satisfaction	6 of 12 positive	Mixed support (50%)
System use (use) - user satisfaction	4 of 5 positive	Strong support
User satisfaction - system use (use)	17 of 21 positive	Moderate support (about 75%)
System use (use) - net benefits	16 of 22 positive	Moderate support (about 75%)
User satisfaction - net benefits	14 of 14 positive	Strong support
Net benefits - system use (use)	15 of 21 positive	Moderate support (about 75%)
Net benefits - user satisfaction	11 of 11 positive	Strong support

Putting the result from Table 2 into Figure 1 will create Figure 2. In that diagram, the dash arrows show.

Note: The relationships that do not exist in the Figure 1 are omitted the low supported relationships, and the solid arrows show the strong supported relationships. The original version Figure 2 can be found in (Petter et al., 2008) pp. 255. As shown in the paper, there are some additional relationships proposed by other researchers as they used DeLone–McLean model in their studies. Those additional relationships are between information quality and net benefits, system quality and net benefits, and service quality and net benefits. Those additional relationships are arguable since net benefits will not be achieved either by individuals, organizations, or even society if the system is not being used. Therefore, even though the studies above showed the strong supported for the a priori relationships, however, this paper will omit them since it does not have a strong logical foundation.

Figure 1: The updated Delone–Mclean information system success model (Delone and McLean, 2003)

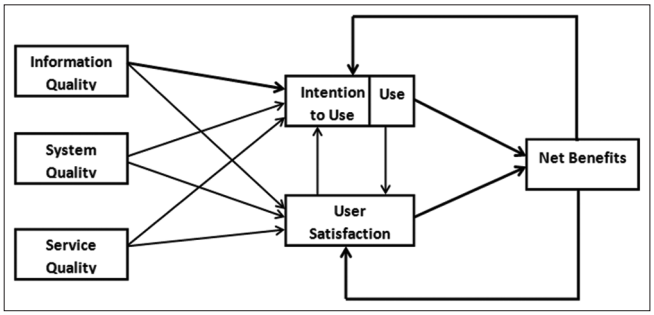
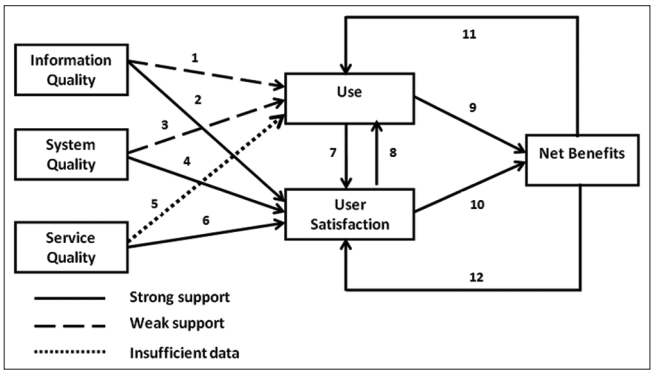


Figure 2: The results of DeLone–McLean model's relationships based on the result from (Petter et al., 2008)'s study



Using the same data set that had been used in (Petter et al., 2008) study, Petter and McLean ran another meta-analysis study (Petter and McLean, 2009). This time they kept the "intention to use" separately instead of con-join it with "use" as in the previous study. It is quite surprising that the analysis shows strong support for all relationships between "intention to use" to success variables, except for service quality since apparently only one study tested the relationship and did not give any result. This result is contradicted with the presumption argument in the previous study in (Petter et al., 2008) that use is more appropriate moderator variable between the three variables on the left side of DeLone–McLean model (which are information quality, system quality and service quality) to the variable on the right end, which is net benefits. On this result, Petter and McLean (Petter and McLean, 2009) argued that people tend to overestimate their future use, therefore they will give positive notion to intention to use. Further, they argue that individuals who vote for having intention to use in the survey might not use it at all in the future. The result of meta-analysis study (Petter and McLean, 2009) is shown in Table 3.

The result shown in Table 3 is a little bit different compared to the original result in the (Petter and McLean, 2009)'s paper. The variables in Table 3 have been separated into two dichotomy groups which are "strong support" and "weak supports." Weak support is meant for "moderate" or "not significant" result. The reasons for dichotomy are, first, to avoid complexity in the diagram, and second, to make it easier for comparison. Figure 3 is the mapping of Table 3 into DeLone–McLean model of Figure 1. The solid arrows represent the "strong supports," while the dash arrows show the "weak supports." The relation between use - individual impact is being substituted with use - net benefits since in the updated DeLone–McLean model, the positive impacts (both individual and organizational) is replaced by net benefits.

