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Entrepreneurs adoption of information system innovation: The impact of individual perception and exogenous factors on entrepreneurs behavior

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The impact of individual perception and exogenous factors on entrepreneurs behavior

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Abstract

Purpose – The purpose of this paper is to explore technology acceptance and use behavior of IS innovations by entrepreneurs. To measure the perception of IS innovations by entrepreneurs the authors review unified theory of acceptance and use of technology and the entrepreneurial potential model, empirically compare the two models, develop a new model that integrates elements from the two models, and then empirically validate the new model (technology adoption decision and use (TADU)) in a technology acceptance context.

Design/methodology/approach – The data used to test the hypothesis are collected from 1,200 entrepreneurs in Malaysia. The research model was analyzed using structural equation modeling.

Findings – The results indicate that perceived desirability and perceived feasibility have significant effects on entrepreneurs' intention to adopt and use innovations. Propensity to use is an important factor that has a significant effect on individual behavior. The precipitating events that happen in the time lag between intention and behavior will disrupt entrepreneurs' inertia and induce a change in their behavior, encouraging them to seek the best opportunity available.

Practical implications – Understanding the individual, technological, and environmental factors that significantly affect IT adoption behavior can support policy makers in providing guidance on the adoption and usage of IT innovations by entrepreneurs.

Originality/value – This study proposes a TADU model with six core determinants of intention and usage – perceived desirability, perceived feasibility, performance expectancy, effort expectancy, social influence and facilitating conditions and two new moderators, precipitating events and the propensity to act.

Keywords Information systems, Management

Paper type Research paper

1. Introduction

Research shows the importance of entrepreneurs and entrepreneurship for economic growth. Entrepreneurs play their part by contributing to economic performance by introducing innovations, facilitating technological progress, creating change, driving business expansion, improving wealth, and job creation (Wong *et al.*, 2005). Entrepreneurs generally have higher achievement motivation, they are risk takers, therefore more inclined to accept changes and be more innovative (Steward *et al.*, 1998).

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Peter Drucker (1985) considers innovation in technology as an aspect of entrepreneurship and believes that innovation and entrepreneurship are the main forces in maintaining the dynamics of organizations, economics, and communities. It is important to investigate entrepreneurs' IS adoption behavior since they often use IS or IT as source of opportunity for new venture creation or to increase job performance in their daily business activities.

The issue of innovation adoption and usage is an important and long-standing research question which can be considered as a mature stream of IS research (Chan *et al.*, 2010). Although many IS researchers have attempted to improve IS adoption theory to better explain IS adoption behavior, these theories still have limitations (Venkatesh *et al.*, 2008) with most of the individual theories being criticized for being fragmented. Indeed, the area lacks a cohesive model that accounts for the numerous factors that influence technology use (Straub, 2009). In 2003, Venkatesh *et al.* presented a review of the most common models used to predict computer use and proposed a theory called the unified theory of acceptance and use of technology (UTAUT). The Theory assumes that facilitating conditions has the ability to measure the influence of environmental or organizational limits, unforeseen events, and the time and the ability that inhibit the act (Venkatesh *et al.*, 2003). A few years later Venkatesh *et al.* (2008) investigated the relationship between intention and use behavior, and found that facilitating condition is not able to capture the effect of external factors. Furthermore, they indicated that behavioral intention has at least three limitations, First, they found that the external factors that can potentially impede or facilitate the performance of a behavior are not fully captured by behavioral intention, second, behavioral intention has weak predictive and explanatory ability to deal with uncertain and unforeseen events between the time the intention is formed and the behavior is performed. Third, behavioral intention also has a weak ability to predict behaviors that are not completely within individual volitional control. Although there are a many studies that have replicated UTAUT and other intentional models, the link between intention and behavior still remains unclear and the work is often criticized as being fragmented and incohesive (Wiedemann *et al.*, 2009; Venkatesh *et al.*, 2008; Sheeran, 2002). However, a review of the literature shows that researchers in the other disciplines such as entrepreneurship found that precipitating events could improve the intention-behavior gap when dealing with unforeseen events and uncertainty between the time an intention is formed and an actual behavior is performed. Precipitating events is one of the constructs in the entrepreneurial potential model (EPM) develop by Krueger and Brazeal (1994), which is rooted in the theory of planned behavior (TPB). The EPM has the ability to measure individual attitude and self-efficacy toward behavior intention to take action.

Further, the UTAUT model does not consider attitude and self-efficacy as direct determinants of behavior intention, but many studies show that these factors are important determinants toward behavior intention (Straub, 2009; Yuen *et al.*, 2010). In addition, attitude is an important factor in theory of reasoned action (TRA), TPB, and technology acceptance model (TAM), and many studies consider it as a direct determinant of behavioral intention in other disciplines. For example, Krueger and Brazeal (1994) when developing the EPM, argue that self-efficacy and favorable attitude are important factors toward the intention to take action. They argue that starting a new action requires at least a threshold level of perception of feasibility and desirability plus some propensity to actually act upon an opportunity.

Considering the limitations of UTAUT coupled with the aforementioned problems, using the UTAUT model alone to test for entrepreneurs' IS acceptance may not be

sufficient, as it may not be able to fully capture the effect of external factors that influence the entrepreneur's intention to use an IS innovation. Most entrepreneurs face different challenges such as legal, financial, and/or personal obstacles that may arise in their daily business activities (Gnyawali and Park, 2009; Damanpour and Schneider, 2006). To a certain extent all of these challenges have the potential to affect their intention toward adopting and using IS in their daily business activities. It is important to investigate the IS adoption behavior of entrepreneurs as they are typically consider as IT pioneers, since they use IT or IS as a source of opportunities for new venture creation or to increase performance in their companies. Considering this, investigating entrepreneurs' technology adoption could make an important theoretical contribution, and create an extension to the UTAUT model, since Alvesson and Karreman (2007) argued that the theory can be extended by leveraging a new context. Furthermore, compared to general theories, theories that focus on a specific context are considered to be vital in providing a rich understanding of a focal phenomenon and have the potential to meaningfully extend theories (Venkatesh *et al.*, 2012). Regarding the case of UTAUT which was developed to explain employee technology acceptance it is worthwhile to examine how it can be extended (Venkatesh *et al.*, 2012) to other contexts such as entrepreneurship.

Considering this background, the main objective of this study is to develop a new model which is able to measure different dimensions of technology adoption to investigate adoption and use of IS innovations in an entrepreneur's context. This study presents the technology adoption decision and use (TADU) model by identifying key additional constructs and relationships to be integrated into UTAUT, thus tailoring it to entrepreneurs' use context. TADU integrates the UTAUT, (Venkatesh *et al.*, 2003) with the EPM (Krueger and Brazeal, 1994) to capture different factors of IS use behavior of entrepreneurs. This study consists of three objectives. First, it identifies the effect of technological factors which measure characteristics of IS innovation (performance expectancy and effort expectancy), individual factors which measure individual perceptions toward IS innovation (perceived desirability, perceived feasibility, and social influence) and environmental factors which measure the existence of infrastructures to support IS innovation usage (facilitating conditions) toward intention to use and use of IS innovations. Second, it investigates the intention-behavior gap and the effect of precipitating events on entrepreneur's intention to use IS innovations. This will provide new insight to the situational conditions faced by entrepreneurs, and how these situations may impact entrepreneurs' decisions toward use of IS innovations. Third, it examines the effect of the volitional aspect of the behavior of propensity to act on entrepreneurs' intention to use IS innovations.

