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Role of entrepreneurial motivation on entrepreneurial intentions and behaviour: theory of planned behaviour extension on engineering students in Pakistan

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Abstract

The purpose of this paper is to extend theory of planned behaviour (TPB) model by focussing on intention-action gap, which is considered by academic researchers as under-researched area. It further examines the moderating role of entrepreneurial motivation between intention and behaviour (action) to enhance predictability of TPB on senior level engineering students in Pakistan. Survey conducted with 448 engineering students from four major engineering institutions for data collection. Structural equation modelling (SEM) and partial least square (PLS) method has been employed for analysing PLS path modelling, hypotheses testing, mediation and moderation analysis. Results reveal that attitude and perceived behaviour control are positively related to entrepreneurial intentions (EIs) and predictors of EIs have an overall variance of 48% in EIs. Entrepreneurial motivation significantly effects intention-behaviour link in TPB which is novel finding in extension of TPB. This is the first study of its kind which explains intention-action gap and include entrepreneurial motivation in TPB as researchers considered longitudinal studies appropriate to investigate intention-action gap. Results reinforced the idea of incorporation of supporting constructs in TPB. Conceptual model contributes theoretically to the existing framework of TPB by enhancing predictive power for better understanding of entrepreneurial behavioural development. Study provide base for future studies on intention-behaviour link in TPB to explain entrepreneurial behaviour for application in various perspectives.

Keywords: Theory of planned behaviour, Entrepreneurship, Engineering, Entrepreneurial motivation, Entrepreneurial behaviour, Entrepreneurial intentions

Introduction

Entrepreneurship for engineering students to create winning minds for economic development in a country is an area which has attracted academic researchers. This has gained importance as role of engineers in industry is evolving which has grown from independent highly skilled self-reliant inventor to a co-dependent team member in a small or large enterprise (Yurtseven, 2002). American Society for Engineering Education (ASEE) has recommended to transform engineering curricula according to the requirements of worldwide economy by fostering business

education in engineering education through various training programs (Dabbagh & Menascé, 2006). Engineering institutions are realizing the importance of changing requirements in engineering education. Beyond science and technology, engineering graduates are now required to have requisite communication skills, leadership traits, discover opportunities, better understanding of market forces and new product commercialization (Dabbagh & Menascé, 2006). Engineer of today is transforming from knowledge to action, and this process of transformation is gradual.

In order to answer whether engineers are different in personality traits from non-engineers, Williamson, Lounsbury, and Han (2013) study compared various personality traits of engineers with non-engineers and found engineers intrinsic motivation and tough-mindedness higher but customer care orientation, emotional stability and image management lower. Global marketplace linked with cutting edge competitiveness on innovation has put human resource capital management under fierce transformation (Geisler & Wickramasinghe, 2009). The corporations responded to match pace with changing scenario. Conceição, Hamill, and Pinheiro (2002) mentioned that 3M encourage intrapreneurship and entrepreneurship in its day to day innovation product development and commercialization. Consequent demands on engineers have arisen to perform more effective role in innovation processes within corporations. These demands from industry towards engineers were way beyond their engineering education. Subsequently, engineering institutions started fostering entrepreneurship in engineering curricula to enable engineers to coup the change. The entrepreneurial contributions must go beyond individual to collective level in engineering institutions and industry for ensured success.

Crawford (2012), in an interview with Steven L. Reid who established Industrial Environmental Systems, Georgia, brought about few very interesting facts about engineering professionals. Steven L. Reid expressed that engineers valued strengths like precision and intelligence becomes their weaknesses once viewed as entrepreneurs because engineers become frustrated early once they interact with people who are less knowledgeable about their subject. On the other hand, entrepreneurs have to be tolerant and flexible. Engineers gave precise technical solutions which at times not worth the time, money and effort to complete. On the other hand, entrepreneurs take immediate decisions and precise solutions that may not be essential at the cost of time (Crawford, 2012).

In literature, variable of intention has been excessively used by researchers to explain human behaviour under study. The planned social behaviour like starting a new business can be predicted well by the measure of intentions (Ajzen, 1991). Over the period of time, researchers have proved entrepreneurial intentions (EIs) as a construct which has been extensively used to explain variants of entrepreneurship (Bird, 1988; Krueger Jr, Reilly, & Carsrud, 2000). EI has been extensively used by researchers as dependent variable in various entrepreneurial-based studies (Davidsson, 1995; Souitaris, Zerbinati, & Al-Laham, 2007). In order to measure entrepreneurial attitude and entrepreneurial behaviour, EI has been declared as the best predictor (Ajzen, 1991). So, entrepreneurial behaviour is derived from entrepreneurial attitude, which further influence EIs. Intentions and attitudes are primarily perception oriented which can be improved through building skills. Hence,

entrepreneurial attitudes and EIs can effectively be improved with entrepreneurship learning which will overall encourage entrepreneurship.

Researchers have studied various factors influencing towards entrepreneurial behaviour while studying entrepreneurship. Intention is considered as an important predictor of behaviour in the literature of psychology. In order to understand how intention takes place is important in understanding of behaviour towards entrepreneurship. EI is a significant predictor of planned behaviour towards new business start-up. Theory of planned behaviour (TPB) appropriately provides theoretical basis about the development of EI (Ajzen, 1991). New business is generally created with planning and is less likely to be unexpected and out to plan; hence, entrepreneurship is considered in perceptive of TPB as a planned behaviour which is predicted by EI.

Many models have been derived by researchers and various theories are in use to explain the phenomenon of intention. The psychological economic model (MEP) which was originally proposed by Bird (1988) and Davidsson (1995) has been used by researchers extensively. Entrepreneurial event model (SEE) is also an important entrepreneurial model which has been examined by researchers (Shapero & Sokol, 1982). TPB by Ajzen (1991) is the prominent EI model, although TPB is not classically a model of EI; however, this model has gained importance due to its conceptual sense.

