

Entrepreneurial intention among science & technology students in India: extending the theory of planned behavior

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Abstract The present research endeavours to comprehend the young S&T graduates' intention toward pursuing an entrepreneurial career in a developing nation i.e., India. Using a modified version of Ajzen's theory of planned behaviour (TPB) as our conceptual model, we attempted to integrate three additional constructs (perceived career option, entrepreneurial knowledge and entrepreneurial personality traits) to explain the relationship between a list of antecedents and entrepreneurial intention (EI). Structural equation modelling (SEM) technique has been implemented while analysing the data, collected through a self-administered questionnaire survey of five premier technology institutes in India. Findings, using a sample size of 476 young Science & Technology graduates at Indian Institute of Technology (IITs), suggest that a positive attitude toward entrepreneurship when reinforced by required entrepreneurial knowledge and the existence of viable entrepreneurial career option significantly influence EI. We found a positive but relatively weak influence of subjective norms on intention formation. Further, our findings recognise that the relationship between entrepreneurial personality traits and EI is fully mediated by perceived self-efficacy. Moderating effect suggests that student's perceived self-efficacy boosts the entrepreneurial personality traits to EI relationship. The results also reinforced the appropriateness of incorporating auxiliary constructs in base TPB, as our conceptual model provides additional predictive power and a better understanding of how entrepreneurial intent develops.

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Introduction

To understand the chemistry behind entrepreneurial intention (EI) formation, scholars have been working diligently on this topic for some 35 long years since the publication of Shapero's (1975) article. With this time-lapse, the field of study went diversified and more vigorous. Synchronously, a large amount of research works in the field of social psychology are found to be targeting those determinants responsible for entrepreneurial intention formation. Hence, among all those scholarly articles one can find a single common goal, i.e., sort out those human zeitgeber that explains the phenomenon, why some individual responds to a particular set of items and situations. And ultimately, to design a list of generalised items and situations that could either be used to enhance the level of existing entrepreneurial intention or sometimes to engender anew.

In general, entrepreneurship as a subject of interest among scholars has travelled a long way since Schumpeter (1934) identified it as one of the most important prerequisite for societal growth and employment creation. For achieving a good economic growth, it is very vital to understand the entrepreneurial intentions and factors that ignite these intentions (Yıldırım et al. 2016). In the literature of entrepreneurship, EI is found to be influenced by both internal factors like personality traits (Littunen 2000; Brandstätter 2011) and external factors which may be environmental (Fayolle 2008; Yeoh and Jeong 1995) or other contextual factors (Brinckmann et al. 2010; Zahra 1995). To make the context more robust, EI scholars took the help from a long list of diversified field of study namely, psychology, economics, management, education and technical studies have been added to it (Davidsson 2008). And a thorough literature survey can help anyone to enlighten that a significant portion of EI scholars considered students as their subject of study because historically, a well-educated individual has shown higher probability to create a healthy venture as compared to his non-educated counterparts (Kennedy and Drennan 2001; Cooper et al. 1994).

In this study, we took Science & Technology (S&T) graduates from India's best technology institutes (Indian Institutes of Technology) as our sample. In particular, the reason behind choosing such a selective case could be multifaceted, firstly, India which is ranked as the world's fastest growing large economy, lies even below UK (less than 5% population of India) in start-up formation (UK has 4000 compared to India's 3100) (Jain 2015). So India (BBB' rating by Fitch) needs a huge boom in this sector to keep its growth projectile sustainable. Secondly, till date India lacks in owning unique path-breaking accomplishment (pioneering) and transformation of its status quo (innovative) i.e., PI entrepreneurs in the field of S&T entrepreneurship (Ramachandran and Ramnarayan 1993). To feed its large young population, India needs to generate approximately 10 million jobs per year (Jain 2015), which can only be possible through big-ticket transformational entrepreneurship. Thus, it becomes a subject of utmost importance, how to fill this entrepreneurial level technology know-how gap? The solution could be having an expertise in understanding the entrepreneurial psyche of young talented S&T graduates from its premier technology institutes and eventually creating an ecosystem that will promote the essence of technical entrepreneurship.

As in this paper, we focus on EI, hence, identification of factors that influence entrepreneurial intention is elemental in this research. Theory of planned behaviour (TPB), has been seen in the forefront of EI research because ‘Entrepreneurship’ can be observed as ‘a planned behaviour’ (Ajzen 1991; Krueger et al. 2000). Though TPB as an intention-behavior model has seen its extensive successful application in western culture however it is not clear that the assumptions underpinning it are well suited to other cultures (Solomon et al. 2006). Hence, we see a chance of replicability, in Indian context to check its veracity. Although enumerable number of studies using TPB, has followed with entrepreneurial personality as an antecedent of EI, but we could not find one which tested the mediating role of perceived self-efficacy between personality traits and entrepreneurial intention. Moreover, studies on EI among science and technology graduates is found to be limited (eg.: Yıldırım et al. 2016; Maresch et al. 2016; Roberts 1991; Souitaris et al. 2007; Fayolle et al. 2006; Lüthje and Franke 2003) which many a times results in lack of robustness, consistency and systematization (Fayolle and Liñán 2014; Liñán and Fayolle 2015).

Thus, we attribute this paper with three objectives: (1) With a modified version of TPB, our research can justify the measurement of effects of three additional constructs namely, perceived career option, entrepreneurial knowledge, entrepreneurial personality traits; (2) The mediating role of perceived self-efficacy between personality traits and entrepreneurial intention; (3) Using the results from above two objectives, our third objective is to make a thorough analysis of entrepreneurial mind-set among young Science & Technology graduates in India.