In Figure 3 it can be seen that the relationships from three variables on the left side of the model (information quality, system quality, and service quality) to use did not get strong support from previous studies. On the other hand the relationships between information quality - intention to use and system quality to intention to use, are having strong support from previous studies. it is clear that there is a need for separation between intention to use and use, as it is common in technology acceptance research. With this separation, this paper proposes the modification of Figure 1 to become Figure 4. In Figure 4, the antecedent of use is only intention to use. use will trigger user satisfaction, and continuous user satisfaction will derive intention to use continuously.

Table 3: The result of meta-analysis study (Petter and McLean, 2009) and is divided into two groups of "strong support" and "weak support"

Relationship	Position
Information quality - use	Weak support
Information quality - intention to use	Strong support
Information quality - user satisfaction	Strong support
System quality - intention to use	Strong support
System quality - use	Weak support
System quality - user satisfaction	Strong support
Service quality - intention to use	Not tested
Service quality - use	Weak support
Service quality - user satisfaction	Weak support
User satisfaction - intention to use	Strong support
Use - user satisfaction	Weak support
Net benefits - intention to use	Weak support
Use - individual impact (net benefits)	Weak support
User satisfaction - net benefits	Strong support

4. THE NEED FOR MORE SUPPORTING THEORIES FOR PREDICITING INTENTION TO USE

As has been discussed previously, DeLone–McLean model is derived from three basic theories which are the theory of communication (Shannon, 1948) and (Shannon and Weaver, 1949), the extension of theory of communication (Mason, 1978), and SERVQUAL (Parasuraman et al., 1988). In the DeLone–McLean updated model (DeLone and McLean, 2003), there is additional dimension which is "intention to use" which has a different psychometric philosophy than other dimensions in the model. Even DeLone–Mclean themselves stated that the relationship between intention to use and actual use is "notoriously difficult to measure" (DeLone and McLean, 2003).

To overcome the measurement barrier, more supporting theories is needed. Additional goal is to enrich the background theories of DeLone–McLean model. The proper theory for predicting intention to use or BI is the theory of reason actioned that is known as the background theory for technology acceptance models (TAMs). The TRA is stemmed from BI concept introduced by

Figure 3: The representation of Table 3 from (Petter and McLean, 2009)'s study

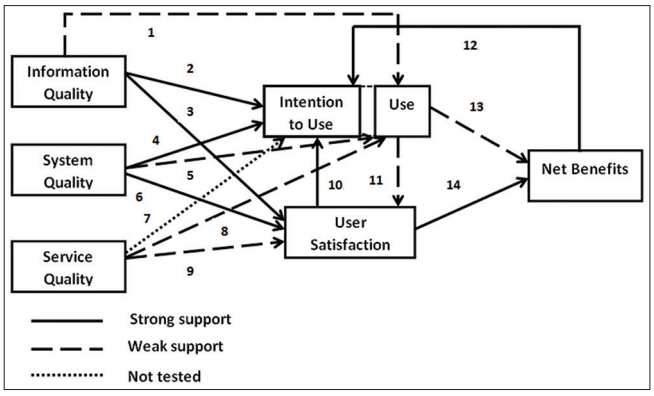
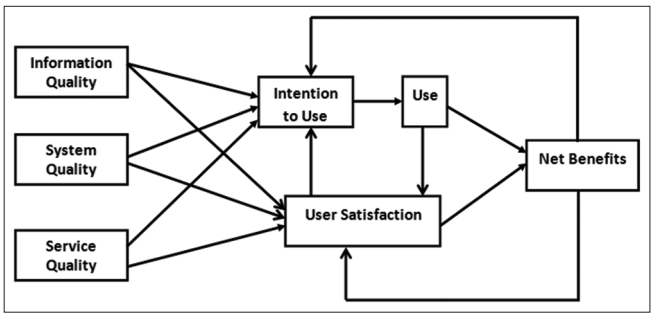


Figure 4: The separation of Intention to Use and Use of DeLone–McLean model



Fishbein and Ajzen (1975). In their theory, Fishbein and Ajzen asserted that certain behavior can be predicted by the intention for doing the behavior in question. In the theory of IS success, the behavior in question is actual system use (use). The intention to use then can be translated as the willingness of user to use the system. With this addition, the framework for assessing IS success is expected to have stronger underlying philosophical theories. The technology acceptance frameworks that will be added into DeLone–McLean are TAM and unified theory of acceptance and use of technology (UTAUT). Figure 5 is the result of DeLone–McLean diagram with the addition of TAM and UTAUT.

