

# Key Drivers for Women in Technology Entrepreneurship: Insights from Saudi Arabia

Completed Research Paper

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## Abstract

*IT entrepreneurs represent a valuable source to the societies. They prompt socio-economic growth, and innovation. Despite the increasing awareness of this importance, evidence indicates that women engagement in technology entrepreneurship is scant, which has received limited attention in both information systems and female entrepreneurship literature. Drawing on the theory of planned behaviour, this research highlights the existing gap by analyzing influential aspects that affect the decision-making process of women tech-entrepreneurs in the Saudi context. Hypotheses were tested using survey data that has been collected from different Saudi female public universities as well as technology incubators, and entrepreneurship programs. Findings from PLS support the core entrepreneurial intention model and highlight the important role of traditional determinants of intention. In addition, the research findings highlight and contribute a new understanding of the value of IT factors for women in increasing their entrepreneurial intention and subsequent decisions, actions, and outcomes.*

**Keywords:** Technology Entrepreneurship, Female Entrepreneurship, Entrepreneurial Intentions, Innovation, Saudi Arabia

## Introduction

Over the past decades, the revolution of information technology (IT) began to transform the society, economy, and industries world-wide. This transformation has involved waves of technological innovations that have been utilized by IT entrepreneurs who take advantage of the associated new opportunities. As a result, IT entrepreneurs have been contributing significantly to socio-economic growth, job creation and providing innovative products/services (Aleidi and Chandran 2018a; Marvel and Lumpkin 2007; Mosey et al. 2017). According to Agarwal and colleagues (2007, p. 11), "in the past decade...the business climate has been characterised by considerable IT-based entrepreneurial activity and innovation, driven largely by the capabilities offered by new information technologies" (Agarwal et al. 2007). Drawing upon rich and multiple traditions of research, technology entrepreneurship is established from two related fields: entrepreneurship and technological innovation (Beckman et al. 2012; Mosey et al. 2017; Shane and Venkataraman 2003). Building from studies in entrepreneurship, technology entrepreneurship is a multi-dimensional and complex phenomenon that involves a variety of actors and different levels of analysis (Gartner 1985). Commensurate with technological innovation, novel technological opportunities can be identified and exploited by entrepreneurs through new business creation (Marvel and Lumpkin 2007; Mosey et al. 2017). One of

the major areas of technology entrepreneurship research is entrepreneurial behaviour (Chen 2013; Chen 2014; Marvel and Lumpkin 2007). This method allows researchers to examine and investigate how IT entrepreneurs acted, why they acted as an IT entrepreneur, and what occurred when they acted (Chen 2014; Stevenson and Jarillo 2007).

Despite the contemporary significance of technology entrepreneurship, however, evidence indicates that women tech-entrepreneurs are heavily underrepresented (Aleidi and Chandran 2017; Ezzedeen and Zikic 2012; Hampton et al. 2009; Hampton et al. 2011; Marlow and McAdam 2012; Mayer 2006; Ozgen and Sanderson 2006). From the foregoing studies, they unanimously agreed that female contribution in technological entrepreneurship and innovation, continue to be at a lower rate than male counterparts. It has been argued that science, technology, and innovation have been associated with a strongly masculinized culture, which resulted in making such fields less attractive for women. Despite these facts, the current literature shows a paucity of research in women's technology entrepreneurship. Specifically, in areas such as information systems and female entrepreneurship disciplines, the study of women's IT entrepreneurship from a behavioural perspective is ignored (Chandran and Aleidi 2019; Martin and Tiu Wright 2005). Furthermore, the existing literature shows that innovation, technology and women's entrepreneurs are rarely discussed in the same context, though each has a vital value for human and economic growth. Although some of previous studies have attempted to examine specific aspects to understand women entrepreneurs at the IT level, most of these studies have chosen to focus on the barriers of women IT entrepreneurs setting up new business (Ezzedeen and Zikic 2012; Hampton et al. 2011; Marlow and McAdam 2012). The primary focus and central argument developed in this study note is that behind IT entrepreneurial action is an intention, and women shape that intention within various influences arising from an individual, social and IT context. Yet, extant research has not examined how these aspects collectively form women's intentions and subsequent the actual behaviour. This study, therefore, aims to provide an empirical evidence to answer the current research questions: (1) What role do attitude towards entrepreneurship, entrepreneurial self-efficacy and subjective norms play in the explanation of women's IT entrepreneurial intention in the Saudi context? (2) How do technological factors identified by IS literature impact women's IT entrepreneurial intention in the Saudi context?

The research constructs have been positioned by drawing upon the theory of planned behaviour (TPB) and the literature on IS and female entrepreneurship to establish a model of women's IT entrepreneurial intention to understand the phenomenon in which little is yet known such as female IT entrepreneurial behaviour in developing countries such as Saudi Arabia. Understanding how intention is formed and what influences an individual's specific intention to engage in technology entrepreneurship and innovation, better guidance can be a new driver of IT entrepreneurial behavior among women. The women's IT entrepreneurial model developed in this study is one-step towards this direction. More precisely, the current research model is a continuation of previous studies that attempt to answer a set of questions related to the current study context (e.g. Aleidi and Chandran 2017; Aleidi and Chandran 2018a; Chandran and Aleidi 2018; Chandran and Aleidi 2019). Restricting this study only to the Kingdom of Saudi Arabia has been chosen due to the following justifications. Firstly, as important components of promoting a knowledge-based economy, the Kingdom has witnessed growth attention in technological innovations and entrepreneurship, which derives from the paradox of a highly advanced innovation environment and decreasing rates of entrepreneurial activity at the same time. Moreover, an increase of social and economic advancement of the women status in the Kingdom could be observed.