Hence, our first two objectives will fulfill theoretical research gaps whereas the third one will replenish real-life functional level gaps. Other theoretical contributions of this study can be finding, perceived career option as an antecedent of EI, as most studies have not included specific career options around entrepreneurship (Wilson et al. 2007). The presence of a positive perception toward entrepreneurship as a prospective career option could cause individuals to hold a more positive attitude toward starting a business when they are offered with other lucrative jobs (Schlaegel and Koenig 2014). The swappable use of perceived behavioral control and perceived self-efficacy once again is confirmed (Guerrero et al. 2008). Along with those above-mentioned theoretical EI enhancement, our functional level contribution lies with the understanding boost for Indian educationist and policy makers who are in dire need to reshape Indian economy by shifting the career focus of its most talented pool of Science & Technology students.

We structured the rest of the paper in four sections. First, “Theoretical Framework and Hypotheses Development” which highlights Ajzen’s TPB, its formation and implication, hypotheses development and conceptual model. “Research Methodology” describes the Instrument and scale development, data analysis and results comprising statistical reports etc. In the “Discussion” section we precisely discuss the results of the study and the final section “Conclusion” includes implication, limitations and future research scope.

Theoretical framework and hypotheses development

Through this section of the paper we proposed to illustrate our conceptual model (Fig. 1), which is a modified version of TPB. The reason behind using TPB can be

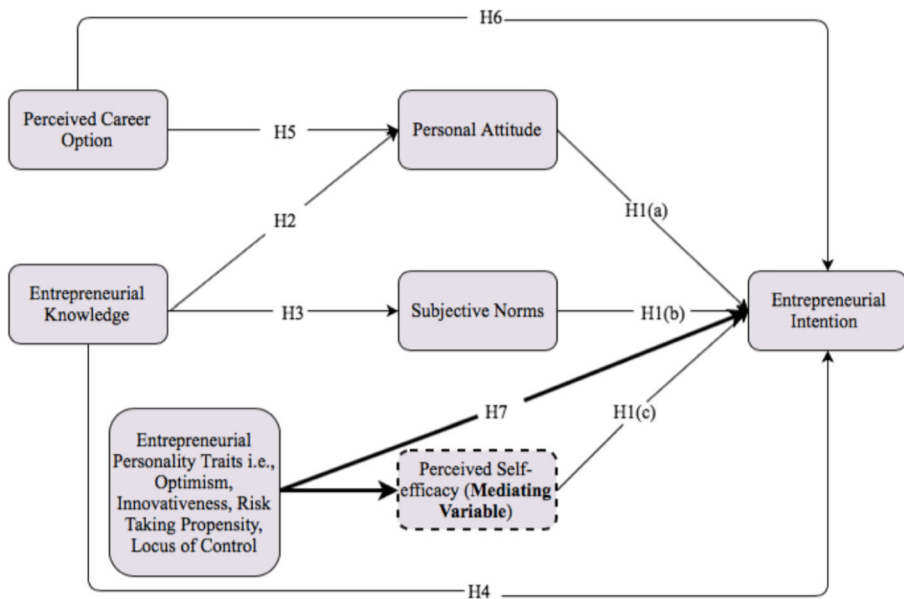


Fig. 1 The conceptual model. Note: Weighted arrow represents the mediated relationship

rest with two arguments, firstly, the robustness of the model has been validated empirically by a significant number of scholar (Lortie and Castogiovanni 2015; Peterman and Kennedy 2003; Liñán and Chen 2009; Guerrero et al. 2008; Kolvereid 1996; Tkachev and Kolvereid 1999; Krueger et al. 2000). A thorough literature review enlightened us about 5000 above citation according to Web of Science, since Icek Ajzen pen down the theory for the first time. So, TPB has shown its resilient over time to validate the basic cognitive linkage from the antecedents of EI to EI itself and to entrepreneurial action (Zhang et al. 2014). Secondly, the applicability of TPB as a psychological model, has been previously applied to nearly all diverse fields such as, health sciences (Godin and Kok 1996), leisure studies (Hagger et al. 2003), psychology (Austin and Vancouver 1996), and marketing (Pavlou and Fygenson 2006) with remarkably effective outcomes (Lortie and Castogiovanni 2015). So has been with almost all EI (entrepreneurship intention) scholars (Liñán and Chen 2009; Krueger et al. 2000; Kolvereid and Isaksen 2006; Shook et al. 2003; Krueger et al. 2000). Hence, being our research in the same category i.e., finding EI among Indian S&T graduates, justifies using TPB.

Short and crisp description about TPB

Ajzen's (1991) model consists of three elements as antecedents of intention formation. They are namely, (1) personal attitude; (2) subjective norms; (3) perceived behavioral control. Whereas, *personal attitude* is the degree to which the individual holds a positive or negative personal valuation about being an entrepreneur. *Subjective norms* measure the perceived social pressure from family, friends, or significant others which could work as a dilemma whether to pursue an entrepreneurial career or not to pursue (Ajzen 1991). Finally, perceived behavioural control refers to the perception of

situational competence that leads to the perceived easiness or difficulty while engaging in the behavior of interest (becoming self-employed).