5. TAM AND UTAUT AT A GLANCE

TAM was introduced originally by Davis in 1986 in his dissertation and has been going into several evolution since then (Chuttur, 2009). The widely accepted TAM model is shown in Figure 6.

Numerous studies have been conducted to validate TAM and have confirmed the relationship between BI and actual system use (Yousafzai et al., 2007a). In a TAM meta-analysis study, (Turner et al., 2010) revealed that BI is a good predictor for actual system use in both subjective and objective measurement. Subjective measurement is taken from self-reporting questionnaire, while objective measurement is conducted by looking at the system log. TAM is an established TAM and has been tested and validated numerous times. Benbasat and Barki, (2007) mentioned TAM as "one of the most influential theories in IS." As shown in Table 4, TAM has the highest number of citation compared to other TAMs.

Conceptually, UTAUT is an extension of TAM (Figure 7). While TAM is designated for general (and mostly volitional) use of computer or technology, UTAUT is designated for mandatory use (Venkatesh et al., 2003). Technology use in mandatory environment aims at supporting the users in doing their work in organization to increase work performance. A user who uses a technology in the workplace will expect that the usage will increase his/her job performance. Performance expectation is a variable in UTAUT that aims to capture the extent to which a person believes that the technology will increase his/her job performance (Chan et al., 2010).

Since UTAUT is designated for mandatory use of IS or technology, therefore numerous studies in e-government or IS in organizational setting had employed UTAUT, such as (Chan et al., 2010),

Figure 5: DeLone–McLean model with technology acceptance model and unified theory of acceptance and use of technology integration

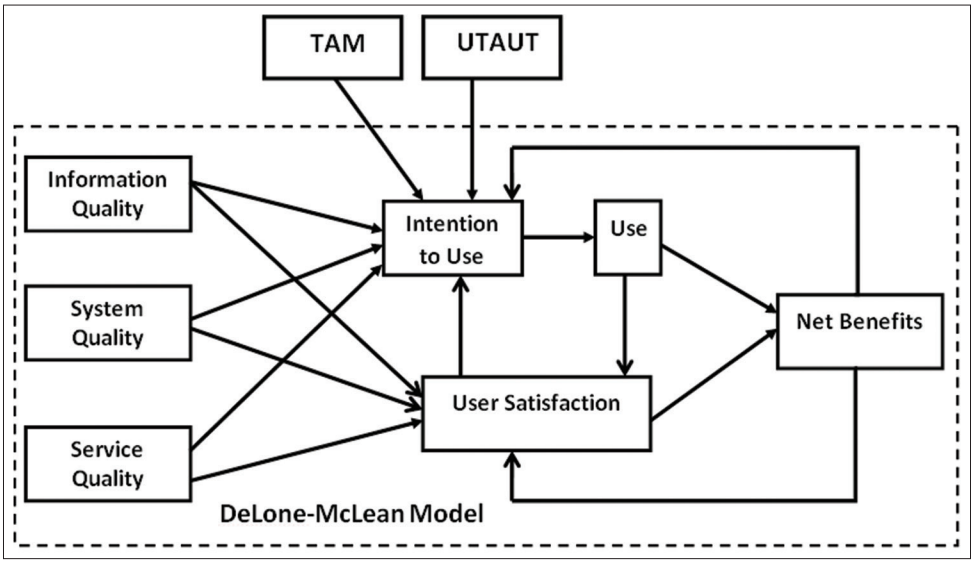
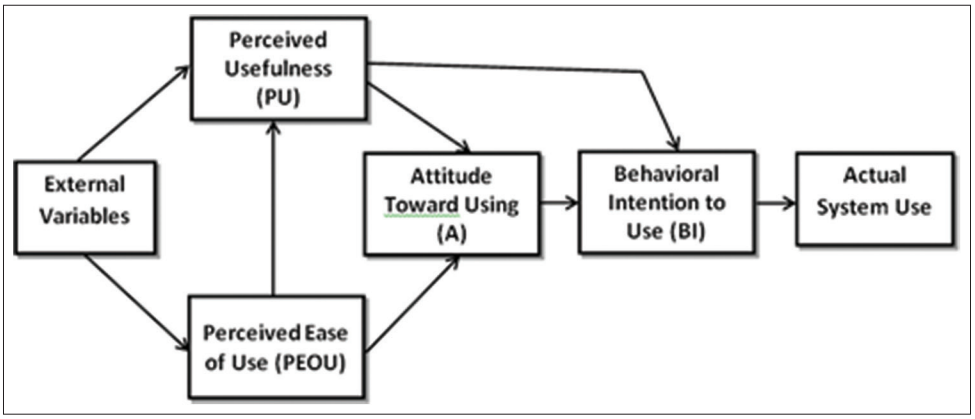