In addition, this study compares the predictive ability of the original UTAUT model and provides a baseline assessment of the explanatory power of the individual model against which the integrated model (TADU) can be compared. The comparison examines the efficacy of these models in predicting the intentions that entrepreneurs hold toward using IS innovations and results in a robust and parsimonious IS adoption model that measures the determinants that may influence entrepreneurs to use IS innovations. With the proposed integrative TADU model, the "distal nature" between intention to use and use behavior may be reduced, thus, decreasing the "intention-behavior gap." Empirical validation of the TADU model involved an empirical test providing support for the model, and revealed that TADU outperforms each of the original models.

2. Background

For 25 years and more, information system researchers have focussed on understanding IS adoption behavior by individuals and organizations. Several IS adoption models have been developed and proposed to explain users' acceptance and use of information technology. Researchers used these IS adoption models to explain technology acceptance in different contexts such as internet advertising (Hanafizadeh *et al.*, 2012), e-mail advertisement (Chang *et al.*, 2013), mobile commerce (Min *et al.*, 2012), mobile banking (Zhou, 2011), electronic business (Lin, 2013; Teoh *et al.*, 2013; Hsu *et al.*, 2013), computer games (Davis *et al.*, 2013) enterprise blogs (Wu *et al.*, 2013a), and e-learning (Cheng, 2012), 3G mobile communication (Wu *et al.*, 2013b), web usability (Wu *et al.*, 2013c), telecare adoption (Huang and Lee, 2013), acceptance of assistive technology (Nam *et al.*, 2013), and multimedia-based learning systems (Lee and Ryu, 2014). Several researchers have investigated entrepreneurs' technology acceptance (e.g. Franquesa and Brandyberry, 2009; Spencer *et al.*, 2012; Chao and Chandra, 2012; Gonzalez-Alvarez and Solis-Rodriguez, 2011) and suggested different factors which effect entrepreneurs' intention to use new technology such as attitude, ease of use, usefulness, facilitating condition, relative advantage, age, education, cost, subjective norm, motivation (Peltier and Zhao, 2012; Ramdani *et al.*, 2009; Tan *et al.*, 2009). However, most of these researchers consider small and medium size comapny (SME) owners as entrepreneurs, and did not differentiate entrepreneurs from SMEs owners.

Previous research on technology acceptance has employed a number of theoretical models to examine individual intention toward technology adoption. TPB explains adoption behavior that is not completely under the individual's control (Ajzen and Fishbein, 1985). According to TPB, in order to predict possible behavior with more accuracy, it is necessary to evaluate intention and the amount of control that the individual has over the behavior (Ajzen and Madden, 1986; Armida, 2008). TAM is specially developed to predict and understand adoption behavior in relation to specific IS applications. Davis (1989) considers both perceived usefulness and perceived ease of use as determinants of attitude and intention to use. Moore and Benbasat (1991) designed an instrument to measure the perceptions of IT innovation adoption based on Rogers' (1995) diffusion of innovation theory (IDT). In the same vein, Compeau and Hinggins (1995) extend the social cognitive theory to IS adoption research to investigate the role of people's beliefs about their skill to competently use computers. Davis *et al.* (1992) adapt motivation theory to explain how people respond to stimuli in an IS context. Taylor and Todd (1995) combine TAM and TPB in a unified model known as C-TAM-TPB to predict inexperienced users' behaviors with new technology compared to experienced users. Throughout the years, IS researchers have adopted, adapted, and expanded the above model with other human behavior theories that allow better explanation of the IS adoption behavior.

In 2003, Venkatesh *et al.* presented a comprehensive review of eight of the most common theories/models employed to predict computer use, based on conceptual and empirical similarities, and proposed the UTAUT model. UTAUT postulates that three core constructs (performance expectancy, effort expectancy, social influence) act as direct determinants of behavioral intention, while the facilitating conditions and behavior intention are direct determinants of usage behavior. They argue that some variables moderate these relationships, namely, voluntariness of use, experience, age, and gender. In the UTAUT model, self-efficacy, attitude, and anxiety were not considered to be direct determinants of intention. Performance expectancy was defined as "the degree to which an individual believes that using the system will help him or

her to attain gains in job performance" (Venkatesh *et al.*, 2003, p. 447). It is moderated by gender and age, and the effect is stronger in men. Effort expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh *et al.*, 2003, p. 450). This factor is moderated by gender, age, and experience, and is more salient in the early stage of use and becoming insignificant with periods of extended usage, when users learn to effectively operate the new technology. Social influence is defined as "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh *et al.*, 2003, p. 451). This construct is moderated by gender, age, experience, and voluntariness of use. Facilitating condition is defined as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh *et al.*, 2003, p. 453). Facilitating conditions has a significant effect on usage behavior when moderated by age and experience (Venkatesh *et al.*, 2003).

Since the UTAUT model was development in 2003 researchers have applied this model in: new contexts such as community health center, managers, mobile owners, and merchants (Hanson *et al.*, 2011; Shu and Chuang, 2011; Wang and Wang, 2010); new user populations such as university students, university faculty members, doctors, educators, lawyers, college teachers, investors, small and medium enterprises, bank customers, internet banking service users (Wang *et al.*, 2010; Loebbecke *et al.*, 2010; Heerink *et al.*, 2010); new cultural settings such as India, China, Taiwan, Malaysia, Australia, Jordan, Saudi Arabia, Kuwait, the Netherlands (Moghavvemi *et al.*, 2012; Wang and Shih, 2009); and finally inclusion of exogenous predictors (Cody-Allen and Kishore, 2006) in the UTAUT model (Venkatesh *et al.*, 2012).

2.1 Limitation of UTAUT

A review of the literature shows that although UTAUT is robust model and many researchers have validated it in different contexts, it is still plagued by limitations that reduce the model's use prediction accuracy. These limitations are rooted in the TRA related to the confounding issues between attitudes and subjective norms, such as environmental or organizational limit, unforeseen events, time and ability, which inhibit the act. Ajzen (1991) proposed the TPB to try to improve these limitations and add perceived behavioral control to TPB. UTAUT assumes that facilitating conditions may have the ability to capture the influence of these factors by integrating perceived behavioral control from TPB and facilitating conditions from the model of personal computer utilization to conceptualize new facilitating conditions. This new variable reflects the perception about individual control over behavior within UTAUT, with the hope that this new facilitating condition variable is able to address the role of external factors. However, there are still criticisms from some IS researchers as prior studies on IS adoption behavior reveal that this facilitating condition could not still capture and measure the effect of external factors and could not actually account for incomplete information (e.g. Sheeran *et al.*, 2003; Venkatesh *et al.*, 2008). In the presence of incomplete and uncertain information regarding behavior, the facilitating conditions may not be a good factor to predict IS adoption behavior (Venkatesh *et al.*, 2008). The other criticism is that UTAUT does not consider attitude and self-efficacy as direct determinants of behavior intention (Yuen *et al.*, 2010; Straub, 2009). However, empirical evidence shows that perceived overall self-efficacy contributes significantly to the motivation and performance of an individual (Bandura and Locke, 2003; Bandura, 1994, 1997). New technology (IT innovation) is viewed as complex by inexperienced users, and confidence in one's ability to handle them has significant influence on individual

acceptance (Yuen *et al.*, 2010). Furthermore, UTAUT excludes attitude as a direct determinant of intention which is an important factor in TRA, TPB, and TAM. Most prior studies have found both these factors to be salient determinants of behavioral intention (Louho *et al.*, 2006; Yuen *et al.*, 2010). Considering these critical points rely on UTAUT alone to predict IT adoption behavior would be inappropriate. Moreover, there is a need to find variables that are able to capture the role of external factors that affects individual's decisions to adopt and use IS, as well as factors that measure the individual dimension toward intention to use and use behavior especially with entrepreneurs who have unique characteristics. This may explain why individuals may have the intention to use, but does not translate into actual use behavior.