TPB and entrepreneurial intentions

As we noted earlier, scholars have been using TPB to predict entrepreneurial intention as early as Krueger and Carsrud (1993). The time onwards, EI researchers have been contributing the field of study with massive number of articles replicating either Ajzen's base TPB model or in most cases modified TPB, which often focused on many different nuances. And measuring intentionality is the core of all that research which precedes action and directs attention toward a goal such as starting a new business (Bird 1988; Krueger and Carsrud 1993). Moreover, intention toward a behavior can be strong indicators of that behavior (Fishbein and Ajzen 1975). In turn, we can say the intention of carrying out a given behavior will depend on the person's attitudes toward that behavior (Ajzen 1991). Thus, having a more favorable attitude toward an act, will eventually make the intention looks more feasible to pursue. Subjective norms segment of TPB works as the social influence that compels the decision making of an individual (Park 2000; Conner and Armitage 1998). The normative beliefs behind subjective norm, concern the individual about the perceived probability, how important referent individuals or groups will react on his/her behavior? Thus, on the basis of existing social context, an individual may perceive that the surrounding environment is either permissible or non-permissible to be entrepreneurial. By this alignment, subjective norms as a construct exhorts its influences on the formation of EI. One of the most discussed topic in TPB literature is whether PBC and self-efficacy are distinct or swappable constructs, that ambiguity resulted in the interchangeable use of the constructs in the EI literature (Schlaegel and Koenig 2014). In intention study, TPB is an enriched version of the Theory of Reasoned Action (TRA), subsequent to the Ajzen and Fishbein's (1980) arguments to incorporate PBC in the TRA. Thus, the role PBC plays in the theory of planned behaviour to derive intention content, is not just significant but the absence of PBC in TPB, makes the model incomplete fundamentally. But with the valid counter argument by Armitage and Conner (2001) in their review, conclude that self-efficacy is far more clear in its definition and shows better correlation with intentions than PCB. Indeed, numerous studies on EI either used self-efficacy instead of PBC or at least mentioned about this interchangeability (Lortie and Castogiovanni 2015; Liñán et al. 2011; Fayolle and Gailly 2005; Carr and Sequeira 2007; Krueger and Brazeal 1994; Krueger et al. 2000; Kolvereid and Isaksen 2006; Moriano 2005; van Gelderen et al. 2008). Hence, we preferred to continue with self-efficacy. And we considered perceived self-efficacy (PSE) instead of only self-efficacy, which we think will better suit the replacement. Further, in Ajzen's own word "...TPB places the construct of self-efficacy belief or perceived behavioral control within a more general framework" (Ajzen 1991). Hence, the relationship between PSE and EI is well documented and could be extended to actual behavior i.e., business creation and entrepreneurial success.

In our research, we examined the impact of two basic TPB components, personal attitude and subject norms along with perceived self-efficacy on the S&T graduate's intentions to start a business. We further extend TPB model by inserting three additional constructs namely, entrepreneurial knowledge, perceived career option and

entrepreneurial personality traits. This research integrates the individual-level factors such as personal attitude, entrepreneurial knowledge, perceived career option, perceived self-efficacy and entrepreneurial personality traits with the external factors like subjective norms. Indeed, in this paper we studied the influence of measure forces both from the personal and external perspective, playing in defining S&T graduates' intention to become entrepreneurial. Additionally, the moderating role of self-efficacy in the relationship between entrepreneurial personality traits and entrepreneurial intentions has been taken care of.

Research hypotheses

Attitude, the first determinant of behavioral intentions in TPB has been tested through a broad range of social science topics namely, consumer behavior, pure psychology, leisure studies, family planning behavior, EI and many more (Ajzen 1991). The findings always echoed the strong influence of attitude as an antecedent in the model. So convincingly, that Armitage and Conner (2001) in their scholarly article on EI through a meta analytic review, persuaded to argue that the more positive the attitude toward a behavior, the stronger should be the individual's intention to perform that behavior. Subjective norms reflect the perceived expectations people have toward salient others (Ajzen 1991). Subjective norms work as an indicator which either positively or negatively creates a perception on any individual's mind by conveying the message from the group of reference people namely, family, friends and important others. We often see individuals indicate that they pursued or not-pursued entrepreneurial career either on the basis of family members' expectation from him/her to learn key behavioral skills and techniques necessary to run their own business (Dyer and Handler 1994) or it could be extrinsic motivations evolved from the external pro or anti-entrepreneurial sensations. Self-efficacy represents an individual's belief that they can successfully accomplish a goal (Bandura 1977). Various researchers have found that PSE is the strongest single predictor of career choice, so follows with the most other human performance (Bandura 1986). And such beliefs help individuals to perceive about the resource availability and anticipating obstacles, which by default stimulate individuals to assess their ability while performing a particular behaviour considering the difficulty or ease of doing that behaviour (Gist and Mitchell 1992). Hence, higher degree of PSE which can contribute to the integration of volitional intent may result in higher levels of self-confidence while accomplishing any entrepreneurial task i.e., starting a new business. TPB as a model has been widely used to predict intention and through a meta-analytic review Armitage and Conner (2001) confirmed the predictive validity of the theory. On EI context, the prediction ranges from 21% (Autio et al. 2001) to 55% (Liñán and Chen 2009).

Applicably, in this research effort, we intended to see through the complex lens of TPB how the young S&T graduates perceive about the possibility of pursuing an entrepreneurial career. As we sum up previous research in EI, we found that entrepreneurial intention thereafter behavior is highly complex, and plethora of events both consciously and subconsciously deciphering this proposition promising. TPB has seen its extensive successful application is western culture however it is not clear that the assumptions underpinning it are well suited to other cultures (Solomon et al. 2006). Hence, it is well-justified to check the replicability of TPB

in Indian context, which by many parameters look different from its western siblings. Thus, our first hypothesis follows:

H1: Entrepreneurial intention is positively related to attitude toward entrepreneurship (Hypothesis 1a), supportive subjective norms (H1b) and perceived self-efficacy (H1c) in Indian science and technology graduates.

Incorporation of auxiliary constructs in the Ajzen's TPB

Ajzen's TPB model is based on the assumption that three predefined antecedents, namely; individual attitude, subjective norm and perceived behavioural control (PBC), primarily regulate an individual's behavioural intention. Entrepreneurship Scholars have altered and expanded upon this original theorization behind TPB to include all types of different variables that precede TPB over the past 20 years in order to enhance the applicability of TPB while explaining and predicting various entrepreneurial phenomena (Lortie and Castogiovanni 2015). Many researchers in the field of psychology (Read et al. 2013; Yazdanpanah and Forouzani 2015) suggested to include supplementary constructs in the base TPB model to advance the predictive power of the model. Similar suggestions have been postulated to excavate and extend TPB framework by incorporating new constructs or modifying the path of the existing variables in the Ajzen's (1991) model (Perugini and Bagozzi 2001). EI researchers have been exploring with various extension and modification to apply TPB in diverse settings namely, prior family business exposure (Carr and Sequeira 2007), Big Five personality traits ((Obschonka et al. 2010), opportunity cost and managerial experience (Cassar 2006), entrepreneurial and industry experience (Dimov 2010), education, financial and legal system (Lim et al. 2010). Hence, to ensemble with our research objectives, the previous literatures are found to be supportive to instill three additional constructs in the base TPB model as possible antecedents of entrepreneurial intention namely; entrepreneurial knowledge, perceived career option and entrepreneurial personality traits.