Researchers in the past have focussed on the issue of entrepreneurial education for determining EIs among students (Duval-Couetil, Reed-Rhoads, & Haghighi, 2011; Duval-Couetil, Shartrand, & Reed, 2016; Souitaris et al., 2007). Many researchers have also compared the EIs in engineering students who acquire entrepreneurship educations to those who have not acquired entrepreneurship education (Ohland, Frillman, Zhang, & Miller III, 2004; Yemini & Haddad, 2010). With regard to extension of TPB on engineering students, researchers have tested the model for measuring EIs of students (Maresch, Harms, Kailer, & Wimmer-Wurm, 2016; Murugesan & Jayavelu, 2015).

Researchers believe that intentions, which developed in people, takes lot more time in transformation into human behaviour (Helmreich, Sawin, & Carsrud, 1986). In perspectives of TPB, attitudes, subjective norms and behaviour controls determine the intention which ultimately transforms into behaviour (Ajzen, 1991). Link of intention and behaviour through motivation may exist but same has not been tested in perspectives of extension of TPB (Carsrud & Brännback, 2011). Little research is done on intention-behaviour gap due to obvious complications in measurement of entrepreneurial behaviour as researchers have suggested to examine behaviour which has transformed from intention through longitudinal study (Farooq et al., 2018). Application of longitudinal study in the case of engineering students has complications as engineer's role in industry changes with experience and career progression. In early years of employment, engineer's role is more technical which transforms into managerial role with career progression. Hence, longitudinal study cannot be relied straightaway to examine transformation of intention into behaviour. In this study, TPB model has been extended on engineering students in Pakistan to measure EIs and investigate the impact of entrepreneurial motivation in bridging the gap between entrepreneurial intention and entrepreneurial behaviour (action). Further, interrelationships in model are examined to enhance predictability of TPB.

Research objectives

Study objectives are:

1. To extend the model of TPB for investigating EIs and behaviours in engineering students of Pakistan.
2. To investigate the role of entrepreneurial motivation in explaining the gap between EI and behaviour.

Literature review

Entrepreneurship in Pakistan

Pakistan has not remained a good state for entrepreneurship and risk taking as policy making potentially ignores small industry which is 40% informal sector (Qureshi & Fawad, 2015). Creativity and risk taking in Pakistan is affected due to intrusive government's role in market. Since independence in 1947, 'enterprise' was synonymous for big industrial sectors like textile. Throughout the history, no such policy for entrepreneurial development was formed rather all policy making like import licencing schemes, tariff protection and various controls on imports were primarily planned for growth of big industries. Hence, entrepreneurial risk taking was not easy. Resultantly, progress in large sector has remained visible. Interestingly, small sector remained existent through informal means without government support.

Engineering entrepreneurship

Technical graduates in different disciplines are more expected to create firms in innovative and dynamic fields so as to support in employment generation and economic growth. As many as 4000 companies founded by graduates and faculty of Massachusetts Institute of Technology (MIT), USA exists generating employment for 1.1 million individuals with an annual sales exceeding $232 billion (Lüthje & Franke, 2003). If companies formed by faculty and graduates of MIT, USA be considered an independent nation, it will be the 24th biggest economy of the world (Ayers, 1997). Stanford University is also a success story in this regard, and most of the leading companies of Silicon Valley are closely associated with Stanford University (Pfeiffer, 1997).

In an entrepreneurial study by Barba-Sánchez and Atienza-Sahuquillo (2018), profile of engineering students to identify motivations for starting a business has been analysed. Investigation of the relationship between entrepreneurial motivation leading to EIs and effect of entrepreneurial training in promotion of entrepreneurship has also been investigated in Barba-Sánchez and Atienza-Sahuquillo (2018) studies. An entrepreneurial activity originates from motivation of individuals and is believed to be a factor which ignites behaviour and leads positively towards objectives (Haynie, Shepherd, Mosakowski, & Earley, 2010).

Researchers in the past have used these models of EI according to the requirement in question and emphasized difference in theoretical models and entrepreneurship reality in present perception. In this regard, Fitzsimmons and Douglas (2011) has opted for SEE for EIs, Izquierdo and Buelens (2011) have used TPB and Krueger Jr et al. (2000) have used a combination of SEE and TPB. Few authors such as Athayde (2009) and

Lee, Wong, Der Foo, and Leung (2011) have projected economic-psychological methods and have provided another account for the important variables and phenomenon which inspire EIs.

Theory of planned behaviour

EI has been regarded as key concept in start-up of business (Van Gelderen et al., 2008). With regard to entrepreneurship and EIs, Ajzen (1991), theory of planned behaviour (TPB) and entrepreneurial event model by Shapero and Sokol (1982) has remained a sound theoretical base for researchers (Schlaegel & Koenig, 2014). In case of explaining the intentions towards start-up of business, TPB has been widely applied by researchers.

TPB theorizes the relationship of attitudes, norms and control with behaviour mediated by intentions. EIs are predicted in TPB by personal attitude, subjective norms and perceived behavioural control (Ajzen, 1991). Previous research estimates 30–45% variance in EI due to three antecedents (Liñán & Chen, 2009; Van Gelderen et al., 2008). Full mediation effect of intention between attitude and subjective norms with behaviour has been explained (Ajzen, 1991). As regards the perceived behaviour control in TPB, mediation effect is multifaceted which is dependent on individual degree of control on behaviour. If an individual has strong control on behaviour, intention predicts the behaviour and fully mediates the influence of perceived behaviour control. Whereas for individual with low control over behaviour, partial mediation of intention has been observed between perceived behaviour control and entrepreneurial behaviour (Ajzen, 1985, 1991).