Figure 6: Technology acceptance model

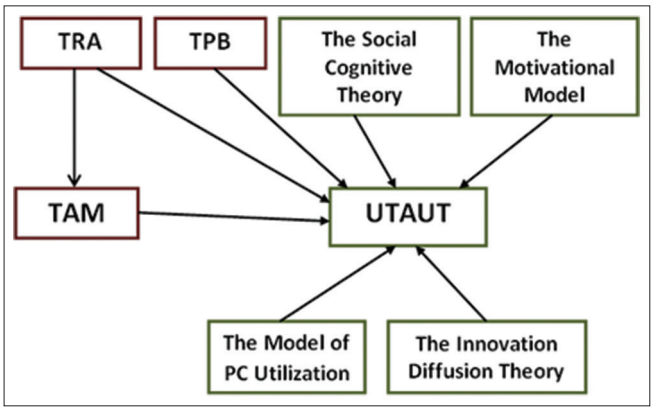


(Alawadhi and Morris, 2009), and (Al-gahtani et al., 2007). However, some researchers have gone beyond mandatory setting in using UTAUT, such as the study of online stocking (Wang, 2005), cross-cultural study of human-computer interaction tools (Oshlyansky et al., 2007), and mobile technologies (Park et al., 2007).

The next question is why TAM and UTAUT. In the IS/information technology discipline, there are several prominent measurement frameworks that are widely used for assessing BI, such as TAM, UTAUT, TAM 2, TAM 3, and UTAUT 2. The criteria for choosing the suitable technology acceptance framework are (1) the availability of variable(s) in the framework which in the past studies have shown to be the best predictor for BI, (2) the number of citation (assuming that more citation means more validation), and (3) the fecundity from the virtues of a good theory by Wacker, (1998). Fecundity is the extent to which a theory is fertile "for generating a new model and hypotheses" (17 pp. 5). Since all of the technology acceptance frameworks contain the variable(s) in question, therefore the criteria number 1 will be set aside (further process for choosing the variable(s) will be discussed in the next section). Table 4 shows the summary of citation and fecundity of the aforementioned theories.

There are some assumptions for choosing the technology acceptance framework. First, more citation means that the probability for the framework has been used, tested, or validated is relatively high, thus the framework is quite robust. Second, if the fecundity is quite high (the framework has been used as a base for developing several new theories), then the theory is a robust theory. Based on Table 4, TAM has the highest citation and the most fecundity. Therefore TAM is the technology acceptance to be integrated into the DeLone–McLean model. UTAUT is chosen based several reasons that will be discussed in the following sections.

Figure 7: The background theories of technology acceptance model and unified theory of acceptance and use of technology



But (Bagozzi, 2007) stated that TAM has a limitation on recognizing the effect of group, cultural and social aspects of technology acceptance. Especially in an organizational environment, more often than not, people rely on their peer group to make work-related decision. Therefore there is a need to include social aspect that is neglected in TAM. In this case, UTAUT is the suitable choice based on three reasons: (1) It has social influence (SI) variable (to capture the influence of important others as the essence of the TRA), (2) it is a quite good theory as has been shown in Table 4, and (3) it is suitable for mandatory environment since most IS in organization is mandatory in nature (Brown et al., 2002). Further, in a meta-analysis study for UTAUT, Dwivedi et al., (2011) stated that in empirical research of technology acceptance, TAM is the most theory being used in integration with UTAUT. The comparison of technology acceptance frameworks is given on the Figure 11. Another reason for choosing UTAUT alongside with TAM is because UTAUT has a better prediction power toward BI - about 70% (Venkatesh et al., 2012), while TAM predicts 40% of variance in BI (Venkatesh and Davis, 2000).