In the entrepreneurship literature, Krueger and Brazeal (1994) developed the EPM to measure individual perception (self-efficacy and attitude) toward intention to start a new venture or use new technology in an existing company. In this model precipitating events is a moderating variable which is able to capture the role of external factors and improve the intention-behavior gap. This model has the potential to mitigate the limitations of the UTAUT model and thus assist in providing a better understanding of IS adoption behavior. The following section will discuss the EPM.

2.2 EPM

Krueger and Brazeal (1994), theorized the EPM and argued that an entrepreneurial event requires the potential to start a business that is defined on two critical constructs: perceived desirability (attitude and social norms), and perceived feasibility (self-efficacy, perceived behavioral control) (Krueger and Brazeal, 1994). Credibility requires the behavior to be both desirable and feasible, and these antecedents affect the intentions toward the behavior. The final choice depends on the relative credibility of alternative behaviors plus some propensity to act. This model explains that although the individual perceives the new venture creation as desirable and feasible, and therefore credible, they have not finalized the intention to realize the behavior if the precipitating event is lacking (Krueger and Brazeal, 1994; Veciana *et al.*, 2005). Perceived desirability is defined as the "degree of attraction an individual perceives towards a specific behavior" (intrapersonal and extra personal) (Krueger and Brazeal, 1994, p. 96). Perception of desirability reflects our perception that likely outcomes are personally beneficial. Perceived feasibility is defined as "the perception regarding their own ability to carry out a specific behavior" (becoming an entrepreneur) (Krueger and Brazeal, 1994, p. 97). It reflects the perception of a personal capability to do a particular job or set of tasks. According to Krueger and Brazeal (1994) if people do not believe that they have the skill and capability to take action, they will not even think about a certain behavioral intention. Precipitating events is defined as certain exogenous variables which facilitate or "precipitate" the realization of intention into behavior (Shapero, 1982). For intent to be translated into action, it often requires a trigger, either removal of a barrier or the presence of a facilitating factor (Krueger *et al.*, 2011). Shapero (1982) defined propensity to act as the individual's disposition to act on their decisions (stable personal characteristics), which reflects volitional aspects of behavior (I will do it). Krueger posits that without significant propensity to act, it is hard to imagine well-formed intentions.

3. Model development

The clearest parallels between the two models (UTAUT and EPM) can be drawn by comparing the elements of their respective underlying theories. The UTAUT model

considers technological and environmental factors in predicting intentional behavior, whereas the EPM considers individual characteristics toward intention and behavior. Both models are intentional and derived from the TPB. In the TPB, perceived behavioral control considers two points of view: as effort requirement perspective and individual's perception of the ease of completion of a task, which influence the individual's opinion of their ability to complete it (Bandura and Adams, 1977) and as a facilitating conditions (resource, technology) perspective, which is the perception that resources will be available to complete the task (Chan *et al.*, 2010). Venkatesh *et al.* (2003), emphasized more on the facilitating conditions aspect in the UTAUT model (Compeau and Hinggins, 1995; Agarwal and Prasad, 2000) while Krueger and Brazeal (1994) emphasized more on the self-efficacy dimension (perceived feasibility). The EPM considers self-efficacy (perceived feasibility) as a direct and important determinant toward behavioral intention. Perceived feasibility in the EPM is related to the individual's skill and ability. In EPM, Krueger and Brazeal (1994) combined the attitude and subjective norm together, and measured the effect of these two factors in one construct perceived desirability (Ajzen, 1991; Krueger and Brazeal, 1994). The EPM focusses on the effect of precipitating events on behavioral intention to take action, and posited that this variable is able to capture the effect of external factors in the relationship between intentions and use behavior. Social influence adopts from the UTAUT and measure how important are others' (family, peers, culture, colleagues, and mentors) beliefs toward adoption and use of IS innovation. The volitional aspects of entrepreneurs behavior measure through propensity to act adopts from EPM. Performance expectancy relates to the benefit of using IS or the expected outcomes such as attain gains in job performance, while effort expectancy relates to the ease of using IS, such as user friendly features.

Given this backdrop, the current study develops a model (TADU) (see Figure 1) by integrating the UTAUT and EPM to predict an entrepreneur's intention to use IT innovation. This study identifies relevant predictors of entrepreneurs' technology adoption based on three reasons: UTAUT model does not measure direct effect of the individual characteristic (attitude, self-efficacy) toward behavioral intention to use new technology, limitations that exist in the relationship between intentions and use behavior, and the EPM's ability to measure perceived desirability, perceived feasibility, and the volitional aspect of the behavior (propensity to act) toward technology adoption and capture the effect of external factors (precipitating events). This study adds precipitating events as a moderator between intention and behavior to fill the intention-behavior gap. The EPM model considers students as potential entrepreneurs while, this

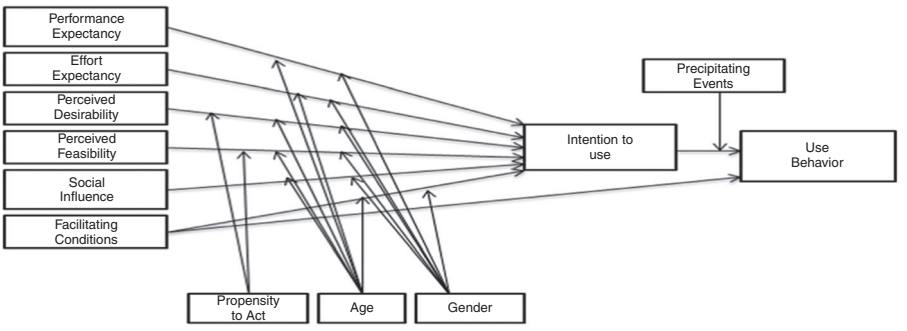

Figure 1. Technology adoption decision and use model

study considers actual entrepreneurs therefore, potential was omitted from the model. Voluntariness was also omits from the model, as this study measure voluntariness through propensity to act. Our research model is shown in Figure 1. Following this rationale, this study integrated constructs from the EPM to the UTAUT model, and developed the following hypotheses.

3.1 Performance expectancy

Performance expectancy is related to expected outcomes in using IT, and thus, performance expectancy has a strong influence on user intention to use a new system, and remains significant at all points of measurement in both mandatory and voluntary settings (Venkatesh *et al.*, 2003). Men tend to be highly task oriented; therefore performance expectancies are likely to be salient in men and younger workers (Venkatesh *et al.*, 2003). In this study, performance expectancy is defined as the degree to which entrepreneurs' perceive that using IS innovation is useful in their job and helps them to attain benefit in their business (Venkatesh *et al.*, 2003). Accordingly, this study hypothesizes that:

H1. Performance expectancy will have a significant effect on entrepreneur's intention to use IS innovations.

H1a. The influence of performance expectancy on intention to use will be moderated by gender and age.

3.2 Effort expectancy

The UTAUT model posits that the effort necessary to learn and use new technology will affect its acceptance and use (Venkatesh *et al.*, 2003; Gefen *et al.*, 2000). In the current study, it is defined as the degree to which entrepreneurs' perceive that using IS innovations would be free of effort or takes less effort or be easy to use. Accordingly, this study hypothesizes that:

H2. Effort expectancy will have a significant effect on entrepreneur's intention to use IS innovations.

H2a. The influence of effort expectancy on intention to use will be moderated by gender, and age.

3.3 Perceived desirability

In this study perceived desirability is defined as the degree of attraction an entrepreneur perceives toward using IS innovations (Krueger and Brazeal, 1994). Krueger and Brazeal (1994), argued that intentions are driven by the perception of what the individual may find desirable, and that depends on the outcome of performing that behavior. Therefore, it is postulated that perceived desirability has a significant positive influence on entrepreneurs' intention to use IS innovations. Following the above rationale, this study hypothesizes that:

H3. Perceived desirability will have a significant effect on entrepreneur's intention to use IS innovations.