Theoretical and empirical support for inserting entrepreneurial knowledge

Entrepreneurial knowledge has been said to represent an important entrepreneurial resource (Barney 1991). In particular, this facet of human capital changes a person's perception of his or her aptitude about different entrepreneurial aspects that contribute to more realistic opinions about entrepreneurial activity (Ajzen 2002). Entrepreneurial institutional framework (entrepreneurial knowledge) has its two dimension: (1) tacit knowledge; (2) explicit knowledge. Tacit knowledge needs to be internalized and often embedded through an individual's cognitive processes (Daft and Lengel 1986) hence, takes much longer time to be effective whereas explicit knowledge can be delivered through short-term entrepreneurship courses or management seminars. Though it's hard to measure the level of tacit knowledge but scholars have empirical evidence for explicitly modeling knowledge as an antecedent of intention (Swanson et al. 2006; Bryan et al. 2003). Moreover, entrepreneurial knowledge as an element to predict EI has been used by some authors (Kor et al. 2007; Lüthje and Franke 2003).

To a certain extent we can say, knowledge is an integral part of base TPB model, where self-knowledge as a background factor influences control (Ajzen 1998). Whereas, the predictive power of TPB could be increased by explicitly modeling knowledge as a construct. The knowledge about the existence of entrepreneurial career, when inferred by the social importance ascribed to the existence of role models (Matthews and Moser 1995; Carrier 2005) then entrepreneurial knowledge may also have influence on PBC, PA and SN (Scherer et al. 1991). Hence, inserting entrepreneurial knowledge as a construct in our conceptual model, is theoretically justified.

In general, entrepreneurial knowledge undeniably play an important role in EI development by influencing a potential entrepreneur's ability to recognize opportunities and pursue them (Shane 2000). The acquisition of institutional level entrepreneurial knowledge can be multifaceted (1) knowledge of new technology, new customers and new markets (Shane 2000); (2) knowledge of strategy, competitive analysis, managing growth and financing (Hindle 2007); (3) knowledge about idea generation, innovation, product design and creativity (Fiet 2001; McMullan and Long 1987). Also on this study context, Indian S&T graduate students (the specific segment we are considering), so far our best knowledge remain purely untested the till date. Hence, incorporating entrepreneurial knowledge, we can thoroughly check the veracity of our extended TPB in Indian context while measuring its impact on EI. Thus, our next hypotheses follow:

- H2:** Entrepreneurial knowledge at individual level among S&T graduates significantly influences their attitude toward pursuing an entrepreneurial career.
- H3:** Entrepreneurial knowledge is found to be significantly influencing the subjective norms that exist in a society.
- H4:** Entrepreneurial knowledge at individual level among S&T graduates significantly influences their intention toward pursuing an entrepreneurial career.

Theoretical and empirical support for inserting perceived career option

An individual's intention to pursue entrepreneurship is favorably correlated with his/her perception about entrepreneurship as a career option. To explain perceived career option scholars often took the help of career choice theory (e.g., Betz and Hackett 1981; Holland 1997; Lent et al. 1994; Dick and Rallis 1991) which in turn, is built on the individual's beliefs and experiences that influence personal attitudes toward a particular career. Traditionally, it's the field of psychology which took the accountability to answer those questions like why people choose entrepreneurship as a career option? Lately, with the development of entrepreneurship theory, scholars attempted to explain this phenomenon with the help of both psychological and economics' perspective (Baumol 2000; Douglas and Shepherd 2000). Someone's decision to be entrepreneurial is fostered on not only how he/she believes that he/she possess the required skills and abilities to be successful, but also whether the desirability of the entrepreneurial option is greater than for alternative career options (Douglas and Shepherd 2000). In general, individual follows utility maximization theory (innovation, risk bearing, work effort, financial success, independence, recognition, perquisites, and self-realization) while comparing various career options available to him/her.

Though the presence of perceived career option as an antecedent in TPB, is not so common but scholar like Sieger and Mosen (2015), in their empirical study over 15,000 students used TPB's additive elements interaction to measure how the student prefer one option against another. However, a complete understanding about the formation of unyielding entrepreneurial intentions may be achieved by exploring those aspects of entrepreneurship that affect the probability that this option is favored over others. Hence, considering perceived career option as an immediate antecedent of EI this study could add even more nuanced insights into the prospect of actual entrepreneurial behavior (Souitaris et al. 2007; Sieger and Mosen 2015).

In summary, through our empirical investigation we would effort to obtain that how perceived career option as a construct in our conceptual model can play an important role for Indian S&T graduates' EI formation. On the context of this study, our finding could be very much relevant as unlike many western countries "job for entrepreneurship" still a very much "outlier" than other career choice in India, among graduates from best engineering colleges which offer ample job opportunities both in Indian and global MNCs. Moreover, India scores comparatively low in individualism and very high in power distance (Hofstede et al. 1991), which in turn, may force many students to perceive entrepreneurship as a less attractive career option. In this sense, we may see an influence of perceived career option on attitude too. Therefore, we suggest the following hypotheses:

- H5:** Perceived career options available for S&T graduates significantly influencing their attitude toward entrepreneurship.
- H6:** Perceived career options available for S&T graduates significantly influencing their intention to pursue an entrepreneurial career.