## **Literature Review**

### ***Technology Entrepreneurship***

Over the past decade, the phenomenon of technology entrepreneurship has attracted the interest of academic researchers and policymakers due to its significant influence upon development. As a starting point, previous studies distinguish technology entrepreneurship from traditional entrepreneurship by its characterization of technical innovations and the nascent markets, which are driven largely by novel services or products offered by new technologies (Agarwal et al. 2007; Beckman et al. 2012). Based on multiple traditions of research, technology entrepreneurship is established from two related fields:

entrepreneurship, which can be simply defined as the emergence of new firms, and technological innovation. In this area, researchers often link theories from various views to both achieve an explanation of the principal entrepreneurial phenomena and advance the fundamental theories with insights from the actual dynamic context of technology entrepreneurship (Beckman et al. 2012; Dutta et al. 2015).

Technology entrepreneurship has been studied from different perspectives. A number of previous studies have considered and explored diverse and broad aspects such as the IT entrepreneur, entrepreneurial behaviour, social, institutional, and contextual factors, the technology venture and support organizations such as university incubators, and accelerators (e.g. Chen 2013; Chen 2014; Dutta et al. 2015; Gaba and Bhattacharya 2012; Marvel and Lumpkin 2007; Shane and Venkataraman 2003; Sine and David 2003). According to Chen (2014), one of the main areas of technology entrepreneurship research is entrepreneurial behaviour. The behavioural method allows researchers to examine and investigate individual entrepreneurial behaviour in business process and operation. The author argued that IT entrepreneurs have distinctive behavioural characteristics and antecedent constructs. In addition, their entrepreneurial behaviour is highly related to their technology knowledge, skills and beliefs. From these perspectives, Chen (2013) has examined empirically IT entrepreneurial behaviour among university students. His findings show that students' IT entrepreneurial intention is influenced directly by students' expected outcomes, social influence, and entrepreneurial self-efficacy. Similarly, Dutta and colleagues (2015) have demonstrated that personal innovativeness with IT as well as related knowledge and experience in technological industries act as key drivers for entrepreneurial intentions in such industries. Moreover, Marvel & Lumpkin argued that the human capital attributes of technology entrepreneurs enable them to create the breakthrough insights that lead to radical innovations. According to their findings, formal education and prior knowledge of technology were vital to the innovation outcomes of technology entrepreneurs.

### ***Entrepreneurial Behaviour***

From the perspective of entrepreneurship, there are two ways to study behaviour. The first method is to measure a behaviour directly (Stevenson and Jarillo 2007). The second method is to measure the behaviour indirectly, utilizing common behavioural intention, which has been widely adopted in entrepreneurship and information systems literature (Aleidi and Chandran 2018a; Autio et al. 2001; Chen 2013; Chen 2014; Dutta et al. 2015; Liñán and Chen 2009). Entrepreneurial intention helps to explain the reasons, which lies behind an individual's decision to start a business, as Krueger (2007) emphasizes, "behind entrepreneurial action are entrepreneurial intentions" (Krueger 2007, p. 124). According to Krueger et al, (2000), intentions have proven the best predictor of planned behaviour, particularly when that behavioural is rare, hard to observe, or involves unpredictable time lags (Krueger et al. 2000). This applies to female IT entrepreneurship in the Saudi context whereas the women's IT entrepreneurial behaviour is a recent phenomenon, and the factors contributing to the research problem were generally unknown. In addition, a growing body of research in information systems have found great success using intention-based models in practical applications to study behavioural intention in the IT context. As a result, the behavioural intention theory is used in this current study to explain women's IT entrepreneurial intention as a predictor to perform IT entrepreneurial behaviour. This selection, as previously argued, is justified by its acceptance and generalized use to explain entrepreneurial intentions in different areas and contexts.

Ajzen's (1991) theory of planned behaviour (TPB) is the most widely applied model of general behaviour for the study of entrepreneurship. It has been successfully applied in predicting and explaining intentions to perform behaviours (Autio et al. 2001; Chen 2013; Chen 2014; Díaz-García and Jiménez-Moreno 2010; Kolvereid 1996; Krueger et al. 2000; Liñán and Chen 2009) among others. According to the TPB, entrepreneurial intention illustrates the effort that is required from individuals to acquire the entrepreneurial behaviour (Krueger, Reilly & Carsrud 2000). And so, it is considered to be influenced by three antecedents. Firstly, an individual's attitude refers to the degree to which the individual has a positive or negative evaluation about willingness to be an entrepreneur (Kolvereid 1996). Secondly is subjective norms, which measure the perceived social pressure from reference people including family, friends or significant others to perform the entrepreneurial behaviour

(Díaz-García and Jiménez-Moreno 2010). Finally, it is the degree of perceived behavioural control, which refers to the perceived ease or difficulty to perform a given behaviour (Díaz-García and Jiménez-Moreno 2010). As Ajzen (1987) points out, this construct is similar to the construct of perceived self-efficacy (Boyd and Vozikis 1994; Díaz-García and Jiménez-Moreno 2010). Both concepts reflect one's perceived ability to achieve a particular goal or behaviour (Ajzen 1991; Boyd and Vozikis 1994; Díaz-García and Jiménez-Moreno 2010).