In a paper that discussed the limitations of TAM, Straub and Burton-Jones (2007) criticized that TAM's mission is to assess "acceptance," while acceptance itself did not clearly defined. In TAM construct, the very end of the model is "actual system use." That gives notion that a user accepts a technology if he/she uses it. But in certain context where the use is mandatory, the technology has to be used regardless the acceptance from the user. About this matter, several years earlier, DeLone anf McLean (2003) have argued that even in mandatory setting, users have a certain degree of freedom to refuse the technology being introduced. In such situation, management has the choice to continue the project or to terminate it.

As TAM suggested, the data for actual system use usually are collected through self-reporting system. But Burton-jones and

Table 4: Prominent technology acceptance theories

Theory/framework for predicting BI	Number of citation	Theory that is built using the aforementioned theory (to show the level of fecundity)
TAM (Davis, 1989)	18932	Wixom and Todd information system model (Wixom and Todd, 2005), TAM 2 (Venkatesh and Davis, 2000), TAM 3 (Venkatesh and Bala, 2008), UTAUT (Venkatesh et al., 2003), UTAUT 2 (Venkatesh et al., 2012), and numerous extension and integration with other theories, such as (Moon and Kim, 2001) and (Amoako-Gyampah and Salam, 2004)
TAM2 (Venkatesh and Davis, 2000)	6350	TAM3 in the only theory built using TAM2. Other frameworks/models using TAM2 is an extension of it
TAM3 (Venkatesh and Bala, 2008)	822	No new prominent theory is built using this theory
UTAUT (Venkatesh et al., 2003)	8371	UTAUT2 is the extending theory that is built using UTAUT. Other frameworks/models using UTAUT is an extension of it
UTAUT2 (Venkatesh et al., 2012)	285	No new prominent theory is built using this theory

TAM: Technology acceptance model, UTAUT: Unified theory of acceptance and use of technology

Straub (2006) suggested that looking through system logs can give a better usage measurement. However, operationalization of this idea is somewhat difficult since the nature of collecting the data is anonymous. Therefore, tapping the usage can only be done through organizational level where usage of the system is aggregated.

6. DISSEMINATION OF VARIABLE(S) FROM TAM AND UTAUT THAT PREDICT INTENTION TO USE

As some studies have shown, not all variables in TAM and UTAUT are good predictors for BI. As such, taking all variables from TAM and UTAUT will be against the initial goal to strengthen the predicting power for intention to use. It will also be against the principle of parsimony to include all of the variables in both models (TAM and UTAUT) to predict intention to use. As stated in (Wacker, 1998) and (Whetten, 1989) that one of the characteristics of a good theory is parsimony. Parsimony refers to the extent to which a theory is simple and has a fewer assumption. The simpler a theory is the better. Therefore, the next step is defining which variable(s) from TAM and UTAUT that are actually the best antecedents for BI. To address the question, six TAM meta-analysis studies were summarized and shown in Table 5.

The meta-analysis studies shown in Table 5 are the studies that had been done between 2003 and 2010 and are showing only the relationships which have correlations with BI since BI in TAMs is the reflection of intention to use in DeLone–McLean model. "Strong support" can be translated into significant relationship. The table shows that only relationship between perceive usefulness (PU) and BI (PU-BI) that get strong support in all of six meta-analysis studies (only in one meta-analysis study gave medium support). That means in all six studies, PU is proven to be the best predictor for BI. This result is supported by some researchers, such as (Venkatesh and Davis, 2000) and (Sun and Zhang, 2006), who mentioned that empirical studies have shown that PU proven to be the strong predictor for BI.

Weak support: <50% of studies.