In the case of entrepreneurial event model, perceptions of desirability, feasibility and propensity to act predict intentions. Constructs of both TPB and entrepreneurial event model are overlapping to an extent as determined by Van Gelderen et al. (2008). Perceptions of desirability and feasibility in the case of entrepreneurial event model have similar effect on intentions as is caused by attitudes and perceived behavioural control in TPB (Van Gelderen et al., 2008). As regard to prediction of intentions, both TPB and entrepreneurial event model are approximately similar (Krueger Jr et al., 2000).

Various meta-analytic studies recognized that intention is a strong predictor of behaviour. As regard to variance of intention in behaviour, researchers have reported variance in terms of type of planned behaviour. In context of business studies, Sheeran (2002) describes 28% variance in behaviour caused by intention. Though intentions to start-up a business has been described in terms of behaviour, yet intention-action gap is difficult to measure and perhaps is the major limitation of TPB in EI research. The proposed extension in model of TPB is reflected in Fig. 1.

Study hypotheses to test contextual applicability (engineering students in Pakistan) of TPB model are as under:

H1: Personal attitude positively relates to EIs.
H2: Subjective norms positively relates to EIs.
H3: Perceived behavioural control positively relates to EIs.
H4: EI mediates between personal attitude and entrepreneurial behaviour.
H5: EI mediates between subjective norms and entrepreneurial behaviour.

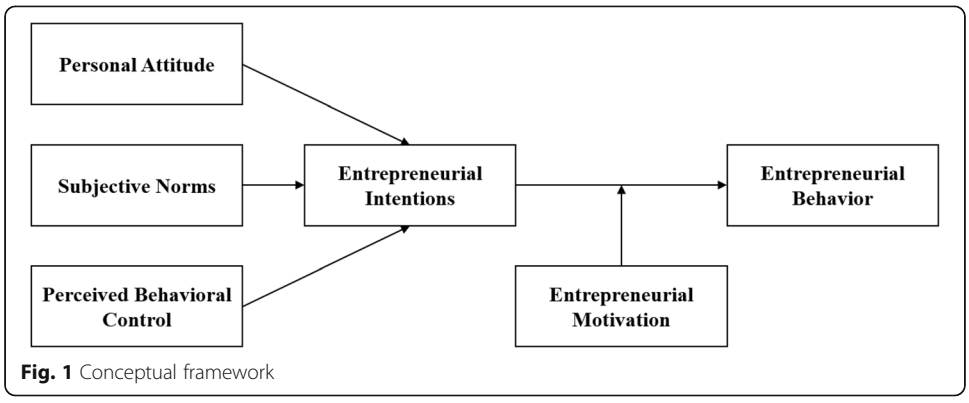

Fig. 1 Conceptual framework

H6: EI mediates between perceived behavioural control and entrepreneurial behaviour.

Entrepreneurial motivation

There are vast differences between EIs and actions of real start-up. Though researchers advocate longitudinal studies to access rate of intentions taking into action (Farooq et al., 2018), yet difference cannot be determined through conventional means of research. As regard to research on intentions, the objective is transformation of intentions into behaviour. Sexton and Smilor (1986) and Smilor and Kuhn (1986) in 1980s were the preliminary studies of entrepreneurial motivation on theoretical and empirical perspectives. Soon after, research on personality traits of entrepreneurs take lead and research on motivation could not attract researchers.

Bird (1989) and Krueger and Carsrud (1993) studies emphasized that idea transformation into action is important to realize the overall process of entrepreneurship. Attitudes and behaviours are correlated which are described through the path of attitude-intention and intention-behaviour links. As regard to empirical studies on the link between entrepreneurial motivation and behaviour, researchers have not deliberated (Kuratko, Hornsby, & Naffziger, 1997); though earlier research study of Carsrud, Olm, and Thomas (1989) emphasized on motivation and behaviour in the perspectives of firm performance. Carsrud and Brännback (2011) have argued that link between intention-action is produced as a result of motivation. Motivators are instincts which eventually drive behaviour in pursuit of goal. Carsrud and Brännback (2011) also argued that researchers have studied motivation to explain different response of people in the same stimuli of motivation and choice of different individual behaviour.

Motivation theories can be categorized into drive and incentive theories. Driving theory emphasized internal stimuli an outcome of fear or hunger which becomes the driving force for most of the planned actions in business perspectives. Whereas, motivational pull is a key consideration in incentive theory. In entrepreneurial perspectives of incentive theory, motivation for achievement of goal leads the person. Push factors drive the force towards achievement of business goals and pull factors dominate in incentive theory.

In motivational research, goal is an important factor (Locke & Latham, 2004). Goals are intangible factors and representative of future outcomes which drive individuals to

keep working hard (Pervin, 2003). Goals, which drives motivation, becomes a link in transformation of intention into action (Pervin, 2003). The fact that capability of people to adopt themselves in changing environment stems from ability of individuals to transform their motives and goals. Entrepreneurship scholars identified this conceptualization of effectuation in their recent research studies (Sarasvathy, 2009).

Motivation originates from individual's cognition, natural and social parameters (Ryan & Deci, 2000). Motivation initiatives determines course with drive and intention. Hence, an important missing link between intention and behaviour stems from pursuance of motivation which is individual's goals and motives. Previous research studies claims that intentions which developed in people takes a lot more time in transformation into human behaviour (Helmreich et al., 1986). In perspectives of TPB, attitudes, subjective norms and behaviour controls determine the intention of behaviour which ultimately transforms into behaviour (Ajzen, 1991). Link of intention and behaviour through motivation may exist but the same has not been tested in perspectives of extension of TPB (Carsrud & Brännback, 2011). Researchers have argued this aspect in entrepreneurial research as an under-researched area which has been deliberated in this research study to explain intentions, motivations and behaviours of engineering students.

Hypothesis to test the role of entrepreneurial motivation in intention-behaviour link is as under:

H7: Entrepreneurial motivation moderates between EIs and entrepreneurial behaviour.