### ***Women Entrepreneurs in Saudi Arabia***

In recent years, Saudi Arabia has witnessed strong growth in entrepreneurship in general and more specifically in female entrepreneurship. Although, women are traditionally restricted to join the economic field for a long time (Almobaireek and Manolova 2013) there is a quantum leap of women status in this area, driven largely by changing the direction of the Saudi government to support women's empowerment and gender equality (Chandran and Aleidi 2019). According to Global Entrepreneurship Monitor 2016, the male rate of participation in the early-stage entrepreneurial activity (TEA) is 12.9% and the female rate 9.7% in the Saudi context. Although participation in TEA has been increasing across both genders, women have been rapidly closing the gap since 2009 (Aleidi and Chandran 2018a). The Saudi government has launched many entrepreneurship initiatives in an effort to support the entrepreneurial culture, develop entrepreneurial leadership among Saudi youth, and enhance women's role in the labor force and economic sector through entrepreneurship leadership. For example but is not limited to, Aramco Entrepreneurship Center, and Badir Program from the scientific organization of King Abdulaziz City for Science and Technology ((Aleidi and Chandran 2018a). More recently, Vision 2030, which is a recent policy view of Saudi government marks a new phase in the development by promoting and supporting Small and Medium Enterprises (SMEs) to create suitable job opportunities for Saudi citizens as well as increasing women's participation in the workforce (Chandran and Aleidi 2018). It aims to support the Kingdom's sustainable development in the light of global trends that focus on technology, and innovation in the knowledge-based economy. In this regard, Misk, which is inspired by the vision, provides a variety of fellowship and traineeship programs for women to support the government's efforts in achieving the Kingdom's Vision 2030, which encompasses the improvement of women's participation as well as capacity building and empowerment in order to increase their contribution to the development (Misk 2018).

### **Research Model and Hypotheses Development**

A research model has been developed based on relevant research and current empirical studies to investigate the factors that will affect women's IT entrepreneurial intention and subsequent behaviour in the Saudi context. Two major streams of literature provide the theoretical foundations for this research. Firstly, the literature on entrepreneurial behaviour with particular emphasis on female entrepreneurship literature. This illustrates the role of entrepreneurial intention as well as its antecedents including attitude towards entrepreneurship, entrepreneurial self-efficacy, and subjective norms. Secondly, the literature on IS, elaborating the role and importance of three context-specific factors, including computer self-efficacy, personal innovativeness in IT and related knowledge and experience in technology as key drivers of behavioural intention in technology entrepreneurship.

#### ***Hypotheses Development***

*Attitudes towards entrepreneurship* (ATE) refer to the degree to which an individual has a positive or negative personal evaluation about willingness to be an entrepreneur (Liñán and Chen 2009). The direct impact of ATE on entrepreneurial intentions has been commonly reported in the previous research (Ajzen 1991; Autio et al. 2001; Díaz-García and Jiménez-Moreno 2010; Kolvereid 1996; Lüthje and Franke 2003). ATE influences the development of women entrepreneurial intention and assessed as inside dimensions of the individual to perform the actual behaviour (Aleidi and Chandran 2018b). Accordingly, the following hypothesis is proposed:

***H1: A favourable attitude towards entrepreneurship influences positively women's IT entrepreneurial intention.***

*Entrepreneurial self-efficacy* (ESE) refers to the strength of an individual's belief that he/she is capable of successfully performing the roles and tasks of an entrepreneur (Boyd and Vozikis 1994). Entrepreneurial self-efficacy is a key factor that influences individuals' belief and entrepreneurial decisions (Boyd and Vozikis 1994; Chen et al. 1998; Wilson et al. 2007; Zhao et al. 2005). ESE has also been confirmed as a most critical antecedent to the formation of women's entrepreneurial decision (Austin and Nauta 2015; Palmer et al. 2015; Wilson et al. 2007; Zhao et al. 2005). However, researchers found that, compared with men, women more frequently have a reduced perception of their own entrepreneurial skills, regardless of their real skills (Chen et al. 1998; Koellinger et al. 2013; Noguera et al. 2013; Wilson et al. 2007). Research on gender aspects in entrepreneurship has recently focused their attention on the perceptions of female entrepreneurs' abilities and skills from the point of view of society (as society perceives the entrepreneurial skills of women), and from the perspective of female entrepreneurs themselves. Previous studies have shown that, compared with men, women more frequently have a reduced perception of their own entrepreneurial skills, regardless of their real skills, especially in the sectors considered to be traditionally male such as technical business (Chen et al. 1998; Koellinger et al. 2013; Noguera et al. 2013; Wilson et al. 2007). This results in a negative perception of women's entrepreneurial intentions and subsequent lower levels of entrepreneurial behaviour (Wilson et al. 2007; Zhao et al. 2005). Additionally, there is evidence that women are more likely than men to limit their career choice and interests due to their low perception of the necessary skills and capabilities (Wilson et al. 2007). Similar studies have suggested that some women may not utilize opportunities to become entrepreneurs because, compared to men, they tend to have lower entrepreneurial self-efficacy (Austin and Nauta 2015; Kelley et al. 2012; Zhao et al. 2005).