H3a. The influence of perceived desirability on intention to use will be moderated by gender and age.

3.4 Perceived feasibility

Perceived feasibility reflects the perception of personal capability to do particular jobs or set of tasks (Krueger and Brazeal, 1994). This persistence is vital: "self-efficacy is more than I can do this but includes I can figure out how to do this (and I will keep trying in the face of adversity) (Krueger, 1998, p. 177). In the context of this study, perceived feasibility is conceptualized as the degree to which entrepreneurs perceived that they are capable and have skill to use IS innovations in their job. Perceived feasibility is able to measure entrepreneurs' perception about their skill and ability to use IS innovations. Therefore, this study hypothesizes that:

H4. Perceived feasibility will have significant effects on entrepreneur's intention to use IS innovations.

H4a. The influence of perceived feasibility on intention to use will be moderated by gender and age.

3.5 Social influence

In the UTAUT model Venkatesh *et al.* (2003) define social influence as the degree to which an individual perceives that important others believe he or she should use the system. Concerning prior research, this study defines social influence as the degree to which an entrepreneur perceives it is important that others believe he/she should use an IS innovation, and argues that the effect of social influence on intention to use is positive and significant. Accordingly, based on the UTAUT and evidence from prior studies, this study hypothesizes that:

H5. Social influence will have a significant effect on an entrepreneur's intention to use IS innovations.

H5a. The influence of social influence on intention to use will be moderated by gender, and age.

3.6 Facilitating conditions

This construct is derived from constructs developed in other models that include; perceived behavioral control from TAM and TPB, facilitating conditions from MPCU and compatibility from IDT (Venkatesh *et al.*, 2003). Facilitating conditions is defined as the degree to which individuals believe that appropriate organizational and technical infrastructure should be in existence to support use of the system. In IS adoption context, IS researchers suggest that users who believe that there is organizational and environmental support to use new IS are more likely to use the system (Yeow and Loo, 2009; Kijsanayotin *et al.*, 2009; Venkatesh and Zhang, 2010; Alawadhi and Morris, 2008). In UTAUT, facilitating conditions is hypothesized to influence technology use directly because many aspects of facilitating conditions such as training and support provided will be freely available within an organization and invariant across users (Venkatesh *et al.*, 2012). In UTAUT2 facilitating conditions was hypothesized to influence both behavioral intention and use behavior directly (Venkatesh *et al.*, 2012). UTAUT2 postulated that the effect of facilitating conditions on behavioral intention to be moderated by age, gender and experience. Regarding prior research, this study follow the TPB and UTAUT2 and link facilitating conditions to both behavioral intention and behavior and argue that facilitating conditions has significant influence on intention to use and the effect of facilitating conditions is moderated by age and gender.

Facilitating conditions is defined as the degree to which an entrepreneur perceives that factors in the environment do support and facilitates the usage of IS innovations which effect their intention to use and actual use of IS innovations (Venkatesh *et al.*, 2003). Consistent with this view, this study hypothesizes that:

H6. Facilitating conditions will have a significant effect on an entrepreneur's intention to use IS innovations.

H6a. The influence of facilitating conditions on intention to use will be moderated by gender and age.

3.7 Intention to use

In this study, behavior intention is conceptualized as the degree to which an entrepreneur has formulated conscious plans to use or reject an IS innovation to improve their business (Krueger and Brazeal, 1994; Stopford and Baden-Fuller, 1994). Consistent with the UTAUT model and other underlying intention models, this study hypothesized that usage intention is an important factor to predict use behavior. Thus:

H7. Behavior intention will have a significant effect on an entrepreneur's usage of IS innovations.

3.8 Propensity to act

Shapero (1982) defined propensity to act as the individual's disposition to act on individual decisions (stable personal characteristics) which reflects volitional aspects of intentions (I will do it). This study conceptualized propensity to act (use) as the degree to which an entrepreneur's perceived disposition to use IS innovations and it reflects volitional aspects of their intention to use IS innovations. Entrepreneurs with a proactive tendency have a higher level of desirability, and feasibility to use IS innovations in their business. This study theorized that the propensity to use (innovation) moderates the relationship between perceived desirability and perceived feasibility toward intention to use IS innovations. Thus:

H8. The influence of perceived desirability on intention to use will be moderated by propensity to use.

H9. The influence of perceived feasibility on intention to use will be moderated by propensity to use.

3.9 Precipitating events

Krueger *et al.* (2000), argued that exogenous factors (external effect) impact attitudes, and may moderate the relationship between intention and behavior (e.g. exogenous variables inhibit a person from realizing the intent to take action) (Krueger and Brazeal, 1994; Schindehutte *et al.*, 2000). Shapero (1982) distinguishes precipitating events based on: first, push vs pull factors: precipitating events (trigger) as push or pull, or the combination of both factors. Second, facilitators vs inhibitors: Shapero (1982) posit that precipitating events may be the emergence of something that the individual perceives as a facilitating action (facilitators), or the removal of perceived barrier (an inhibitor). Schindehutte *et al.* (2000), divided entrepreneurial triggers into five key dimensions which are subjected to the individual's perception: internal vs external (to organization), opportunity driven vs threat driven, market pull vs technology push, top-down vs

bottom-up, systematic or deliberate search vs chance or opportunism. Extending the above finding to this study, precipitating events is hypothesized to moderate the relationship between behavioral intentions and use behavior. Therefore, this study hypothesize that:

H10. The influence of intention on use behavior will be moderated by precipitating events.

4. Method

4.1 Participants and procedure

The sampling frame is entrepreneurs involved in providing products and services in the areas of manufacturing and service in Malaysia. There is a difference in the definition of entrepreneurs and entrepreneurship. Based on McDaniel's (2000) definition, not all managers or owners of business are entrepreneurs because one can run a business without trying new ways of doing business. Thus, an entrepreneur is someone whose role is to do new things or do things that are already done in a new way (innovation) (Schumpeter 1936). Most of the entrepreneurs are small business owners, but they have higher achievement motivation and risk taking, and thus fore are inclined toward innovation and change. They rely on short-term rather than long-term strategic plans (Levy and Powell, 2002; Lee and Runge, 2001), have fewer bureaucratic procedures, less complex interpersonal and political relations, and less organizational inertia (Chau and Hui, 2001).

The target population of this study is entrepreneurs that bring new ideas, new practice (product, service or method of production), or innovation in their job, start new business, or market a new innovation. As it was difficult to find the total population of entrepreneurs in Malaysia, this study uses the total number (1,200 entrepreneurs) of attendees in different workshops, seminars, and conferences as the target population. IS innovation is defined as any digital and communications technology that is new for an individual or other unit of adoption. Therefore, this study considers any new hardware or software which is related to IS such as mobile banking, online banking, mobile commerce, Web2 and enterprise resource planning as IS innovations. The questionnaire was prepared in two languages, English and Bahasa Malaysia. However, most of the respondents choose to answer the English version. This may be because most of the Malaysians are able to speak English. This study conducted a two stage survey since it had to measure the effect of precipitating events on entrepreneurs' intention to use IT innovations in a specific time frame. In the first phase, 1,200 questionnaires were distributed personally to participants during the entrepreneurs' gatherings. During the first stage, the survey asked entrepreneurs for their perceptions prior to using the technology. This study measured the antecedents of the core technology adoption beliefs, i.e., performance expectancy, effort expectancy, social influence, facilitating conditions, perceived desirability, perceived feasibility, usage intention and propensity to act as moderating variables. Eight months later, we sent those who had responded to the first stage of survey (550 entrepreneurs) the second version of the survey. In Phase II, e-mails were used to distribute the questionnaires. The second version of the questionnaire contains the items related to the use of IS innovations and precipitating events. This study aimed to measure precipitating events which happen in the time intention to use is formed, use of IS innovation was performed, and its effect on their use behavior. Therefore they were asked about their use of IT innovations after eight months and if there were any precipitating events that

happened in that specific time which effected their use of IT innovation. There were 550 respondents to the first stage survey and 412 in the second stage survey. Data analysis was based on the 412 respondents who participated in both stages of the survey. Of these respondents, 305 (74.3 percent) were men and 107 (25.7 percent) were women. The average age of respondents was about 35 years.