The mediating role of perceived self-efficacy

Perceived self-efficacy which can be defined as an individual's perception about his/her beliefs on a list of skills and abilities that he/she can effectively use to execute any given task (Bandura 1989, 1997). Hence, high self-efficacy as a motivational construct found to be influencing various human development activities that underlies most human performance, namely, choice of activities, goal levels, persistence (Zhao et al. 2005; Bandura 1977). And entrepreneurship being one of the highly complex human activity, without a strong sense of self-efficacy, an entrepreneur will find it perplexing to act or to persevere in the face of difficulties (Bandura 2002). The very role of self-efficacy, as a major predictor of EI, has been validated by numerous authors (Krueger et al. 2000). Also, scholars (Boyd and Vozikis 1994) confirmed that entrepreneurial self-efficacy incorporates personality and is believed to be a strong predictor of entrepreneurial intentions and ultimately action (McGee et al. 2009). Thus, we assume that increased entrepreneurial self-efficacy results from students' entrepreneurial personality traits.

Again, why might students' personality traits influence their entrepreneurial intention? To answer such a query, we have proposed perceived self-efficacy as a mediator in the relationship between entrepreneurial personality traits and EI, which follows Mischel and Shoda's (1998) argument that to describe personality judiciously author must take not only traits components but also mediation process. We arrive at this view

on research that has revealed that students are found to be more entrepreneurially intended when they have higher levels of perceived self-efficacy (Wilson et al. 2007; Zhao et al. 2005).

Moreover, when we define an entrepreneur, we see him/her through the lens of various roles he/she plays. Sometimes it could be discovery and exploitation of opportunities, search for creative solutions, the other time it's working under awful resource constraints by employing specific skills and abilities. So, we can correlate such tasks with few specific personality traits, namely, optimism, innovativeness, risk taking propensity and locus of control. Hence, in our study, we proposed to include these four entrepreneurial personality traits.

Optimism

Entrepreneurship begins with the search of an opportunity and then the decision to exploit that opportunity hence, individual differences in optimism about the particular opportunity may influence the whole process (Shane and Venkataraman 2000). Again, as psychological well-being and personal accomplishments are found to be associated with EI hence, an optimistic sense of perceived self-efficacy could increase the level of persistence by promoting beliefs in accomplishing a task at an uncertain circumstances. Therefore, optimism as a personality trait when attached with self-efficacy beliefs then we can see an optimal functioning which may lead to EI formation followed by entrepreneurial success.

Innovativeness

Innovation as one of the core concepts of entrepreneurship has epitomized its importance days back, when Schumpeter (1934) through his seminal contribution on entrepreneurship mentioned its incontestable existence for entrepreneurial success. Now, when we intend to relate this act of innovation with some human qualities, we call it innovativeness. Thus, as a core entrepreneurial personality trait, innovativeness inspires entrepreneurs, right from the searching phase i.e., intention formation, where he/she develops unique idea to exploit special opportunity. Although this relationship looks simple and direct, but scholars (Chen et al. 1998) often question this relationship. Is it simple innovation, or the self-efficacy of innovation which define an entrepreneur?

Risk taking propensity

Numerous authors confirmed that there is a positive direct relationship between risk taking propensity and EI. But to explain this phenomenon better, we implant perceived self-efficacy as a mediator between this relationship. By this exploit we mean to say that, it is not risk taking propensity that directly impact individuals' EI, but it's perceived self-efficacy which makes the individuals with higher risk propensity, feel assertive about the task they need to accomplish while pursuing an entrepreneurial career. As entrepreneurship, cannot be pursued without taking personal and financial

risk hence, individuals with high risk taking propensity would feel more comfortable in uncertain situations.

Locus of control

Other than global self-efficacy, entrepreneurship which requires task-specific or state self-efficacy finds its association with various cognitive variables, and locus of control has been a prominent one. Hence, entrepreneurial self-efficacy is more relevant with internal locus of control other than external locus of control. Additionally, internal locus of control, through the manifestation of core evaluation of individual's coping skills and persistence toward an intended outcome may inspire to pursue an entrepreneurial career. Thus, entrepreneurial self-efficacy being explicitly oriented toward perceived behavioural capabilities, we see an increased internal locus of control intuitively shifts toward a more approving intention.

Therefore, the role of personality traits as antecedents of EI is unequivocal but we propose that the consistency of the model could be improved if we consider the function of perceived self-efficacy. In summary, we hypothesize that:

H7: Perceived self-efficacy mediates the relationship between four entrepreneurial personality traits and entrepreneurial intention.

Research methodology

Instrument and scale development

To pursue the objectives of our research, we primarily adopted all the constructs from relevant literature from the field of entrepreneurship. A six-member (entrepreneurship, marketing, psychology and economics, sociology) expert panel was constituted for questionnaire review. At the beginning, a rigorous pilot test was conducted among 55 students pursuing a bachelor degree in Science & Technology. As all the constructs used in the study were adopted, so the hosts of researchers have already recognized the validity and reliability of the scale. However, for refinement, we again checked the content and construct validity of the questionnaire, and achieved pre-defined magnitudes successfully. We used a five-point Likert-type scale ranging with scores- 1 (“lowest measure”) to 5 (“highest measure”). To increase the validity of the questionnaire, some of the items were reversed scored (Anastasi 1982; Nunnally 1978; Schriesheim and Eisenbach 1995). Finally, we designed a self-administered structured questionnaire containing two parts, (1) demographic content and (2) psychological content, on the basis of collective inputs from the pilot study. Table 1, lists the questionnaire items along with their sources of adoption.