With three strong supports and one medium support, actually perceived ease of use (PEOU) can be considered as a relatively good predictor for BI. But perceived ease of use is similar to effort expectancy (EE), a variable in the UTAUT model that represents the extent to which a user will find that learning to use the system is easy. In the UTAUT questionnaire (Spil and Schuring, 2006), EE includes perceived ease of use measurement. Similar case also applies to attitude. In Table 5, it is shown that attitude, as an antecedent for BI, is strongly support by three studies, and one study gave medium support. As such, attitude is pretty much a good predictor for BI. But this result is contradicting with (Venkatesh et al., 2003) suggestion that for mandatory setting, attitude should not be included in the model since measurement for attitude has been included in the EE and performance expectancy (PE). EE and PE are variables from UTAUT that latter in this paper found to be good predictors for BI. Mapping Table 5 into Figure 6 will result in Figure 8, where bold arrow represents the significant relationships between PU and BI.

Similar method is being used for disseminating variables form UTAUT. Two UTAUT meta-analysis studies are shown in Table 6. Table 6 shows the relationship between PE, EE, and SI and BI (BI). From the table, it can be concluded that the three variables (PE, EE, and SI) are good predictors for BI. The mapping of Table 6 into Figure 9 gives Figure 10 where bold arrows represent significant relationships.

PE is the extent to which a person believes that using a certain technology or IS will improve his/her job performance. EE is the degree of ease for an individual for using certain technology or system. In a study for investigating smart cards adoption as part of e-government system in Hongkong using a modified UTAUT model, (Chan et al., 2010) stated that PE and EE are among the important variables for evaluating system in mandatory environment. Both variables play the role to "encourage positive attitudes toward and user satisfaction with system use by enhancing efficiency and minimizing effort in using the technology."

SI is defined as the extent to which the user believes that important others believe he or she should use the system (Van Schaik, 2009).

Table 5: Number of studies that report positive relations between TAM's variables (PEOU, PU, and A) and BI

TAM meta-analysis study	PEOU-BI	PU-BI	A-BI
Legris et al., 2003	Strong support	Strong support	Strong support
King and He, 2006	Weak support	Strong support	N/A
Schepers and Wetzels, 2007	Strong support	Strong support	Strong support
Yousafzai et al., 2007b	Weak support	Medium support	Medium support
Turner et al., 2010	Strong support	Strong support	N/A
Holden and Karsh, 2010	Medium support	Strong support	Strong support

PEOU: Perceived Ease of Use, PU: Perceived Usefulness, A: Attitude, BI: Behavioral Intention. Strong support: More than 50% of studies support the positive relationship between variables. Medium support: 50% of studies, TAM: Technology acceptance model, PE: Performance expectancy

Table 6: Number of studies that report positive relations between UTAUT's variables (PE, EE, and SI) and BI

Meta-analysis study	PE-BI	EE-BI	SI-BI
Dwivedi et al., 2011	Strong support	Strong support	Strong support
Taiwo and Downe, 2013	Significant (strong support)	Significant (strong support)	Significant (strong support)

BI: Behavioral intention, UTAUT: Unified theory of acceptance and use of technology, PEOU: Perceived ease of use, PU: Perceived usefulness, A: Attitude. Strong support: More than 50% of studies support the positive relationship between variables. Medium support: 50% of studies. Weak support: <50% of studies, PE: Performance expectancy, EE: Effort expectancy, SI: Social influence

Figure 8: The significant relationship between perceived usefulness - BI in technology acceptance model (from Table 5)

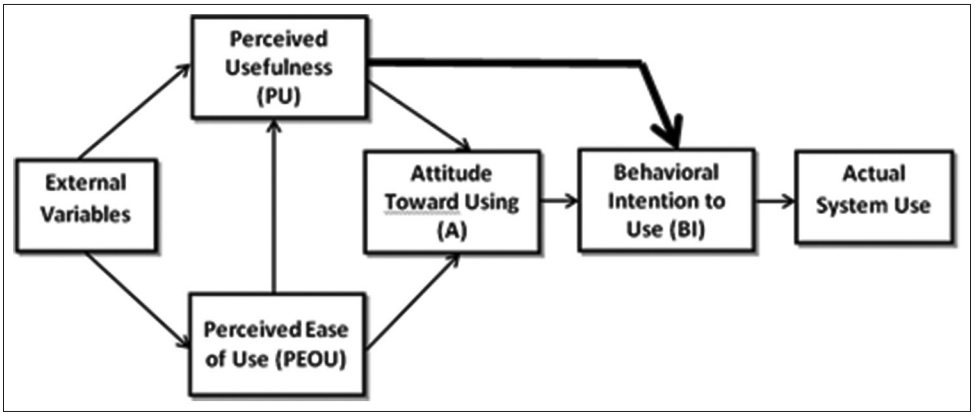


Figure 9: Unified theory of acceptance and use of technology (Venkatesh et al., 2003)