4.2 Measurement

Whenever possible, this study used previously validated scales and adapted them to the context of IT innovation (see Table AI). This study modified some items to better fit the current research context. Measurement items for performance expectancy, effort expectancy, social influence, facilitating conditions, behavior intention, and use behavior were adopted from the technology acceptance literature (Venkatesh *et al.*, 2003, 2008; Taylor and Todd, 1995). Four other constructs; perceived desirability, perceived feasibility, precipitating events, and propensity to act related to the entrepreneurship context are adopted from the EPM which Krueger and Brazeal developed in 1994 (Krueger, 1993; Krueger *et al.*, 2000; Krueger and Brazeal, 1994; Schindehutte *et al.*, 2000).

4.3 Results

This study tested the model using structural equation modeling using Amos 18. First, exploratory factor analysis was conducted to identify all dependent and independent variables and associations among measured variables in the research model. The result shows that most factor loadings were larger than 0.50, which represented acceptable construct validity.

4.4 Convergent and discriminant validity

Table AI provides the list of items and their factor loading. Even though the sample size is not big (412) there was not significant error in the data analysis and the data fit to the model very well. The current study assessed the convergent and discriminant validity of the scales. The convergent validity is used to check the loading of each observed indicators on their underlying latent construct (Gefen *et al.*, 2000). The composite reliabilities of all constructs exceeded 0.87, and average variance extracted (AVE) for each construct was greater than 0.50 (see Table I). Thus, the results suggest evidence of convergent validity. In order to evaluate discriminate validity, this study examined: exploratory factor analysis to confirm that each indicators loads highly with its own construct than others; comparison of the square root of each construct's AVEs to its correlation with other variables (Chin, 1998; Noudoostbeni *et al.*, 2010). Results show that all items loading significantly on their predefined constructs and construct correlations were all below the square root of AVE for each construct. These analyses provided evidence of discriminant validity. This study performs exploratory factor analysis to determine if the results indicate the existence of common method variance. Results of EFA reveal no sign of single-factor that account for the majority of variances thus; confirming that the data is free from CMV issues.

4.5 Structural model testing

Before testing the integrated model, we ran the data in UTAUT original model and compared the results to the integrated model. This study also assessed the relative ability of TADU in explaining the entrepreneur's intention to adopt and use IS innovations, and compared it to the original UTAUT model.

	Mean	SD	AVE	CR	1	2	3	4	5	6	7	8	9	10
Performance expectancy	5.85	0.91	0.874	0.928	*0.934*									
Effort expectancy	5.30	0.81	0.870	0.926	0.430**	*0.932*								
Facilitating conditions	5.25	0.86	0.832	0.871	0.529**	0.418**	*0.912*							
Perceived desirability	5.96	0.84	0.832	0.932	0.720**	0.429**	0.572**	*0.912*						
Perceived feasibility	5.60	0.89	0.886	0.936	0.774**	0.488**	0.607**	0.731**	*0.941*					
Propensity to act	5.73	1.06	0.795	0.874	0.659**	0.330**	0.502**	0.699**	0.608**	*0.891*				
Precipitating events	4.54	1.44	0.809	0.884	0.349**	0.269**	0.289**	0.381**	0.378**	0.305**	*0.809*			
Intention to use	5.82	0.94	0.839	0.905	0.738**	0.399**	0.527**	0.794**	0.736**	0.738**	0.374**	*0.915*		
Use behavior	5.48	0.79	0.814	0.857	0.595**	0.311**	0.442**	0.565**	0.612**	0.522**	0.349**	0.579**	*0.902*	
Social influence	4.95	1.22	0.855	0.916	0.078	0.047	0.084	0.012	0.056	0.094	0.154**	0.069	0.119*	*0.924*

Notes: CR, composite reliability; AVE, average variance extracted. Value on diagonal are square root of AVE. *$p < 0.05$; **$p < 0.01$

Table I.
Descriptive statistics and co-relations

4.6 Basic UTAUT model

The data analyzed based on the basic UTAUT model was compared with the integrated model. The results showed that the data fit to the model very well. The result indicated that the effect of performance expectancy ($\beta = 0.698$, $p < 0.001$), and effort expectancy ($\beta = 0.193$, $p < 0.001$) toward intention to use is positive and significant. However, the effect of effort expectancy on the intention to use for males was not significant, while for women and younger age groups were significant. Moreover, the effect of social influence on intention to use was not significant ($\beta = 0.005$), whereas the influence of the facilitating conditions ($\beta = 0.240$, $p < 0.001$) and intention ($\beta = 0.521$, $p < 0.001$) on use behavior was positive and significant. The results reported that 65.7 percent of the variance associated with behavior intention was accounted for by its two predictors: performance expectancy, and effort expectancy. Accordingly, it was determined that 45.2 percent of the variation in usage behavior was accounted for by its two predictors, facilitating condition, and behavioral intention.

4.7 Research model

The structural model examined the research model (TADU) and all the relationships in the model were tested. The proposed structural model was tested for an overall model fit. The final model with χ^2 871.154 (χ^2/df = 1.998), degree of freedom 436, GFI = 0.883; TLI = 0.952; CFI = 0.958; RMSEA = 0.049; indicated that the model fits the data very well. Among the six predictors of intention perceived desirability, performance expectancy, effort expectancy, and perceived feasibility were positive and significant determinants of intention to use IS innovations, thus, supporting *H1*, *H2*, *H3*, and *H4*. Perceived desirability was the strongest determinant of intention to use IS innovations, followed by performance expectancy perceived feasibility and effort expectancy (see Table II). The effect of performance expectancy on the intention to use IS innovations vary with gender and age such that it is more significant for females and younger entrepreneurs. Therefore, results supported *H1a*. The effect of effort expectancy on intention to use is moderated by age and gender such that it is more significant for male and young entrepreneurs. Thus, results supported *H2a*. The effects of perceived desirability on intention to use IS innovations for younger women is stronger than older men, therefore *H3a* was supported. This suggests that the attractiveness of IS innovations is more important for women entrepreneurs compared to men entrepreneurs. The effect of perceived feasibility on intention to use is significant for older females compared to younger males thus, supporting *H4a*.

Hypotheses		β	SE	CR	p
H1	Performance expectancy → intention to use	0.223	0.059	4.127	***
H2	Effort expectancy → intention to use	0.078	0.038	2.260	0.024*
H3	Perceived desirability → intention to use	0.545	0.072	8.832	***
H4	Perceived feasibility → intention to use	0.190	0.067	3.132	0.002**
H5	Social influence → intention to use	0.032	0.022	1.104	0.270
H6	Facilitating conditions → intention to use	−0.022	0.049	−0.506	0.613
	Facilitating conditions → use behavior	0.187	0.049	3.138	0.002**
H7	Intention to use → use behavior	0.577	0.047	8.885	***

Notes: β, standardized regression weight; SE, standardized error; CR, critical ratio. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table II.
Standardized regression weights for structural model and hypotheses

Contrary to *H5*, the effect of social influence on intention to use was not significant among different ages and gender. Results did not support *H5* and *H5a*.