Wilson and colleagues (2007) have examined the relationships between gender, entrepreneurial self-efficacy, and entrepreneurial intentions for two sample groups: adolescents and adult master of business administration (MBA) students. The authors have found empirical evidence that both groups showed strong gender effect and lower rates of female entrepreneurial self-efficacy and entrepreneurial intention than their male counterparts. On the other hand, Palmer and colleagues (2015) have found that the relationship between gender and entrepreneurial intentions was reduced when self-efficacy was considered (Palmer et al. 2015). Similarly, other authors confirmed that women entrepreneurs with a high level of self-efficacy significantly influences innovative behaviour compared to women entrepreneurs with low self-efficacy (Babalola 2009).

Bandura (1986) indicates that self-efficacy causally influences expected outcomes of behaviour, but not vice versa (Bandura 1986; Chen 2013). Whereas the expected outcomes construct is linked to the attitude in Ajzen's theory of planned behaviour (Krueger et al. 2000). In addition, it is reasonable to suggest that women who exhibited higher beliefs regarding their capabilities, their motivation and attitudes toward entrepreneurship will be stimulated and increased specifically when these women show a poor level of entrepreneurial attitude. Accordingly, this study proposes the following hypotheses:

**H2a:** *Entrepreneurial self-efficacy influences positively women's IT entrepreneurial intention.*

**H2b:** *Entrepreneurial self-efficacy influences positively attitude toward entrepreneurship.*

The subjective norms construct refers to a perception of social pressure to carry out or not carry out entrepreneurial behaviors (Liñán and Chen 2009). There is considerable support in the literature regarding the importance of the subjective norms perception on individual's intention and behaviour. A favorable perception of the subjective norms is related positively to entrepreneurial intention; the higher the perceived social pressure, the higher the entrepreneurial intention will be (Díaz-García and Jiménez-Moreno 2010; Kolvereid 1996). From a gender perspective, it is important to analyse the influence of the social perception on women behavioral intention in the IT context, as has been argued that women tend to be more concerned about the environment and public opinion on the formation of the intention to perform a specific behaviour. This proposition is consistent with Venkatesh & Morris's (2000) assertion that women are strongly influenced by subjective norms perceptions toward IT adoption and usage behaviour (Venkatesh and Morris 2000). Accordingly:

**H3:** *Subjective norms influence positively women's IT entrepreneurial intention*

*Computer self-efficacy* (CSE) refers to individual's beliefs and judgments of their capabilities to use computer in different situations (Compeau and Higgins 1995). Individuals with a higher CSE have higher and positive perceptions of IT and IT usage intentions (Chen 2013; Chen 2014; Lewis et al. 2003). He and Freeman (2010) have found that CSE beliefs can have an effect on behavioural intention through computer attitude (He and Freeman 2010). Furthermore, Chen (2013; 2014) demonstrated that CSE has a direct and positive impact on ESE, which in turn influences entrepreneurial intention. Therefore, it is reasonable to consider that CSE as an antecedent to attitude towards entrepreneurship and entrepreneurial self-efficacy in the IT context. More importantly, CSE can be helpful in reducing the effects of low self-efficacy of women as previous studies show that compared to men, women have a low perception of their own entrepreneurial skills, regardless of their real skills, particularly in sectors that are seen traditionally as male domains (Noguera et al. 2013; Wilson et al. 2007; Zhao et al. 2005). This conclusion is in line with a finding, which shows that users who possess high CSE are more likely to form positive perceptions of IT and IT usage intentions (He and Freeman 2010; Venkatesh 2000). Based on the arguments explored above, the following hypotheses were proposed:

**H4a:** *Computer self-efficacy positively influences women's ATE.*

**H4b:** *Computer self-efficacy positively influences women's ESE.*

*Personal innovativeness* (PIIT) represents "the willingness of an individual to try out any new information technology" (Agarwal and Prasad 1998, p. 3). A considerable amount of information system literature has demonstrated that personal innovativeness with IT "PIIT" is associated with IT adoption and usage (Agarwal and Prasad 1998; Agarwal et al. 2000; Chen 2014; Dutta et al. 2015; Lewis et al. 2003). From an IT perspective, entrepreneurs highly depend on technology innovation and entrepreneurial opportunities to create new knowledge-intensive enterprises, and new technologies (Chen 2014; Dutta et al. 2015). Researchers have found that PIIT has an indirect influence on IT entrepreneurial intention through attitude towards entrepreneurship and self-efficacy. As was argued earlier in the literature review, women tend to have lower self-efficacy than men (Koellinger et al. 2013; Wilson et al. 2007; Zhao et al. 2005); however, the impacts of PIIT on entrepreneurial intentions and behaviour may not be as effective for men as for women. In the other words, it is reasonable to expect that PIIT could play a critical role in the development of entrepreneurial self-efficacy as well as the poor attitude toward IT entrepreneurship for women. This proposition confirms previous studies showing that individual with high PIIT will improve his/her ability, motivate him/her to incubate technological innovation and look for ways it could be deployed to transform technology innovation into a market opportunity (Chen 2014; Dutta et al. 2015). Accordingly:

**H5a:** *Personal innovativeness in IT positively influences women's ATE.*

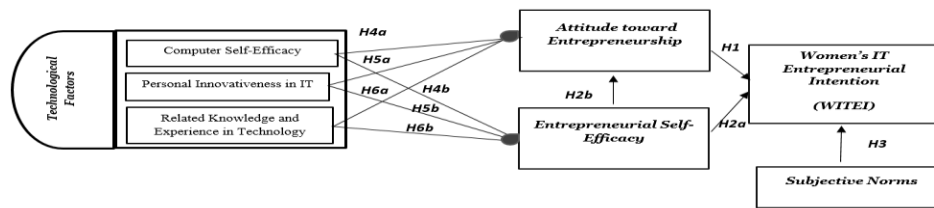
**H5b:** *Personal innovativeness in IT positively influences women's ESE.*

*Related knowledge and experience* (RKE) in IT become important with regards to the development of IT entrepreneurial intention. Both concepts influence individual's behaviour in the context of IT entrepreneurial products or services (Dutta et al. 2015; Marvel and Lumpkin 2007). Individuals with a high level of RKE will enable individuals to connect the previous relevant knowledge with the new knowledge, which in turn helps to identify and develop opportunities at the intersection (Dutta et al. 2015; Marvel and Lumpkin 2007). Dutta and colleagues (2015) who have demonstrated that RKE of the entrepreneur act as key drivers in virtual worlds' business, which positively influence the development of the perceived feasibility (equivalent to entrepreneurial self-efficacy) and the perceived desirability (equivalent to attitude). Individuals with a high level of RKE not only find IT-based industry attractive, but they also are able to utilize their knowledge and experience to identify experimenting with new technologies. In addition, following the social cognitive theory, RKE provides the most important source of information for the development of entrepreneurial self-efficacy (Zhao et al. 2005). Therefore, it is more reasonable to assume that RKE will be more helpful for women to strengthen their skills, and motivate them to engage in innovations and in entrepreneurial activities. Therefore, the following hypotheses were developed:

**H6a:** *Related knowledge and experience positively influence women's ATE*

**H6b:** Related knowledge and experience positively influence women's ESE.

Based on the above hypotheses, this study develops the following research model as shown in Figure 1.



**Figure 1. Research Model**

## Research Methodology and Data Analysis

### *Instrument Development and Data Sample*

This study applied a quantitative method to collect numerical data from respondents. It adopts previously validated instruments based on previous research in IS and entrepreneurship literature in order to ensure that survey items are adequate. Items of women's IT entrepreneurial intention, attitude and subjective norms were derived from a scale developed by (Liñán and Chen 2009), which is based on Ajzen's TPB. Items have been extensively used and validated in prior entrepreneurship studies. ESE was measured with (Cassar and Friedman 2009) instrument. CSE was measured with Compeau and Higgins' (1995) instruments. PIIT items were derived from a scale developed by (Agarwal and Prasad 1998). RKE items were derived from a scale developed by Venkatesh and colleagues. (2008) and have been used and validated in prior IS studies (Dutta et al. 2015). Items were framed to fit the scenario in the study. The survey was originally developed in English. A translated Arabic version has been included in the survey. All measurements used 5-point Likert scales.

Data was collected from different sources in order to achieve diversity. According to the literature, most studies of entrepreneurial intention have relied on student samples (Autio et al. 2001; Chen 2013; Chen 2014; Díaz-García and Jiménez-Moreno 2010; Kolvereid 1996; Liñán and Chen 2009; Zhao et al. 2005). There are basic reasons for selecting a students' sample. Firstly, according to Sexton and Bowman (1986), entrepreneurship students did not differ in a significant way from business owners in terms of conformity, energy level, interpersonal affect, social ability and risk aversion (Díaz-García and Jiménez-Moreno 2010). Similarity, Chen (2013-2014) stated that a large number of world-class IT companies are founded by technology entrepreneurs including college students and those graduated. Other authors show that university students are a dynamic segment of the population and, in the information age, they reflect the main source of entrepreneurial talent (Díaz-García and Jiménez-Moreno 2010). For this study, we surveyed a broad range of samples to increase the generalizability of undergraduate student populations to older graduates, as these would provide different levels of knowledge, experience, and perception. Hence, the sample consists of female university students in their last years, majoring in different disciplines including but not limited to students majoring in IT and other related areas as well as subjects related to business and management. Also, the sample includes female nascent entrepreneurs who are not entrepreneurs yet, but are pondering it and in the process of starting a business, which is therefore in line with the nascent entrepreneur profile (McGee et al. 2009). 520 participated in the online survey, and after removing incomplete responses, a total of 475 responses were used for data analysis. With respect to the female university students, data has been collected in large, public universities in Saudi Arabia, which are Princess Nourah Bint Abdulrahman in Riyadh, which is the largest university for women in the world, female colleges at King Saud University in Riyadh, and female colleges of King Abulaziz University in Jeddah. To identify the nascent entrepreneurs, technology incubator, and entrepreneurship programs were targeted. This includes Badir Program for Technology Incubators, as well as King Salman Institute for Entrepreneurship that provides

education and training programs for entrepreneurship guidance. The demographics of the subjects are shown in Table 1.