Methods

Research design

Study uses deductive approach to test hypotheses based on existing theories and studies to confirm the existence of relationship among variables (Wilson, 2014). This states that if a particular relationship exists among variables or constructs in certain case, same relationship might be true in various other situations or cases. In deductive design, existing relationship based on existing theories is obtained on other general circumstances (Gulati, 2009). Quantitative methods have been used as variables in this study and are well established in literature and measures of variable are available (Bryman & Bell, 2015). EIs, entrepreneurial motivation and entrepreneurial behaviour have widely been used by researchers. Valid and reliable measures of constructs have been used in study. Structured approach has been applied in this research.

The purpose of the study is to extend the model of TPB for investigating EIs and behaviours in engineering students of Pakistan. Researchers have adequately applied TPB to predict intentions caused by its predictors in various contexts (Maresch et al., 2016; Murugesan & Jayavelu, 2015). This study has applied TPB model to measure EIs of engineering students in Pakistan. Further, moderation of entrepreneurial motivation has been tested to see the role of intentions on behaviour to extend model of TPB as previous research reported gap in intention-action (Carsrud & Brännback, 2011).

Instrumentation

It is important for any empirical study to consider 'how to measure the proposed variables'? As this study has taken lead from previous studies and theories in adoption of

proposed variables of study, hence it is important to acquire measurement scales of the constructs which are well established. Scale of entrepreneurial motivation measurement is adopted from Amabile's Work Preference Inventory (Amabile, Hill, Hennessey, & Tighe, 1994). This scale was validated by Sánchez and Sahuquillo (2012) in the study and the same scale was also adopted by Barba-Sánchez and Atienza-Sahuquillo (2018). Scales of entrepreneurial attitude, subjective norms, perceived behavioural control and EI have been adopted from Liñán and Chen (2009). Measures of entrepreneurial behaviour have been adopted from Alsos and Kolvereid (1998). The 5-point Likert scale has been used to measure the items of the variables (ranging from 1 as 'strongly disagree' to 5 as 'strongly agree' and 3 as 'neither agree nor disagree').

Sampling

Engineering universities in Pakistan can be broadly categorized into public and private universities. Curriculum is centrally prepared by Higher Education Commission (HEC), Pakistan in consultation with key stakeholders (HEC, 2017). The curriculum and education system of engineering institutions is accredited by Pakistan Engineering Council (PEC), which is the sole bridging link between academia and industry (PEC, 2018). Large variations in quality of education exist among public and private institutions due to various factors. For acquiring primary data for this study, target population comprises of senior-level engineering students studying in engineering universities of Pakistan. Engineering students of final year from four large universities comprised the sample. Students were approached using various means including searching students through their social media profiles from institutional groups, self-administered survey, sending questionnaire through e-mail and WhatsApp. In the case of data collection from Superior University, Lahore (a large private sector institution), institutional help was also extended by faculty and administration. A total of 448 valid responses have been included for data analysis is this study.

Use of sample obtained from students to assess EI has been recommended by Liñán and Chen (2009) as it is possible to get response from individuals who are currently engaged in choice of career and assist in psychological method examination prior to creation of new venture as an option against job. The sample size is appropriate for the study since it maintains above the minimum sample size threshold for analysis using structural equation modelling (SEM) for latent constructs employed in this study (Hair Jr, Hult, Ringle, & Sarstedt, 2016). Table 1 presents the composition of sample for the study.

Data screening

Data screening was done through cleaning for making data ready prior to analysis. Examination of data for missing values and outliers was done after data collection. The missing values were found to be less than threshold for a particular variable (Cohen, Cohen, West, & Aiken, 1983; Kline, 1998). Missing values were replaced using median replacement method as Likert scale was used for measurement of items of constructs (Lynch, 2003). SPSS version 24 was used for missing value treatment. Cook's distance method was used for identification of outliers and four responses were dropped as they

Table 1 Composition of sample

	Category	*N* (%)	Total
Gender	Male	283 (63.2%)	448 (100%)
	Female	165 (36.8%)	
Major	Electrical	130 (29%)	
	Mechanical	101 (22.5%)	
	Chemical	85 (19%)	
	Civil	79 (17.6%)	
	Other	53 (11.8%)	
Entrepreneurial family	Yes	88 (19.6%)	
	No	296 (66.1%)	
	I'm not sure	64 (14.3%)	

exceeded threshold (Stevens, 2012). A total of 448 useable responses were included for analysis.

Data for independent and dependent variables were collected at the same time from the same respondents; hence, probability of effect on data due to common method bias was there (Chang, Van Witteloostuijn, & Eden, 2010). Harman's one factor test was used to test the presence of common method bias in data (Podsakoff & Organ, 1986). Exploratory factor analysis was conducted to analyse whether a single factor could cause major covariance in independent as well as dependent variables. Results of Herman's single factor test are presented in Table 2. Results dictate that single factor was unable to explain major covariance (34.44%). Hence, statistical results show that data was not suffering from common method bias.

Data analysis

All variables used in model (independent variables, moderator and dependent variables) are latent variables with multiple items of measurement. Hence, multivariate technique, SEM is the most appropriate in this case. Variance-based partial least square structural equation modelling (PLS-SEM) has been used in this study. PLS is gaining popularity in social sciences which is a second-generation technique of SEM. Smart PLS 3.2.6 has been used for all computations related to this study (Hair Jr et al., 2016), due to user friendly interface, level of measurement, normality of data issues, nature of study and small sample size requirements (Chin & Newsted, 1999).