The result indicates that facilitating conditions is not a determinant of intention while there is a significant and positive relationship between facilitating conditions and use behavior and the effect of facilitating conditions is stronger for older female entrepreneurs. Intention to use was positive and a significant determinant of use of IS innovations, thus supporting *H7*. The squared multiple correlations reported that 84.4 percent of the variance associated with behavior intention was accounted for by its four predictors: perceived desirability, performance expectancy, perceived feasibility, and effort expectancy. Accordingly, it was determined that 49.9 percent of the variation in usage behavior was accounted for by its two predictors, which are facilitating conditions and intention to use.

To test the hypothesized moderation model in the SEM, two group models can be used in the core model, which is tested for high and low groups (Hair *et al.*, 2006; Salarzadeh Janatabadi, 2014). Referring to the moderating effect, the propensity to use on perceived desirability and perceived feasibility, the results confirmed that the propensity to use moderated the relationship between these two variables toward behavior intention, thus supporting *H8* and *H9*. This study tested the moderating effect of precipitating events on the relationship between the intention to use and use behavior, and the results support a moderating effect of this variable. Using similar techniques, the results show that the values of $\Delta\chi^2$ difference on low and high groups were all significant, thus *H10* was supported. Results of this study revealed that during the time the intention to use IS innovations is formed, if some unforeseen event occurs, it will change the entrepreneur's intention to use IS innovations. If an external factor, which influences an entrepreneur's work situation is moderate or low level, and causes acceptable change in work situation, entrepreneurs would be more interested to use IS innovations, and their intention and use of IS innovations will grow faster compared to when the events make major changes in their companies. Therefore, in both negative and positive extreme levels of precipitating events, entrepreneurs' intention to use and use of IS innovations would increase but in the lower rate. It appears that entrepreneurs who experience a high impact from precipitating events that may disrupt their normal work conditions will use IS innovations, but that would not be their immediate cause of action.

4.8 Compares the results of basic UTAUT and TADU

This study analyzed the data based on the basic UTAUT model to compare result with integrated model. The results showed that the data fit to the model very well. The result indicated that the effect of performance expectancy ($\beta = 0.698$, $p < 0.001$), and effort expectancy ($\beta = 0.193$, $p < 0.001$) toward intention to use is positive and significant, while social influence do not influence entrepreneurs' IS innovation adoption behavior. On the other hand, in the integrative TADU model, it appears that the individual factors of perceived desirability and perceived feasibility are salient determinants that influence intention to use by entrepreneurs (see Table III). The increase in the variance explained from 65.3 percent in basic UTAUT to 84.4 percent in the integrative TADU model is due to the two variables from the individual factors: perceived desirability and perceived feasibility, indicating the salient roles of these variables in predicting entrepreneurs' intention to use IS innovations. The findings of the integrative TADU model show that although technological factors of performance expectancy and effort expectancy are determinants of intention to use, in the presence of perceived

Table III.
Comparison of findings between the basic UTAUT and integrative TADU

Hypotheses	Basic UTAUT β	p	Variance explain	TADU β	p	Variance explain
Performance expectancy → intention to use	0.698	0.000	65.7% in usage intention	0.223	0.000	84.4% in usage intention
Effort expectancy → intention to use	0.193	0.000		0.070	0.024	
Social influence → intention to use	0.005	0.898		0.032	0.270	
Perceived desirability → intention to use	–	–		0.545	0.000	
Perceived feasibility → intention to use	–	–		0.190	0.002	
Intention to use → use	0.521	0.000	45.2% in use	0.577	0.000	54.2% in use
Facilitating conditions → use	0.240	0.000	behavior	0.187	0.002	behavior

desirability and perceived feasibility, the technological factors have less effect on intention to use IS innovations by entrepreneurs. In the case of entrepreneurs' intention to use, it seems that the perception of the entrepreneur's individual intrinsic interest is the determinant that stimulates entrepreneurs to adopt IS innovations.

The increased in variance explained for use behavior from 44.1 percent in the basic UTAUT to 54.2 percent in the integrative TADU shows the strong effect of intention and facilitating condition on use behavior. However, by including the precipitating events construct as a moderator variable, it strengthens the ability of intention to use to predict use behavior by entrepreneurs.

5. Discussion

The present research sets out to establish a model that is able to measure different dimensions of technology adoption and capture the effect of external factors on the relationship between intention and behavior, while filling the gap between intention and behavior. The TADU model was empirically tested and the results provided strong empirical support for the new model. The findings suggest that perceived desirability is the strongest factor toward intention to use IS innovations. This finding shows that in the beginning, entrepreneurs will consider the attractiveness of the new technology and their desire to use it. If it is unattractive, and they lack the desire to use it, they will most probably ignore it. Many useful technologies introduced to the market that failed could not command the attention of the consumers. Therefore, the critical factors when introducing technologies are related to its attractiveness to the target audiences. For example, if mobile banking allows entrepreneurs to access their bank transactions regularly and this improves the quality of their business or saves time and money, and results in entrepreneurs achieving personal satisfaction, then using mobile banking is perceived as attractive for entrepreneurs. The second strongest factor toward intention to use IS innovations by entrepreneurs is performance expectancy. Based on these findings it can be assumed that when entrepreneurs perceive that an IS innovation is useful and beneficial it will encourage them to be more interested in investing in the IS innovation, and so they would be more likely adopt the system in their daily business activities.

The third salient determinant of intention of entrepreneurs to use IS innovations is perceived feasibility. This finding indicates that it will not be an obstacle for entrepreneurs to adopt an IS innovation, once entrepreneurs feel comfortable about using the system and are confident that they can put in the effort needed to use it in

their daily business activities. Entrepreneurs that perceive they have the appropriate skills, knowledge and ability to use an IS innovation would be more interested and willing to adopt it. Effort expectancy is another determinant of entrepreneurs' intention to use IS innovations. In the context of entrepreneurship, lower effort expectancy can come from the innovation's user friendly features and instructions. If the new technology or innovation is not easy to use, entrepreneurs and users will be less likely to use it. The hypothesized path from social influence to intention to use is not significant. The non-significant relationship between social influence and intention to use could be attributed to the fact that the adoption of IS innovations by entrepreneurs is voluntary, whereby they do not need to comply with referent others' expectations when those referent others have the ability to punish or reward the desired behavior (Venkatesh *et al.*, 2003), while entrepreneurs do not expect any rewards from referent others. Another possible explanation is that as an IS innovation is relatively new in the market then the entrepreneurs consider using it as an opportunity to gain competitive advantage, therefore they want to be a pioneer of IS and to be the first to use it, rather than be a follower.

The findings suggest that facilitating conditions is not a determinant of intention while it is one of the key factors toward use behavior of IS innovations. This suggests that, for entrepreneurs to actively use an IS innovation they must be certain that they have the necessary resources and knowledge for the IS innovation, and there are external and/or internal support group available that can assist them with any difficulties related to using the system. These findings support that the propensity to use has a moderating effect on the relationship between perceived desirability and intention to use. These findings suggest that entrepreneurs' decisions to use IS innovations will influence desirability of use and increase their intention to use such innovations. Hence, using IS innovations in business is more attractive for entrepreneurs who have made a strong decision to use the system. It suggests that a volitional decision to use an IS innovation effects entrepreneurs perception about the attractiveness of using an IS innovation in their business.