Survey procedures and participants' description

With the background support from previous studies on entrepreneurial intention which observed that university students have a higher potential to be entrepreneur when they

Table 1 Questionnaire items and their source of adoption

Constructs and measuring items	Sources
<i>Attitude</i>	Liñán and Chen (2009)
<i>Indicate your level of agreement from Extremely bad (1)/extremely good (5)</i>	
AT1: Being an entrepreneur implies more advantages than disadvantages to me.	
AT2: A career as an entrepreneur is attractive for me.	
AT3: Even if I had the opportunity and resources, I'd never like to start a firm*.	
AT4: Being an entrepreneur would entail great satisfactions for me.	
<i>Subjective Norm</i>	Krueger et al. (2000)
<i>Think of important people in your life and answer the questions, extremely unsupportive (1)/extremely supportive (5)</i>	
SN1: If I were to start my own business, my parents would be supportive.	
SN2: If I were to start my own business, my close friends would be very supportive.	
<i>Think of important people in your life and answer the questions, Very little importance (1)/utmost importance (5)</i>	
SN3: My parents' opinion are not at all important for me*.	
SN4: How important are your close friends' opinions to you?	
<i>Perceived Self-efficacy</i>	Wilson et al. (2007)
<i>Rate yourself against your peers on the following measures, Extremely worse (1)/extremely good (5)</i>	
PSE1: Making decisions.	
PSE2: Managing money.	
PSE3: Being able to solve problems.	
PSE4: Being a leader.	
<i>Entrepreneurial Knowledge</i>	Liñán et al. (2011)
<i>Indicate your level of knowledge about entrepreneurship, absolute ignorance (1) to complete knowledge (5)</i>	
EK1: To what extent do you understand the activity of an entrepreneur?	
EK2: To what extent you can differentiate between good or bad entrepreneurs?	
EK3: To what extent do you understand the activity of a business association?	
EK4: To what extent do you know how business support bodies can help you to get loan and technical aid to start your business?	
EK5: To what extent do you know about specific training provided for young entrepreneurs?	
<i>Perceived Career option</i>	Sampson et al. (1998)
<i>Rate yourself on the following questions, Extremely worse (1)/extremely good (5)</i>	
PCO1: Choosing among various career options is so complicated, I just can't get started*.	
PCO2: The more I try to understand myself and find out about various career options, the more confused I get*.	
PCO3: I worry a great deal about choosing the right career*.	
PCO4: I am not afraid; I'm overlooking a career option.	
PCO5: I'm always getting mixed messages about my career choice from important people in my life*.	
<i>Entrepreneurial Personality traits</i>	
<i>Optimism</i>	Wally and Baum (1994)
<i>Rate yourself on the following questions, extremely worse (1)/extremely good (5)</i>	
O1: I feel the economy will expand next year.	
O2: I never expect any kind of improvement in my life and the economy*.	
O3: I feel my performance will improve next year.	

Table 1 (continued)

Constructs and measuring items	Sources
Innovativeness	Chye Koh (1996)
<i>Rate yourself on the following questions, extremely worse (1)/extremely good (5)</i>	
I1: While others see nothing unusual in the surroundings, I am able to perceive in them opportunities for business.	
I2: I am able to get around difficulties through strokes of ingenuity and resourcefulness.	
I3: I believe there are always new and better ways of doing things.	
Risk taking propensity	Chye Koh (1996)
<i>Rate yourself on the following questions, Extremely worse (1) /extremely good (5)</i>	
RT1: I am willing to take higher risks for higher returns.	
RT2: I do not care if the profit is small, so long as it is assured and constant.	
RT3: I never fear moving into a new undertaking, I know nothing about*.	
Locus of Control	Levenson (1974)
<i>Rate yourself on the following questions, Extremely worse (1)/extremely good (5)</i>	
LOC1: When I get what I want, it is usually because I worked hard for it.	
LOC2: My life is mostly determined by my own actions.	
LOC3: I mostly cannot control what will happen in my life*.	
Entrepreneurial Intention	Liñán and Chen (2009)
<i>Rate yourself on the following questions, Extremely worse (1)/extremely good (5)</i>	
EI1: I'm not ready to do anything to be an entrepreneur*	
EI2: My professional goal is becoming an entrepreneur	
EI3: I will make every effort to start and run my own firm	
EI4: I'm not determined to create a firm in the future*	
EI5: I've got the firm intention to start a firm some day	

*Items with an asterisk are reverse scored

are guided by adequate education necessary for venture creation and its successful performance (Zhang et al. 2014; Cooper et al. 1994; Kennedy and Drennan 2001). Hence, in this study, we have considered a population of science and technology graduates from the top five institutes of science and technology in India (i.e. Indian Institute of Technology-Delhi, Indian Institute of Technology-Chennai, Indian Institute of Technology-Mumbai, Indian Institute of Technology-Kanpur, Indian Institute of Technology- Kharagpur), these institutes offer a broad range of courses related to: engineering, technology and basic sciences. To pursue the objectives of our research, we have collected the data through a quantitative data collection method i.e. a survey, which empowered us to directly face the thoughts, feelings and opinions of the respondents and further enhanced the response rate (Yin 1984; Zikmund et al. 2003; Adler and Clark 2014; Evans and Rooney 2013).

The entire data was collected in the month of July–October 2015. We employed stratified and non-probability (purposive) sampling method (Vrontis and Pappasolomou 2007) where stratification was done in order to have the sample that was a true representative of the population and the purposive method allowed us to choose the respondents on the basis of preordained wisdom. Furthermore, the administration of

these universities was contacted to seek permission and assistance with on-site data collection. In order to reduce the selection bias, we considered students that have been enrolled under different disciplines of engineering and science, such that their responses could be randomly assessed. The size of the population was approximately 15,000 engineering students. In our study, we administered a total of 800 questionnaires.

In order to reduce non-response biasness, (which generally occurs when a respondent decline to answer the questionnaire, or when there is a response difference between the respondents and the non-respondents; Forza 2002), we tried to increase the response rate or the level of response (Lindell and Whitney 2001). In the present study, the class representatives were contracted to seek assistance with on-site data collection and several follow-up reminders were also made. In the end, we received a sum of 526 valid questionnaires, i.e., 65% responses rate.