The data processing using Smart PLS 3 software is done because all constructs are latent variables which are measured by indicators and dimensions. This study has adopted multidimensional constructs which are combination of reflective measurement and composites (Jarvis, MacKenzie, & Podsakoff, 2003). This implies that first-order

Table 2 Total variance explained (Herman's single factor test)

Component	Extraction sum of squared loadings		Cumulative %
	Total	% of Variance	
1	19.06	33.44	33.44

Extraction method: principal component analysis

and second-order constructs can be determined using separate measurement model (MacKenzie, Podsakoff, & Jarvis, 2005). Composite common factors configuration is an important configuration of second-order constructs. In the case of composite common factors configuration, a reflective measurement model is used in the first-order constructs while various first-order constructs formed to make a composite second-order construct. In the case of social sciences, this is the widely used approach in which hierarchical component model type is used for deeper examination of the models (Ringle, Sarstedt, & Straub, 2012).

In this paper, latent variable entrepreneurial motivation is a second-order reflective construct which is formed by three first-order constructs such are "need the independence" which is measured with seven indicators, "financial motivation" which is measured with five indicators and "need achievement" which is measured with four indicators. Entrepreneurial behaviour is also a second-order construct used in this study which is formed by three first-order constructs such as "business planning" which is measured with seven indicators, "financing the new firm" which is measured with seven indicators and "interaction with the external environment" which is measured with seven indicators.

Results

Model estimation

Results of PLS calculation is shown in Fig. 2.

Evaluation of measurement model

Measurement model has been used for assessment of reliability and validity of constructs (Henseler, Ringle, & Sinkovics, 2009). Evaluation of measurement model is carried out by assessment of reflective measurement model. Evaluation of measurement model includes composite reliability to evaluate internal consistency, outer loadings of

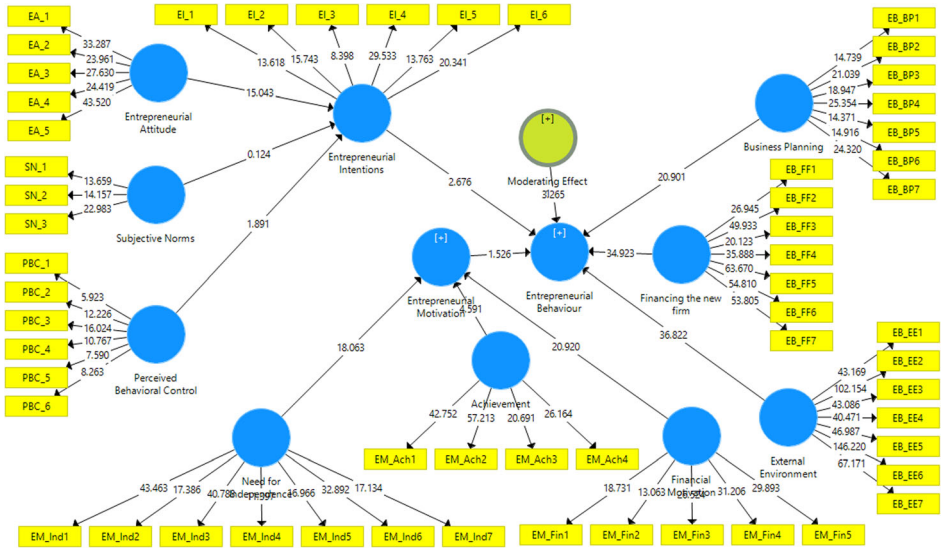

Fig. 2 Structural model second-order constructs PLS-SEM

indicators for individual indicator's reliability, average variance extracted (AVE) to evaluate convergent validity and Fornell–Larcker criterion and cross loadings to assess discriminant validity.

Convergent reliability

Results of convergent reliability are shown in Table 3. Measurement model used in this study included four first-order and two second-order constructs. In assessing a model's reliability, loading of each indicator on its associated latent variable have been calculated and compared to a threshold. Generally, loading should be higher than 0.7 for indicator reliability to be considered acceptable (Hair, Ringle, & Sarstedt, 2011). A loading lower than 0.4 indicates that the item should be considered for removal. Items with a loading of 0.4–0.7 should be considered for removal if they increase composite reliability (CR) and AVE above the threshold (Hair et al., 2011). Table 3 indicates that most of the indicator loadings on their corresponding latent variable were higher than 0.7.

CR coefficient is also used for assessing construct reliability and should be higher than 0.7 to establish construct reliability (Hair et al., 2011; Vinzi, Chin, Henseler, & Wang, 2010). Table 3 indicates that CR for all latent variables in the measurement model for both groups were higher than 0.7. These results indicate that measurement model possesses acceptable reliability. In order to assess convergent validity of the measurement model for both groups, AVE of latent variables should also be higher than 0.5 (Hair et al., 2011; Vinzi et al., 2010). Table 3 shows that AVE of constructs were higher than 0.5; therefore, convergent validity was acceptable.

Outer loadings for indicators of reflective constructs show individual indicator's reliability. It is observed from Table 3 that outer loadings of all indicators of reflective constructs are more than the minimum acceptable value (0.7).

Discriminant reliability

Discriminant validity is the extent to which each latent variable is distinct from other constructs in model (Hair Jr, Sarstedt, Hopkins, & G. Kuppelwieser, 2014). In order to establish discriminant validity, square root of AVE for each construct should be greater than all correlations among constructs and other constructs in model to meet Fornell–Larcker criterion (Hair Jr et al., 2014). In addition, heterotrait–monotrait (HTMT) ratio has recently been established as a superior criterion compared to more traditional assessment methods, such as the Fornell–Larcker criterion. Previous studies have suggested construct thresholds of 0.85 and 0.9 for HTMT to establish discriminant validity (Vinzi et al., 2010) (Tables 4 and 5).

Assessment of structure model

Assessment of structural model includes **c**ollinearity issues of structural model, significance and relevance of structural model relationships, level of R^2, effect sizes F^2 and SPMR.