The findings suggest that entrepreneurs who have a strong disposition in their decision to use an IS innovation will believe that they have the capability to use such an innovation. In other words, with confident entrepreneurs, they are able to acquire the skills and capability to use IS innovations, which would have greater impact on their intention to use an IS innovation. The findings suggest that precipitating events (displacement) will disrupt entrepreneurs' inertia and induce a change in their behavior, encouraging them to seek the best opportunity available. These precipitating events can be positive (e.g. new contract, new customer, market change, international opportunity, availability of IS innovation) or negative (e.g. declining profit, government policy, financial crisis, rising cost), and that the high or low impact levels of these precipitating events serve to encourage entrepreneurs to consider available alternatives on the best way to use IS innovations so that they are able to compete, survive, or gain benefit in their job performance.

5.1 Theoretical contributions

This study has several important theoretical contributions. The main theoretical contribution is in improving UTAUT for the entrepreneur technology adoption and use context. Since UTAUT was originally developed to explain employee technology acceptance and use, it will be critical to examine how it can be extended to other contexts (Venkatesh *et al.*, 2012). This study extends the knowledge on IS adoption

behavior research by integrating two behavior models (UTAUT and EPM). The new model (TADU) is also able to measure individual, technological, and environmental factors related to technology adoption and use behavior. Most importantly, TADU is able to capture the effect of external factors in the relationship between behavior intentions and use behavior, which are relatively important in the context of entrepreneurs. Second, this study attempts to mitigate the limitations arising from the relationship between behavioral intention and use behavior (intention-behavior gap) from the UTAUT model.

Third, this study extends the notion of individual perception, with regards to perceived feasibility, desirability, and propensity to act. Including these constructs in the IS adoption model provides a framework with more power and capability to measure technology adoption. Furthermore, the TADU points to the importance of the volitional aspect of entrepreneurs' behavior on the relationship between individual factors and intention to use. The finding of this study support prior studies in that it is hard to envision well-formed intention without some level of propensity to use by adopters, whereby the adopters must have the desire to gain control by taking action.

5.2 Practical contributions

This study provides new information to policy makers (i.e. government agencies) and educational leaders (i.e. business associations, business communities, business groups) that may be useful in understanding entrepreneurs' behavior and adoption of IS innovations. Based on Roger's (2003) work most individuals evaluate an innovation through subjective evaluation of near-peers who have adopted an innovation and not on the basis of scientific research. Therefore government could encourage entrepreneurs as early adopters to adopt and use IS innovations in their business while others look to early adopters and would follow them, thus increase the rate of adoption and use of IS innovations. This study may be able to assist policy makers and managers who want to increase use of IS innovations by turning their efforts to entrepreneurs who are ready to change their work situation, or career perspective. This study may assist policy makers in viewing entrepreneurs as pioneers when policy makers introduce new technology in the market. The policy makers can consider selected entrepreneurs as a target sample in the first phase of IS adoption to get the entrepreneurs' attention. Once, they are able to convince and successfully encourage these selected entrepreneurs to use IS innovations, they can be role models to other entrepreneurs, the selected entrepreneurs would indicate feasibility issues and the satisfaction that can be derived from using the system. Furthermore, understanding the effect of external factors (such as personal, political, or economic events) will enable policy makers to provide the appropriate guidance and counseling. This information is useful for a policy maker who designs special plans for economic growth and enhance IS innovation usage. When policy makers or developers want to implement new IS innovations they should consider the attractiveness of such innovation for entrepreneurs. Even though a new Information System may be useful and easy to use, if it is not attractive for users they would not be interested in using it. For example, the results of this study revealed that during a market crisis, entrepreneurs will focus more on their survival in the market, and will not be concerned about using new technology in their companies.

Entrepreneurs are usually small businesses that greatly depend on doing business with government agencies and large organizations. Most of them (i.e. government agencies and large organizations) would introduce and impose a new system to their

small businesses partners when conducting their business activities. Subsequently, these entrepreneurs may have to adopt and adapt to the system being imposed or introduced. Therefore, before imposing the new system to these entrepreneurs, these policy makers (government agencies and large organizations) need to organize workshops or seminars to their small business partners. The workshops and seminars could be about educating entrepreneurs on the benefits of using the system, as using the system would increase entrepreneurs' probability of getting new tenders or contracts, thus creating the attractiveness of using the system. At the same time, during these workshops and/or seminars, the policy makers can demonstrate the use of the system to create confidence and enhance the skills and knowledge of the entrepreneurs about the system. With demonstrations the entrepreneurs would be comfortable and are more likely to use the system. The policy makers can also provide training for entrepreneurs on the use of IS innovations and/or be tutored on how to apply this knowledge in their job.

5.3 Future research

Future research will be necessary to validate the findings of this study, i.e. by applying the TADU model in different contexts or cultures. It will provide the opportunity to test the robustness of the model across cultural boundaries. Future research should expand the findings of this research to other theories, which examine the relationship between intention and behavior, and include longitudinal studies to identify and measure if there is any effect of external factors on an individual's intention to use behavior. Longitudinal research is necessary to verify if behavioral intention changed over time due to external factors (precipitating events) and their effect on use behavior. Considering propensity to act as the mediating variable and replacing it with behavior intention would be another door for future research, as previous researchers consider it as an independent and moderating variable; however, this variable has the ability to be the mediating variable as well. Future researchers should examine the role of uncertainty avoidance because the implementation of innovation is likely to be accompanied by uncertainty, and this is a very interesting topic in the entrepreneurship context as well.

6. Conclusions

This study proposes the integrative TADU model based on two existing models: UTAUT and EPM to explain IS adoption and use behavior by entrepreneurs. Combining these two models enables a coherent and consistent explanation for interpreting and understanding IS adoption behavior by entrepreneurs that possess both organizational and individual perceptions and attitude. The integrative TADU model has six core determinants toward IS adoption behavior of entrepreneurs: performance expectancy, effort expectancy, social influence, perceived desirability, perceived feasibility, and facilitating conditions, along with four moderators: gender, age, propensity to use, and precipitating events. The results demonstrated the importance of these factors in influencing intention to use and use behavior in the UTAUT model. TADU model was validated in the context of technology acceptance, and the results showed that the model has the ability to predict an entrepreneur's intention to use IS innovations. The integrated model is able to account for 84.4 percent of the variance in intention, which is impressive and relatively high. Overall, the findings of this study significantly enhance our understanding of entrepreneurs' technology adoption and use behavior, and the determinants that they employ when they want to use new technology.

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Appendix 1

Variables	Sources	Factor loading	Cronbach's α
Performance expectancy			
I find the IS innovation to be useful in my business	Venkatesh *et al.* (2003)	0.813	0.916
Using the IS innovations enable me to accomplish tasks more quickly		0.872	
Using IS innovation increase my productivity		0.890	
Using IS innovation, increase my chances of getting more benefit in my business		0.892	
Using IS innovation gives me competitiveness power in my business		0.838	
Perceived desirability			
Using IS innovation in my business is much more desirable for me	Krueger (1993)	0.797	0.929
I would enjoy the personal satisfaction of using IS innovation in my business		0.844	
Using IS innovation would increase quality of work in my business		0.836	
Using IS innovation in my business is an attractive idea		0.863	
I am very enthusiastic to use IS innovation in my business		0.843	
The success of my business lies in the use of IS innovation		0.758	
Using IS innovation would result in a more relax working environment in my business		0.756	
Perceived feasibility			
I am able to use the IS innovation even if there is no one around to show me how to use it	Krueger (1993)	0.677	0.929
I would feel comfortable using IS innovation in my business		0.836	
I have the skills and capabilities required to use IS innovation		0.820	
I am confident I can put in the effort needed to use new IS innovation in my business		0.876	
It would be very practical for me to use new IS innovation in my business		0.905	
It would be very feasible for me to use IS innovation in my business		0.882	
Social influence			
People who influence my behavior think that I should use the IS innovation in my business	Venkatesh *et al.* (2003)	0.708	0.885
People who are important to me think that I should use the IS innovation in my business		0.819	
The IT expert in the business has been helpful in the use of the IS innovation in my business		0.735	
In general, the whole organization has supported the use of the IS innovation in my business		0.855	
Propensity to act			
I will learn to operate IS innovation in my business	Krueger (1993)	0.718	0.934
I will use IS innovation to achieve more opportunity in my business		0.812	