**Table1. Sample Profile**

Variable	# of Subjetscs	Percentage %
<b>City</b>		
Riyadh	56	65
Jeddah	45	45
<b>Age</b>		
18-25	220	46
26-35	171	36
36-45	66	14
46 -60	16	3
60 or above	2	1
<b>Education Level</b>		
Bachelor's degree	310	56
Master's degree	143	30
Doctorate degree	13	3
Other	9	2
<b>Educational background</b>		
IT and related areas	239	50
Business and related areas	190	40
Other	46	10
<b>Work Experience</b>		
Have never worked	43	9
Less than one Year	89	19
1-3 Years	135	28
3-5 Years	167	35
More than 5 Years	41	9
<b>Entrepreneurial statuae</b>		
Nascent entrepreneurer	298	63
Nonnascent entrepreneurer	177	37

### **Statistical Techniques**

Partial Least Squares technique using the SmartPLS 3.0 has been adopted to analyse a complete survey dataset. The use of PLS has been a preferred analysis technique among IS researchers in recent years. It allows for the simultaneous assessment of structural model parameters and path coefficients (Chin et al. 2003). Moreover, the algorithm of PLS, which is variance-based rather than covariance-based SEM, allows the modeling of both reflective and formative indicators (Chin 1998; Chin et al. 2003), while covariance-based deals only with reflective variables (Henseler et al. 2009). In this study, the research model has both formative and reflective constructs. In addition, PLS is suited for predictive applications and theory building (Chen 2013; Chin 1998). It has also the ability to test the measurement model and the structural model. The measurement model technique is performed to test the relationships between observed variables (indicators) and their underlying latent variables (constructs). The structural model is used to test the hypothesized relationship among constructs by evaluating the significance of the path coefficients and their levels of significance and the R2 variance for the dependent constructs.

### **Reliability and Validity Assessment**

The data were first analysed for internal consistency, convergent validity and discriminant validity (Hair et al. 2011). Internal consistency is measured using Cronbach's alpha with the recommended value of 0.70 (Hair et al. 2011). Furthermore, convergent validity is measured using average variance extracted (AVE) and the composite reliability (CR), and the acceptable values of AVE are 0.50 and the CR should be greater than AVE (Hair et al. 2014). Discriminant validity is measured using the square root of individual AVE of each construct that should be more than any correlation between the latent variables (Hair et al. 2014). Subjective norm is modelled as a formative construct that cannot be assessed in this procedure. All the items loadings of reflective factors and the items weight of the formative construct were significant at p value < 0.05. Table 2 shows acceptable results of the factors reliability and validity assessment. In addition, Table 3 shows the subjective norms items weight.



**Table2. Reliability and Validity Assessment**

Factors	AVE	C ( $\alpha$ )	CR	CSE	PIIT	RKE	ESE	ATE	SN	WITEI
Computer Self-Efficacy (CSE)	0.61	0.74	0.80	<b>0.78</b>						
Personal Innovativeness in IT (PIIT)	0.63	0.77	0.83	0.58	<b>0.79</b>					
Related Knowledge and Experience in IT (RKE)	0.63	0.78	0.84	0.57	0.54	<b>0.79</b>				
Entrepreneurial Self-Efficacy (ESE)	0.63	0.74	0.84	0.46	0.65	0.31	<b>0.79</b>			
Attitude toward Entrepreneurship (ATE)	0.75	0.81	0.87	0.42	0.52	0.50	0.62	<b>0.86</b>		
Subjective Norms (SN)	NA	NA	NA	0.34	0.54	0.57	0.47	0.44	<b>0.83</b>	
Women's IT Entrepreneurial Intention (WITEI)	0.61	0.77	0.81	0.44	0.50	0.40	0.59	0.55	0.54	<b>0.78</b>

Notes:

- AVE: Average Variance Extracted, CR: Composite Reliability C ( $\alpha$ ): Cronbachs Alpha
- CSE: Computer Self-Efficacy; PIIT: Personal Innovativeness in IT; RKE: Related Knowledge and Experience in IT; ATE: Attitude towards Entrepreneurship; ESE: Entrepreneurial Self-Efficacy; SA: Subject Norms; WITEI: Women's IT Entrepreneurial Intention
- Diagonal elements are the square root of the AVE. Average variance extracted (AVE).

**Table 3. Subjective Norms Items Weight**

Social norms	Weights	p-value	VIF
SNS1	0.305	0.000	1.65
SNS2	0.156	0.002	1.62
SNS3	0.198	0.003	2.16

VIF: Variance inflation factor of all items < 5 and significant at the 0.05 level.

**Structural Model Testing**

In the second step, the proposed hypotheses are tested using the structural model results. The path coefficient is assessed using bootstrapping technique for two-tailed tests. The value of R<sup>2</sup> indicates the percentage of the variance explained by the dependent factors in the structural model. Table 4 and Figure 2 show the path testing.

**Table 4. Hypotheses Testing**

	Path	Path Mean	StDev	T-value	P-value	Supported?
<b>H1</b>	ATE-> WITEI	0.41	0.02	4.70	0.000*	Yes
<b>H2a</b>	ESE -> WITEI	0.33	0.03	2.43	0.000*	Yes
<b>H2b</b>	ESE -> EA	0.29	0.03	2.16	0.002**	Yes
<b>H3</b>	SN -> WITEI	0.51	0.02	1.99	0.000*	Yes
<b>H4a</b>	CSE -> ATE	0.29	0.03	3.10	0.001*	Yes
<b>H4b</b>	CSE -> ESE	0.21	0.04	1.98	0.003***	Yes
<b>H5a</b>	PIIT -> ATE	0.32	0.02	4.19	0.000*	Yes
<b>H5b</b>	PIIT -> ESE	0.22	0.04	3.12	0.000*	Yes