Table 3 Convergent reliability measures

Constructs		Items	Loading	Alpha	CR	AVE
Attitude		EA_1	0.848	0.917	0.938	0.752
		EA_2	0.834			
		EA_3	0.877			
		EA_4	0.86			
		EA_5	0.914			
Subjective norms		SN_1	0.861	0.841	0.902	0.755
		SN_2	0.869			
		SN_3	0.877			
Perceived behavioural control		PBC_1	0.617	0.833	0.878	0.547
		PBC_2	0.747			
		PBC_3	0.818			
		PBC_4	0.76			
		PBC_5	0.677			
		PBC_6	0.8			
EIs		EI_1	0.676	0.885	0.913	0.637
		EI_2	0.781			
		EI_3	0.755			
		EI_4	0.869			
		EI_5	0.84			
		EI_6	0.85			
Entrepreneurial motivation	Need the independence	EM_Ind1	0.823	0.898	0.920	0.624
		EM_Ind2	0.698			
		EM_Ind3	0.82			
		EM_Ind4	0.66			
		EM_Ind5	0.685			
		EM_Ind6	0.826			
		EM_Ind7	0.743			
	Financial motivation	EM_Fin1	0.748	0.841	0.887	0.612
		EM_Fin2	0.742			
		EM_Fin3	0.732			
		EM_Fin4	0.856			
		EM_Fin5	0.825			
	Need achievement	EM_ Ach1	0.883	0.883	0.920	0.742
		EM_ Ach2	0.924			
		EM_ Ach3	0.815			
		EM_ Ach4	0.82			
Entrepreneurial behaviour	Business planning	EB_BP1	0.749	0.855	0.890	0.536
		EB_BP2	0.781			
		EB_BP3	0.666			
		EB_BP4	0.721			
		EB_BP5	0.712			
		EB_BP6	0.702			

Table 3 Convergent reliability measures *(Continued)*

Constructs		Items	Loading	Alpha	CR	AVE
		EB_BP7	0.788			
	Financing the new firm	EB_FF1	0.713	0.927	0.943	0.706
		EB_FF2	0.833			
		EB_FF3	0.649			
		EB_FF4	0.885			
		EB_FF5	0.925			
		EB_FF6	0.922			
		EB_FF7	0.911			
	Interaction with the external environment	EB_EE1	0.859	0.956	0.963	0.790
		EB_EE2	0.939			
		EB_EE3	0.892			
		EB_EE4	0.887			
		EB_EE5	0.842			
		EB_EE6	0.9			
		EB_EE7	0.9			

Collinearity issues of structural model

Collinearity issue of constructs were assessed by validating variance inflation factor (VIF) values which should be less than 5. VIFs of constructs are shown in Table 6. All VIFs found < 5; hence, collinearity issue is not present between constructs.

Assessing significance and relevance of structural model relationships

Significance of path coefficients for our model as per bootstrapping report is shown in Table 7. All path coefficients are significant less subjective norms. Magnitude of path coefficient provides us relevance of that path. Entrepreneurial attitude and entrepreneurial intention has the largest path coefficient (0.615) followed by other as depicted in Table 7. It is evident that relevance of entrepreneurial attitude is more as compared

Table 4 Fornell–Larcker criterion

	Ach	BP	EA	EB	EI	EM	EE	FM	FF	Ind	PBC	SN
Achievement	0.862											
Business planning	0.343	0.732										
Entrepreneurial attitude	0.669	0.39	0.867									
Entrepreneurial behaviour	0.182	0.789	0.267	0.736								
EIs	0.663	0.37	0.685	0.164	0.798							
Entrepreneurial motivation	0.931	0.367	0.706	0.252	0.68	0.75						
External environment	0.076	0.6	0.157	0.93	0.068	0.147	0.889					
Financial motivation	0.769	0.336	0.567	0.343	0.495	0.899	0.256	0.782				
Financing the new firm	0.146	0.64	0.235	0.93	0.092	0.224	0.798	0.347	0.84			
Need for independence	0.849	0.343	0.71	0.191	0.71	0.955	0.091	0.77	0.151	0.79		
Perceived behavioural control	0.425	0.706	0.502	0.647	0.434	0.496	0.472	0.526	0.623	0.439	0.74	
Subjective norms	0.318	0.641	0.524	0.561	0.421	0.365	0.43	0.377	0.497	0.325	0.611	0.869

Table 5 Heterotrait–monotrait (HTMT)

	Ach	BP	EA	EB	EI	EM	EE	FM	FF	Ind	PBC	SN
Achievement												
Business planning	0.393											
Entrepreneurial attitude	0.738	0.449										
Entrepreneurial behaviour	0.235	0.911	0.323									
EIs	0.746	0.426	0.737	0.265								
Entrepreneurial motivation	1.012	0.416	0.758	0.315	0.74							
External environment	0.1	0.661	0.19	0.954	0.138	0.2						
Financial motivation	0.878	0.407	0.636	0.403	0.556	1.002	0.294					
Financing the new firm	0.185	0.719	0.274	0.979	0.194	0.271	0.844	0.41				
Need for independence	0.943	0.401	0.789	0.278	0.799	1.032	0.181	0.865	0.205			
Perceived behavioural control	0.491	0.828	0.578	0.751	0.475	0.563	0.534	0.639	0.717	0.508		
Subjective norms	0.361	0.745	0.587	0.646	0.455	0.414	0.488	0.454	0.558	0.384	0.711	

to other predictors of EI. Predictors of entrepreneurial behaviour have higher coefficient value (β); hence, determinants better explain entrepreneurial motivation.

Coefficient of determination (R^2 value)

R^2 value ranges (0 to 1) and value near to 1 indicates high predictive accuracy. R^2 value of EI for this study is 0.488 ($t = 9.66$), which states that combined effect of all independent variables can cause 48.8% variation in EIs.