(*continued*)

Table AI.
Factor loading and Cronbach's α value for each construct

Variables	Sources	Factor loading	Cronbach's α
I will use IS innovation because I cherish the feeling of a useful service		0.880	
I will use IS innovations that enable me to run my business successfully		0.722	
Use behavior			
On average, in an ordinary day, how long do you use IS innovation (new purchase) in your business?	Venkatesh *et al.* (2008)	0.780	0.854
On average, how frequently, do you normally use the IS innovation in your business?		0.889	
On average, how much time do you spend on newly purchased IS innovation in your business, in a day?		0.778	
Effort expectancy			
My interaction with the IS innovation would be clear and understandable	Venkatesh *et al.* (2003)	0.796	0.901
It would be easy for me to become skillful at using IS innovation in my business		0.854	
Learning to operate the IS innovation is easy for me		0.887	
I would find the related IS innovation easy to use		0.866	
Facilitating condition			
I have resource necessary to use the IS innovation in my business	Venkatesh *et al.* (2003)	0.824	0.847
I have the knowledge necessary to use the IS innovation		0.845	
There is external/internal support group available for assistance with IS innovation difficulties		0.824	
New innovation is not compatible with other IS systems I use		0.678	
There are special allocations (i.e. loan, intensive) for using IS innovation for entrepreneurs, from government		0.682	
Intention to use			
I predict I would use IS innovation, if it is available in the future	Venkatesh *et al.* (2003)	0.773	0.924
My personal philosophy is to do whatever it takes using IS innovation in the future		0.848	
I have very seriously thought of using IS innovation in my business if it available, in next 2 months		0.881	
I plan to use current IS innovation in my work in the next year		0.876	
I intent to use similar IS innovation technology in the future		0.846	
Precipitating events			
If you experience any changes in your work situation (e.g. being offered a big contract, declining profit, availability of financial resource, new investment, rising cost, new product), how much have these changes influenced your decision in using IS innovation?	Krueger and Brazeal (1994), Schindehutte *et al.* (2000)	0.785	0.861
If you experience any change in your work environment (e.g. government policy, financial crisis, customer or new		0.875	

Table AI. (*continued*)

Variables	Sources	Factor loading	Cronbach's α
market, supplier request, industry or market change, declining market share), how much have these changes influenced your decision in using IS innovation?			
If you decided to change your work situation, due to recent opportunity or lack of opportunity (e.g. competitive nature of environment, competitor threat or action, strategic growth target, perception of increasing risk, attract new customer, international opportunities), how much have these assessments influenced your decision in using IS innovation?		0.844	
If you experience any technical change in your work environment (e.g. availability of IT innovation, technological change, new technology in accounting practice, availability of online system), how much have these changes influenced your decision in using IS innovation?		0.744	

Table AI.

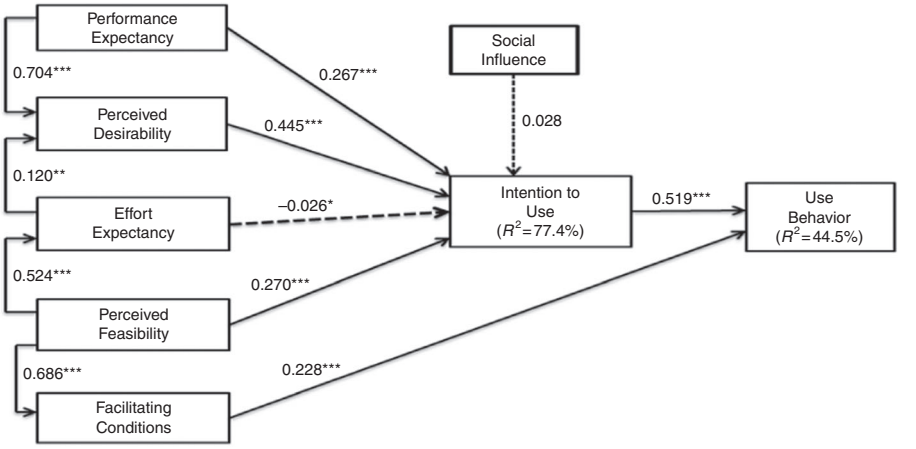
Appendix 2

Relationship among determinants of IS adoption

Davis (1989) argues that if individuals perceive an innovation to be useful, they would be more interested to use it and that innovation will most likely be adopted. Therefore his study expects the performance expectancy has an influence on perceived desirability toward intention to use. We examined the effect of performance expectancy on entrepreneurs' perceived desirability and findings indicate that there is a positive and significant relationship between performance expectancy of IS innovation and entrepreneur's desirability to use it. The effect of effort expectancy on perceived desirability toward intention to use IS innovation is also examined and findings indicate that there is a significant and positive relationship between effort expectancy and perceived desirability of IS innovation. This study expects that entrepreneurs perceived feasibility will affect effort expectancy and facilitating conditions of IS innovation adoption. IS researchers state that self-efficacy is a factor that precedes ease of use, which then influence intention to use IS innovation. Findings indicate that both paths from perceived feasibility to effort expectancy and to facilitating conditions were positive and significant (Figure A1).

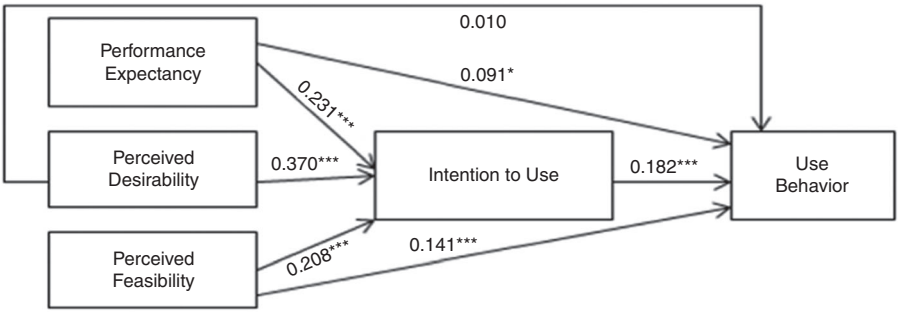
Mediating effect of intention to use

This study assesses whether intention to use mediates the relationship between perceived desirability, performance expectancy, and perceived feasibility toward IS innovation use behavior. Subsequently, the direct and indirect effect of perceived desirability, performance expectancy, and perceived feasibility are tested on use behavior through bootstrapping using AMOS. The results reveal that the direct effect of perceived desirability to use behavior is not significant, and that intention to use fully mediates the effect of perceived desirability on use behavior. The results also reveal that perceived feasibility and performance expectancy have significant direct effects on intention to use, and at the same time, the links between perceived feasibility and performance expectancy to use behavior are mediated by intention to use and are significant. Thus, contrary to perceived desirability, intention to use partially mediates the relationships between perceived feasibility and performance expectancy to use behavior of IS innovation by entrepreneurs (Figure A2).



Notes: *$p<0.5$; **$p<0.01$; ***$p<0.001$

Figure A1.
Relationship among determinants of IS adoption



Notes: *$p<0.5$; ***$p<0.001$

Figure A2.
Mediating effect of intention to use

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