<b>H6a</b>	RKE -> ATE	0.21	0.03	2.01	0.003***	Yes
<b>H6b</b>	RKE -> ESE	0.10	0.05	2.22	0.002***	Yes
Notes:						
<ul style="list-style-type: none"> <li>• StDev: Standard deviation, Attitude towards Entrepreneurship; ESE: Entrepreneurial Self-Efficacy; CSE: Computer self-efficacy; PIIT: Personal innovativeness in IT; RKE: Related knowledge and experience;</li> <li>• * Significant at 0.001 level **, Significant at 0.01 level, *** Significant at 0.05 level</li> </ul>						

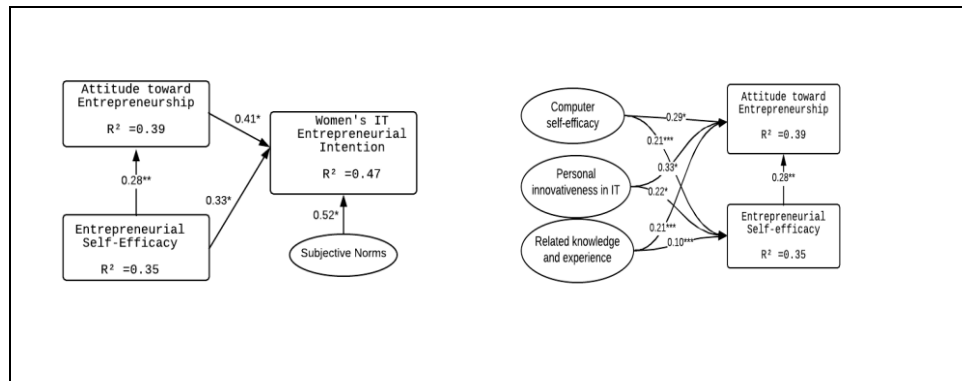


Figure 2. Path Testing

## Discussion

This study aims to examine factors that influence women's IT entrepreneurial intention and subsequent actual behaviour using the theory of planned behaviour. In accordance with the academic literature, the findings show that transferring technology innovation into a market opportunity or entrepreneurial project will be determined by the attractiveness that entrepreneurship has for the woman, the confidence about their ability to perform the entrepreneurial process as well as a positive perception of social pressure to carry out IT entrepreneurial behaviours. The findings have revealed that among the influential factors that have a direct effect on women is IT entrepreneurial intention and the likelihood of starting a new business is subjective norms, followed by attitude and lastly ESE. In addition, our findings show that a strong positive and significant correlation exists between IT factors and women's IT entrepreneurial intention indirectly. Overall, our analysis supports earlier research of IS and female entrepreneurship regarding women's IT entrepreneurship.

First, the attitude towards IT entrepreneurship emerged significant in the results. Therefore, H1 is supported, in which attitude influence the entrepreneurial intention directly (t value 4.70,  $p < 0.001$  and path coefficient of 0.41). Attitude contributes the strongest explanation towards the IT entrepreneurial intentions of women. In other words, women who have a high attitude toward entrepreneurship (e.g., high advantage expectations or high interest in technology innovation) are more likely to become IT entrepreneurs. Hence, given the current initiatives in the Kingdom that aims to increase the number of women entrepreneurs and inspire the innovators in them, an improvement of women's attitude is something that can be influenced and controlled. Moreover, the results also supported that the entrepreneurial self-efficacy (ESE) positively influences women's IT entrepreneurial intention in hypothesis H2a (t value 2.43,  $p < 0.05$ ). Our findings provide evidence that women formulate intentions to become IT entrepreneurs most directly because they are high in ESE, which is the belief that they can succeed in this position. These results further confirmed the prior finding that self-efficacy is a key determinant to behavioural intention in the entrepreneurial context (Boyd and Vozikis 1994; Chen et al. 1998; Krueger et al. 2000). More precisely, ESE has been proven as a most critical antecedent to the formation of women's entrepreneurial decision (Austin and Nauta 2015; Palmer et al. 2015; Wilson et al. 2007; Zhao et al. 2005). Moreover, ESE an indicator of the formation of individual's attitude, hypothesis H2b, is also found to be supported (t value 2.16,  $p < 0.05$ ). This findings are further confirmed previous studies indicating that self-efficacy causally influences attitude (Chen 2013; Krueger et al. 2000). Therefore, attitudes toward entrepreneurship will be stimulated if individuals exhibited higher beliefs regarding their capabilities. However, the effect of ESE on women's IT

entrepreneurial intention is stronger (path coefficient of 0.33) than the effects on attitude (path coefficient of 0.28). Furthermore, there was noteworthy finding regarding hypothesis H3. The subjective norms construct emerges as the most important antecedent of the intention for becoming tech-entrepreneurs (t value 1.99,  $p < 0.05$  and path coefficient of 0.52). The subjective norms have a strong and highly significant effect on the women's IT entrepreneurial decision and conviction in the Saudi context. This result is not surprising because some literature demonstrates that women did consider subjective influences in their decision making process specifically at the early stage of technology usage and adoption (Venkatesh and Morris 2000). Furthermore, it might be also expected that women's behaviour is influenced by the subjective norms received from people who are important to them, which is significant in a collectivistic culture, especially Saudi Arabia which is considered to have a high collectivistic culture. Hence, the likelihood of becoming IT entrepreneurs will be especially high if they are supported and encouraged by their societies (such as families and friends), which is in line with the findings of previous studies (Díaz-García and Jiménez-Moreno 2010; Kolvereid 1996).