Hypothesis testing

Research model proposed a total of seven hypotheses. The first three hypotheses (H1, H2 and H3) propose direct relationships. Entrepreneurial attitude ($\beta = 0.62$, $t = 16.54$, $p < 0.05$) and perceived behavioural control ($\beta = 0.10$, $t = 2.83$, $p < 0.05$) are significantly and positively related to EIs. However, subjective norm ($\beta = 0.03$, $t = 0.71$, $p > 0.05$) is not significantly effecting EIs. Moderating role (H7) of entrepreneurial motivation between EI and entrepreneurial behaviour is significant (LLCI = 0.01, ULCI = 0.03). Simple slope analysis to present moderating effect is presented in Fig. 3. Entrepreneurial motivation significantly moderates between EI and entrepreneurial behaviour. EI mediates (H4) between

Table 6 Collinearity statistics of structural model (inner VIF)

	Entrepreneurial behaviour	EIs	Entrepreneurial motivation
Achievement			4.055
Business planning	2.134		
Entrepreneurial attitude		1.487	
EIs	2.051		
Entrepreneurial motivation	1.97		
External environment	2.904		
Financial motivation			2.779
Financing the new firm	3.211		
Need for independence			4.071
Perceived behavioural control		1.72	
Subjective norms		1.774	

Table 7 Path coefficients

	Path coefficient	*t* value
Achievement–Entrepreneurial motivation	0.299	34.265
Business planning–Entrepreneurial behaviour	0.259	23.714
Entrepreneurial attitude–EIs	0.615	16.498
External environment–Entrepreneurial behaviour	0.452	48.728
Financial motivation–Entrepreneurial motivation	0.317	53.424
Financing the new firm–Entrepreneurial behaviour	0.404	46.962
Need for independence–Entrepreneurial motivation	0.457	57.163
Perceived behavioural control–EIs	0.104	2.839
Subjective norms–EIs	0.035	0.693

entrepreneurial attitudes and perceived behavioural control (LLCI = – 0.02, ULCI = – .01). EI mediation effect (H5) has not been established in the case of subjective norms (LLCI = – 0.004, ULCI = 0.004). EI mediates (H6) significantly between perceived behavioural control and entrepreneurial behaviour (LLCI = 0.006, ULCI = 0).

Discussion

The aim of the study was to extend the model of TPB for investigating EIs and behaviours in engineering students of Pakistan and the role of entrepreneurial motivation in transformation of EIs into entrepreneurial behaviour. Results indicate that there is significant relationship of attitude and perceived behavioural control with EIs. Results are consistent with previous research studies (Liñán & Chen, 2009; Van Gelderen et al., 2008). Previous studies also indicated that perceived behavioural control has the highest impact on intentions (Maes, Leroy, & Sels, 2014). This means that engineering students generally showed better attitudes and perceived behavioural control towards EIs as a result of engineering education and entrepreneurial education. Subjective norms

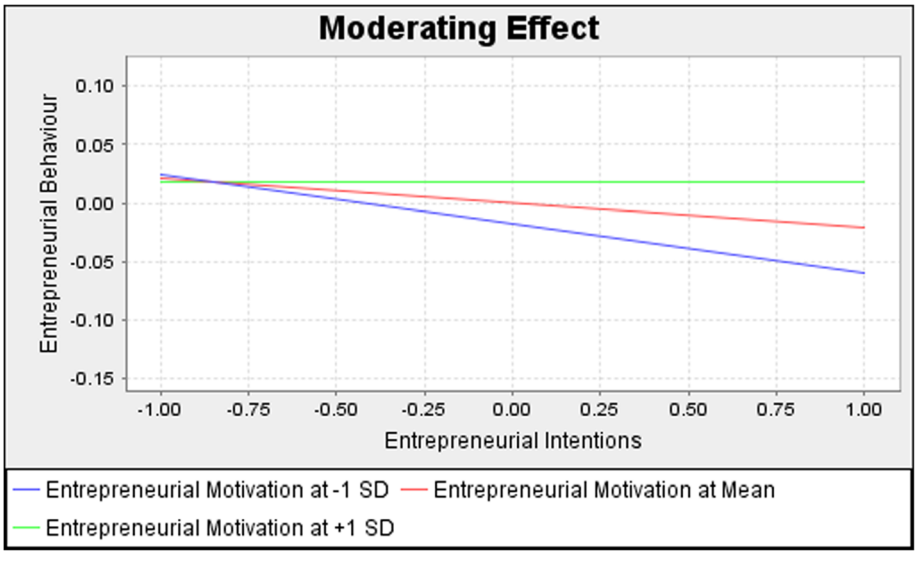

Fig. 3 Interaction effect of entrepreneurial motivation on relationship between entrepreneurial intention and entrepreneurial behaviour

showed insignificant relationship with EIs. Results indicate that attitudes towards entrepreneurship by senior level engineering students have highest impact on EIs; hence, results are aligning previous research (Geissler, Jahn, Loebel, & Zanger, 2011).

The study found out that attitude and perceived behavioural control are good predictor of intentions; hence, findings are different from already held research on the issue (Shook & Bratianu, 2010; Souitaris et al., 2007). Predictors of intention cause 48% variance in EIs; hence, results are in line with previous research (Appiah-Nimo, Ofori, & Arthur, 2018). Non-significant relationship of subjective norms is consistent with previous research (Iqbal, Melhem, & Kokash, 2012; Stone, Jawahar, & Kisamore, 2010); researchers have also reported negative correlation (Shook & Bratianu, 2010), or in some cases no relationship of subjective norms with EIs (Krueger Jr et al., 2000). Since various research studies report inconsistent relationship of subjective norms with intentions, researchers need to adopt other parameters and measurement to bring consistent findings. Shook and Bratianu (2010) has also claimed that this non-significant relationship is due to variability in various economies. Though this argument is opposed by Naia, Baptista, Biscaia, Januário, and Trigo (2017) in similar research study by proposing the fact that variability is due to individual's internal locus of control which takes him or herself towards believing in self-cognitivism. Further, variability in findings due to population under study cannot be ignored. Hence, this research reports non-significance of subjective norms with regards to senior level engineering students. Overall results dictates that antecedents being hypothesised as regard to TPB (subjective norms, perceived behavioural control and attitude) explain variance of 48% in EIs and results are in line with previous research (Liñán & Chen, 2009; Van Gelderen et al., 2008).