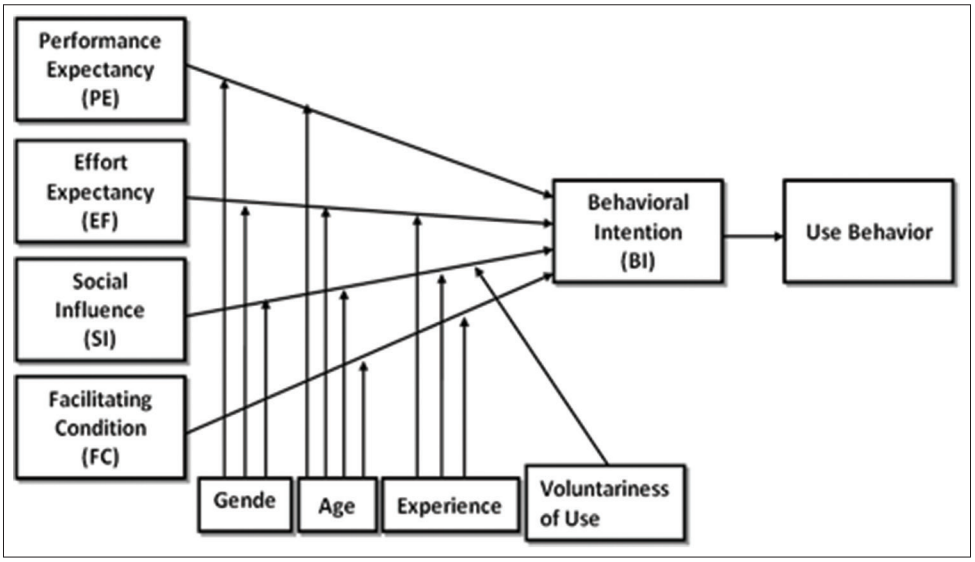
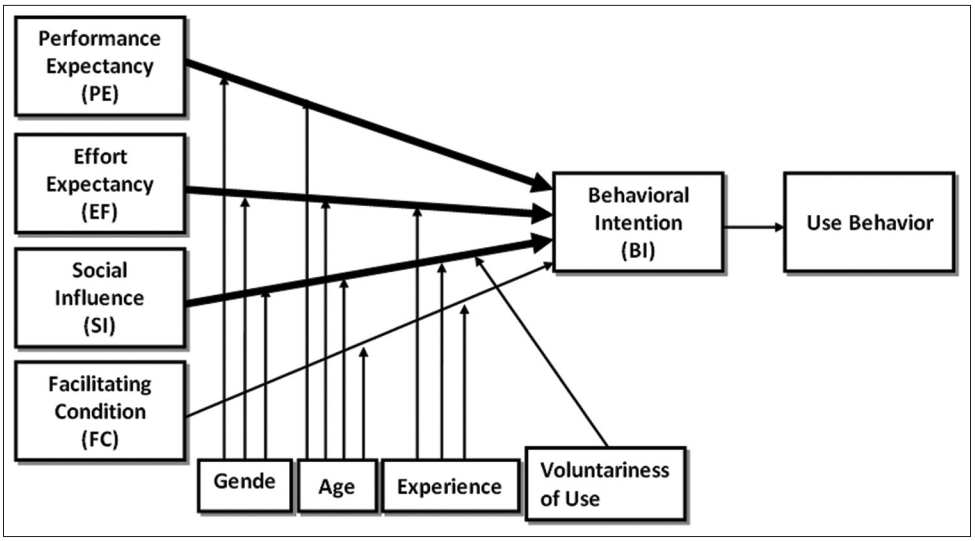
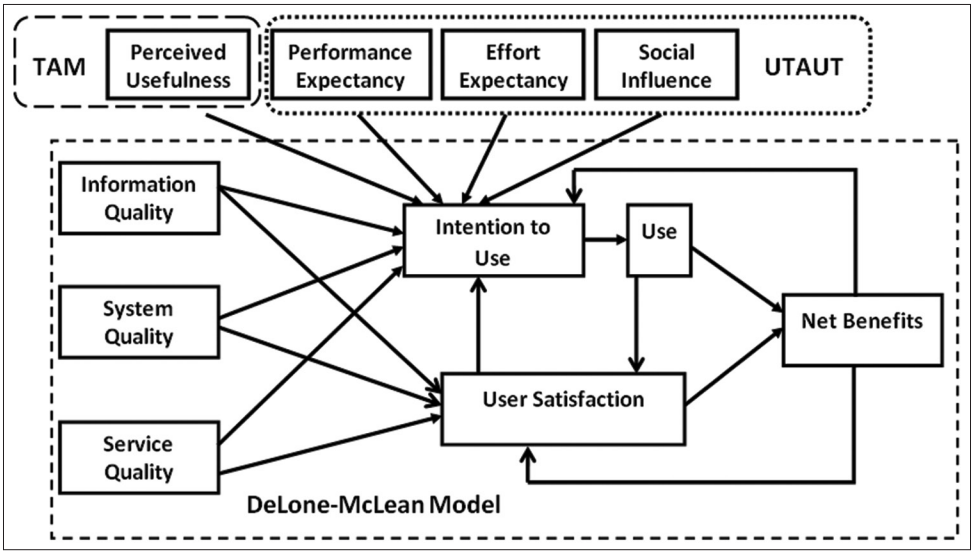