Hypothesis H4a and H4b argued that computer self-efficacy (CSE) positively influences both women's attitude towards entrepreneurship and entrepreneurial self-efficacy. A sizeable amount of IS literature demonstrated that CSE is a key component of individual's behaviour in using the computer (Chen 2013; Chen 2014; Compeau and Higgins 1995; He and Freeman 2010; Lewis et al. 2003; Venkatesh 2000). CSE had a high statistical significance on attitude in H4a (t value 3.10,  $p < 0.001$ ) and on ESE in hypothesis H4b (t value 1.98,  $p < 0.05$ ), which is further confirmed by the previous literature. For instance, the findings are consistent with observations from the career development literature which demonstrates that CSE has a strong effect on attitude toward behavioural intention to select the management information system discipline for his/her future study and career (He and Freeman 2010). PIIT has been found to be positively impact the ATE in H5a (t value 4.19,  $p < 0.001$ ) and ESE in H5b (t value 3.12,  $p < 0.001$ ). This is not surprising, as PIIT is associated with IT adoption and usage, which is consistent with a significant body of findings in IS literature (Agarwal and Prasad 1998; Lewis et al. 2003), and more precisely in the IT entrepreneurial context (Chen 2014; Dutta et al. 2015). This finding confirms previous studies showing that a high PIIT increases an individual's ability and inspires him/her to incubate technological innovation. In addition, the study finding provides strong support for the robustness of PIIT at the IT level. Moreover, it provides a fuller understanding of this construct contributing to the development of women entrepreneurial intentions in the IT context. Finally, Hypotheses H6a and H6b suggest that related knowledge and experience in IT (RKE) positively influence women's attitude towards entrepreneurship and entrepreneurial self-efficacy. Both concepts influence an individual's behaviour in the context of IT entrepreneurial products or services (Dutta et al. 2015; Marvel and Lumpkin 2007; Zhao et al. 2005). The quantitative findings statistically supported that the RKE positively influence attitude toward entrepreneurship H6a (t value 2.01,  $p < 0.05$ ) and ESE H6b (t value 2.22,  $p < 0.05$ ). Hence, RKE is very significant with regards to stimulating women to be an entrepreneur at the IT level. This finding is in line with a growing body of research in information systems, which suggest that assimilation of new knowledge and technologies is facilitated when individuals have greater related knowledge (Fichman and Kemerer 1997; Lenox and King 2004). In addition, this finding is consistent with the empirical results showing that both concepts influence an individual's IT entrepreneurial behaviour (Dutta et al. 2015; Marvel and Lumpkin 2007).

According to the results, the order of path significance among technological factors that have significant effects on attitude toward entrepreneurship is PIIT (path coefficient of 0.33), followed by CSE (path coefficient of 0.29), and RKE (path coefficient of 0.21). In addition, regarding the same factors, the order of path significance that has significant effects on ESE is PIIT (path coefficient of 0.22) followed by CSE (path coefficient of 0.21) and RKE (path coefficient of 0.10). Therefore, PIIT can be viewed as the core value and the most likely enabler of women's IT entrepreneurial behaviour. In other words, women with higher PIIT are expected to develop a more positive attitude about technological innovation and a high level regarding their entrepreneurial skills and capabilities.

## **Conclusion and Implications**

Understanding IT adoption and usage behaviour has been widely discussed in the IS literature. This current study extended previous behavioural studies in the IS discipline to entrepreneurship. More

precisely, this current study focused on female IT entrepreneurship from a behavioural perspective. We find that in addition to traditional determinants of intention such as attitude toward entrepreneurship, and entrepreneurial self-efficacy and subjective norms, technological factors act as key drivers of women's IT entrepreneurial intention. This research offers several contributions. Firstly, it contributes to IS and female entrepreneurship literature by enhancing our understanding of aspects influencing decisions to create new business in IT-related industries. Practically, the IT entrepreneurial intention model developed in this study can provide a better picture of how intention is formed and what influences an individual's specific intention towards engaging in technological entrepreneurship and innovation. As such, the findings provided much-needed research on the existing literature of IS and female entrepreneurship. Furthermore, the current study provided evidence for the usefulness and applicability of the theory of planned behaviour in predicting and explaining entrepreneurial behaviour and enhanced the literature through its detailed results. More specifically, this study reconfirms the TPB in explaining the entrepreneurial intentions from the developing countries context in general and the IT female context in Saudi Arabia. From a practical perspective, our study also contributes to support Kingdom's new economic direction that aims to increase SMEs contribution to the economy, increase women's participation in the workforce and transferring the economic system from its oil-based economy to a knowledge-based economy through innovation and technology. Finally, like any research this study has limitations. The research model did not cover all aspects of the institutional environment that may affect entrepreneurial intention and subsequent behaviour. Furthermore, although, as explained earlier, the election of intentional theory is justified by their acceptance and generalized use to explain entrepreneurial intentions in different contexts and areas, we confirm that entrepreneurial intention is not the actual behaviour. Thus, this is an area for future research to consider the IT entrepreneurial behaviour as well. Moreover, applying the multi-group analysis would help to strength the results and help to address concerns relating to the generalizability of undergraduate student populations.

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