Intention-action gap, which is considered as an under-researched area (Carsrud & Brännback, 2011), has been adequately explained in this research study using moderation analysis. Results demonstrate that entrepreneurial motivation significantly moderate between EI and entrepreneurial behaviour. Hence, proposed link (intention-action) as suggested by Carsrud and Brännback (2011) is moderated by entrepreneurial motivation. Simple slope analysis (Fig. 3) demonstrates that for low entrepreneurial motivation, increase in intention results in decrease in action (behaviour towards start-up of business) for engineering students. Similarly, for medium motivation level, increase in intention reduces the overall behaviour towards start-up of business. For high entrepreneurial motivation, increase in intention has little or no effect on entrepreneurial behaviour. Though moderation is significant but effect is very low which signifies the need for further primary studies on testing moderation effect in various other contexts and cultures.

Mediation effect of intention between antecedents of TPB and behaviour has been tested and found that the mediation effect of intention between attitude and behaviour is significant. Mediation effect of intention between subjective norms is insignificant. Hence, intention plays little role once behaviour is measured for start-up of business. Most studies applying TPB in various contexts measure effect of predictors (attitude, perceived behavioural control and subjective norms) on intention and intention-behaviour link is not measured due to obvious peculiarities in instrumentation as most researchers suggest application of longitudinal studies for studying intention-behaviour link (Farooq et al., 2018).

Conclusion

Entrepreneurial development in the engineering sector is essential for economic development. Study attempts entrepreneurial motivation in model of TPB to focus on the intention-action gap. Though findings of the study explain gap in intention-action to an extent, yet it is difficult to fully explain the phenomenon using quantitative methods only. Combination of longitudinal study and qualitative methods are suggested for studying intention-action gap in examining TPB particularly in the case of engineering students.

Despite the contributions to existing body of knowledge, this study is not without limitations. Results of the study will be difficult to generalize over all engineering students in Pakistan due to high variation in the quality of instruction at different engineering institutions. Few engineering institutions are equipped with state of the art labs and qualified instructors are available; however, many engineering institutions are less equipped with quality labs and quality of instruction in not good. Though this study attempts to address an under-researched area of entrepreneurial behaviour, yet researchers have not reached a conclusion to measure entrepreneurial behaviour besides longitudinal studies, which in the case of engineers is difficult to handle due to varied employment and role in industry during early years of professional career. Hence, this study still considers entrepreneurial intention-behaviour gap an under-researched area considering it a limitation of TPB. Study used sample selection non-randomly. Hence, generalization of findings on entire population of engineers in Pakistan is not appropriate. Further, inherent variability due to engineering specialities have not been considered in this study.

Conducting a study on entrepreneurial intention and behaviour gap has always remained challenging for researchers. In the case of engineers of Pakistan, intentions based studies on TPB are limited. This study extends the model of TPB in bridging intention behaviour gap and offer prospects for researchers to further investigate this extended model in various other settings for its confirmation.

As regards to implications on entrepreneurial practice, this study is useful in various aspects. Pakistan is a developing country with major portion of population under 30 years of age. Trend of acquiring engineering education has long been considered as aspiration in youth. Though large number of engineering institutions in public and private sector exists, yet there are pressures on engineering institutions due to large influx of periodic intake. As of now, engineering education in Pakistan is not aligned with current industrial requirements (PEC, 2018), so unemployment of engineers is more as compared to overall unemployment rate (PEC, 2018). There is a great need of empowerment of engineers through entrepreneurial exposures. Study findings can make policy makers aware of current state of individual entrepreneurial profile of engineering students in Pakistan. There is a great need to foster entrepreneurial training for engineering students in order to build their attitudes. This can be done by exposing students to role models. Behavioural controls have great value towards EIs and behaviours. Exposure to business education and regular visits to industry can inspire engineering students towards improved behaviours to be an effective team member of a business-oriented engineering firm. Entrepreneurial motivation building is a complex phenomenon which can be enhanced by exposing engineering student to business

plans and better knowledge of financial matters in organization. Hence, an overall entrepreneurial environment at engineering institutions will yield great results in terms of economic development.

Engineers are part of a global community; their innovation and entrepreneurial endeavours have effects on global economy and sustainability. At the national level, each country can make mechanism to channelize entrepreneurial exposure to engineers by registering first year engineering students on some online platform where their initial online entrepreneurial assessment (questionnaire based) be conducted. At each stage of their career, engineers should be able to report their employment, skills so far attained and entrepreneurial risk takings. Researchers need to focus on this dimension for building a complete framework for applicability in some country as a pilot case.

Abbreviations

AVE: Average variance extracted; CR: Composite reliability; EIs: Entrepreneurial intentions; HEC: Higher Education Commission; HTMT: Heterotrait–monotrait; MEP: Psychological economic model; PEC: Pakistan Engineering Council; PLS-SEM: Partial least square structural equation modelling; SEE: Entrepreneurial event model; SEM: Structural equation modelling; TPB: Theory of planned behaviour; VIF: Variance inflation factor

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Authors' contributions

MZA conceived the study and carried out literature review. Research design was finalized after approval of CAR. SK carried out statistical analysis and finalized the findings of the study. MZA had written introduction, discussion and conclusions of the study. SK and MZA jointly carried out data collection. CAR coordinated institutional supports to assist data collection, overall supervised the study and approved the write-up. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

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