From Table 2, we clearly observe that the respondents of the survey belonged to diverse demographic characteristics. Seventy-nine percent (79%) of the graduates that participated in the study were males. The probable reason for this larger gender imbalance can be attributed to lower number of female students studying in technological institutes in India. According to a recent article, for every eight to fourteen male students in premier engineering colleges in India, there is just one woman who takes admission in undergraduate engineering programs (Bagla 2016). Most of the respondents (marital status: single, 98.23% and married, 1.77%) were between 18 and 21 years (68.05%), the rest of the respondents were between 22 and 25 years (31.95%). Sixty-seven percent (67.13%) of the respondents reported that they belonged to nuclear family type, while the rest (32.87%) of the respondents said that they came from joint family. Moreover, most of the respondents were fresher (87.42%) and did not have any job experience. The survey also depicted that most of respondents belonged to middle income family group (<25,000 INR per month,

Table 2 Demographic profile of the S&T graduates ($N = 476$)

Dimensions	Category	Frequency	Percentage
Gender	Male	378	79.37
	Female	98	20.63
Age	18–21 years	324	68.05
	22–25 years	152	31.95
Marital Status	Single	468	98.23
	Married	08	1.77
Family Type	Nuclear	319	67.13
	Joint	157	32.87
Professional Experience	Freshman	416	87.42
	Job Experience	60	12.58
Household family income (monthly) (in Indian rupee: INR)	below 25,000	115	24.09
	25,001–45,000	153	32.17
	45,001–65,000	124	26.06
	65,001–85,000	53	11.23
	85,001 - above	31	6.55

24%; 25,001–45,000 INR per month, 32.17%; 45,001–65,000 INR per month, 26.06%; 65,001–85,000 INR per month, 11.23%; >85,001 INR per month, 6.55%).

Data screening

The obtained data was then screened to ensure that the data was clean and ready for further analysis. Firstly, the data was examined for the presence of any missing values or outliers. It was observed that the maximum percentage of missing data was 6%, which was less than the threshold limit of 10% of the responses on a particular variable (Kline 1998; Cohen and Cohen 1983), moreover the missing data was replaced using ‘regression imputation’ (through median replacement method, because of the use of Likert type scaled data) (Lynch 2003) through SPSS (software version 21). Later on, outliers were also identified using Cook’s distance. A total of 07 responses were deleted as they exceeded the threshold limit of 1 (Stevens 2012). Therefore, the sample size was reduced to 476. According to Kline (2011), there should be at least 10 responses per parameter. Hence, a sample size 476 meets this priori condition, since the questionnaire comprised of 39 items.

One of the underlying assumptions to perform structural equation modelling (SEM) is that, data should be normally distributed, in order to increase statistical inference (Baumgartner and Homburg 1995; Shook et al. 2004). Therefore, in the present study, we tested the data for the presence of deviation from normality. We used Mardia statistic (to measure multivariate kurtosis), it was observed that the statistic was equal to 13.12, with a critical ratio of 1.82 (a critical ratio above 1.96 signifies departure from multivariate normality with 95% confidence). Therefore, non-normality was not a major issue for our data.

In our study, since the data for both the dependent variable (i.e. entrepreneurial intention) and independent variables (i.e. perceived career option, entrepreneurial knowledge, entrepreneurial personality traits, personal attitude, subjective norm and perceived self-efficacy) were collected at the same time from the same respondent, there was a probability that the data could suffer from common method bias (Chang et al. 2010). The presence of common method bias was tested through Harman’s one-factor test (Podsakoff and Organ 1986). So, we conducted an exploratory factor analysis to see, whether a single factor could account for major covariance in both the dependent as well as the independent variables. It was found that the single factor structure was unable to explain a significant covariance (32.73%) (Table 3). This clearly showed that common method bias was not a source of concern.

The collected data was then analysed with the help of AMOS (Analysis of Moment Structure) version 21 software, which applies a covariance based structure modelling technique. The study has used two step approach as suggested by Anderson and

Table 3 Total variance explained (Harman’s single factor test)

Component	Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	11.778	32.727	32.717

Extraction Method: Principal Component Analysis

Gerbing (1988). At first, the measurement model was constructed to test the validity and reliability of the conceptual model and later on two structural models were constructed to assess the model fitness, validate the proposed hypotheses and assess the possibility that self-efficacy is a full mediator between entrepreneurial personality traits and entrepreneurial intention.

Results

Measurement model: reliability and validity

Measurement model is used for the qualitative assessment of validity and reliability of the constructs included in a study (Henseler et al. 2009). In this research, we first conducted a confirmatory factor analysis (CFA), to verify whether the predetermined sets of variables were interrelated in the hypothesized manner. The initial CFA findings suggested an adequate model fit with the following indices: $\chi^2 = 341.19$, $\chi^2/df = 1.76$, GFI = 0.92, TLI = 0.91, CFI = 0.94, IFI = 0.94, RMSEA = 0.04; Individual item reliability was analysed using factor loadings, it was observed that three items (one from entrepreneurial knowledge, EK 2; and two from perceived career option, PCO3 and PCO5), showed a low factor loading i.e. below the threshold limit of 0.6 (Chin et al. 1997). Therefore, these three items were deleted. CFA was again conducted on the remaining measurement items. The final CFA showed a better model fit with the following indices: $\chi^2 = 289.03$, $\chi^2/df = 1.57$, GFI = 0.97, TLI = 0.96, CFI = 0.96, IFI = 0.98, RMSEA = 0.04.

The construct reliability was assessed using composite reliability (CR) and Cronbach's alpha (α). For composite reliability, the score of 0.6 and above (Bagozzi and Yi 1988) and for Cronbach's alpha the score of 0.7 and above (Hair et al. 1998) is considered to be adequate. In the present study, value of composite reliability ranged between 0.74 and 0.87, whereas the Cronbach's alpha value ranged between 0.73 and 0.89. Therefore, all the constructs and their dimensions were reliable (Table 4).