Figure 10: The unified theory of acceptance and use of technology diagram resulted from Table 6



The inclusion of SI into the proposed construct compensates the limitation of TAM that was mentioned by (Bagozzi, 2007). Another study, (Malhotra and Galletta, 1999), stated that user commitment toward information technology/system is influenced by his/her perception toward the system. More precisely, they stated that user's perception toward IS is "a function of the perceived fit of the system use to the users' values." Values can be imposed by somebody that is important to the user and affect the user in the form of SI. The impact

Figure 11: The extended DeLone–McLean model based on literature review



of SI affects people in the process of decision making on something that they are not familiar with, such as using a new technology.

Based on both Tables 5 and 6 it can be concluded that the variables from TAM that will be integrated into the model is PU, while variables from UTAUT are PE, EES, and SI. Substituting these variables into the TAM and UTAUT boxes in Figure 5 will result in the final model as shown in Figure 11.

7. RESULTS AND DISCUSSION

The final model in Figure 11 is the result from a thorough examination of the literature so far. The changes in technology itself and user's savviness toward technology might change the model in the future. Some papers have shown that the changes of the nature of technology could influence the interaction between technology and its users, thus changing the model that represents that relationship. For example, the addition of service quality into the updated DeLone–McLean model is based on the consideration that recent development on IS have shown that IS is no longer just a product but also a provider of services (DeLone and McLean, 2003). The recent advancement of technology and the proliferation of its implementation for hedonic lifestyle has triggered some researchers, such as (Venkatesh et al., 2012) and (Zhou et al., 2007), to modify or extend the TAMs to fit the model with the newest development.

The result in Figure 11 shows the more complicated model compare to the initial model in Figure 1. Eventhough some steps have been done to choose only the variables that have strong predicting power, nevertheless the final model is relatively complex. Parsimony is desirable for a theory, but Okasha, (2002)'s rhetorical question "for how do we know that the universe is simple rather than complex?" has given the possibility of preferable less parsimony theory or model.

8. CONCLUSION AND FURTHER RESEARCH

Integrating TAM and UTAUT into DeLone–McLean IS model is expected to provide stronger and robust theoretical background toward IS success model. The next challenge is defining the operationalization of the measurement to avoid the overlapping assessment. Reviewing some literature has given the sense that some researchers are overlapping in operationalized the variables. Since the final model in Figure 11 contains both observable and unobservable variables, therefore precaution is needed when validating the model. Further literature study is needed to define the perfect measurement for each variable.

The drawback of the final model in Figure 11 is that the model is opposing the concept of parsimony. The growing model is needed to be "pruning" without sacrificing the internal validity of the model, since internal validity is also an important factor of a good theory. Further research also is needed to discover the possibility of the influence of culture toward IS success, since numerous literature is overwhelmingly giving the proofs for cultural involvement on the IS's users that in turn could affect IS itself.

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