Furthermore, convergent validity and discriminant validity were also examined. Convergent validity was measured through, average variance extracted (AVE). All the constructs and their dimensions attained the benchmark of <0.5 (Fornell and Larcker 1981; Hair et al. 1998) (Table 4). Table 5, shows the results of discriminant validity. It was observed that each construct was related more strongly and closely to its own measures than with the other constructs included in the study with the factor correlation of >0.8 (Brown 2015). Moreover, the square root of AVE for each construct was found to be higher than its co-relational value (Chin et al. 1997). For the evaluation of formative measurement models, test of potential multi-collinearity was also done between the items (Henseler et al. 2009). The maximum value of the variance inflation factor (VIF) for the construct was 2.34, which is below the threshold level of 3.3 (Roldán and Sánchez-Franco 2012).

Structural model: goodness of fit statistics

After the CFA, we constructed three structural models (Model 1: proposed framework model; Model 2: TPB model and Model 3: mediated structural model), for assessing

Table 4 Measurement model

CONSTRUCT/Key dimensions/items	Cronbach's alpha	SFL	SMC	VIF	Composite Reliability (CR)	Average Variance Extracted (AVE)
<i>Construct 1: Personal Attitude</i>	0.80			1.8	0.81	0.51
PA1.		0.65	0.42			
PA2		0.62	0.38			
PA3		0.78	0.61			
PA4		0.8	0.64			
<i>Construct 2: Subjective Norms</i>	0.76			2.25	0.8	0.51
SN1		0.8	0.64			
SN2		0.74	0.55			
SN3		0.68	0.46			
SN4		0.62	0.38			
<i>Construct 3: Perceived Self-Efficacy</i>	0.84			1.12	0.82	0.53
PSE1		0.63	0.39			
PSE2		0.78	0.61			
PSE3		0.78	0.61			
PSE4		0.71	0.5			
<i>Construct 4: Entrepreneurial Knowledge</i>	0.86			2.34	0.81	0.53
EK1		0.64	0.41			
EK3		0.66	0.44			
EK4		0.79	0.62			
EK5		0.8	0.64			
<i>Construct 5: Perceived Career Option</i>	0.74			1.87	0.82	0.6
PCO1		0.76	0.58			
PCO2		0.76	0.58			
PCO4		0.8	0.64			
<i>Construct 6: Entrepreneurial Personality Trait</i>	0.87			2.06	0.94	0.55
Optimism						
O1		0.62	0.38			
O2		0.73	0.53			
O3		0.8	0.64			
Innovativeness						
I1		0.64	0.41			
I2		0.66	0.44			
I3		0.89	0.79			
Risk Taking Propensity						
RT1		0.72	0.52			
RT2		0.83	0.67			
RT3		0.67	0.45			

Table 4 (continued)

CONSTRUCT/Key dimensions/items	Cronbach's alpha	SFL	SMC	VIF	Composite Reliability (CR)	Average Variance Extracted (AVE)
Locus of Control						
LOC1		0.78	0.61			
LOC2		0.79	0.62			
LOC3		0.77	0.59			
<i>Construct 7: Entrepreneurial Intention</i>	0.85			1.89	0.84	0.52
EI1		0.62	0.38			
EI2		0.82	0.67			
EI3		0.79	0.62			
EI4		0.61	0.37			
EI5		0.75	0.56			

One item from entrepreneurial knowledge (EK2) and two items from perceived career option (PCO3, PCO5) were removed from the analysis due to low factor loadings. SFL-Standardized factor loadings; SMC- squared multiple correlation; VIF- variance inflation factor

the goodness of fit statistics. Entrepreneurial personality traits was modelled as the shared variance amongst each of the four item-based (i.e. Optimism, innovativeness, risk taking propensity and locus of control) entrepreneurial personality traits. At the initial stage, the structural model depicted a poor model fit. Modification indices were then examined for the re-specification of the proposed framework based on theoretical justification (Anderson and Gerbing 1988). After the application of modification

Table 5 Discriminant validity and co-relation among the constructs

Variables	PA	SN	PSE	EK	PCO	EPT	EI
PA	0.71						
SN	0.17**	0.71					
PSE	0.13**	0.11**	0.73				
EK	0.23*	0.10*	0.25*	0.73			
PCO	0.16**	0.33*	0.08*	0.38*	0.77		
EPT	0.36**	0.25**	0.37**	0.25**	0.22*	0.74	
EI	0.20*	0.23**	0.15**	0.46*	0.31**	0.26**	0.7
Mean	4.24	4.07	4.13	4.06	4.42	4.32	4.08
SD	0.45	0.4	0.43	0.4	0.46	0.69	0.44

Diagonal elements (bold) are the square root of variance shared between the constructs and their dimensions (AVE). The off-diagonal elements are the correlations among the constructs. For discriminant validity, the diagonal elements should be larger than the off-diagonal elements

PA Personal attitude, SN Subjective norms, PSE Perceived self-efficacy, EK Entrepreneurial knowledge, CC Career choice, EPT Entrepreneurial personality trait, EI Entrepreneurial intention

* $p < 0.05$. ** $p < 0.01$, *** $p < 0.001$

indices, there was an improvement in the model fit indices. Furthermore, the base TPB model along with the mediated model was also tested for goodness of fit indices (Table 6). Furthermore, we also apply the AIC (Akaike information criterion) test (Akaike 1974) to compare the three models (Model 1, Model 2 and Model 3). According to this criterion, given a set of models for the data, the preferred model is the one with the minimum AIC value. The AIC value of the Model 1 is 234.34, for the Model 2, it is 344.90 and for Model 3, it is 215.89. The AIC test, therefore indicates that the mediated model (Model 3) is preferred over the other two models (Model 1 and Model 2).

The three structural models (Model 1, Model 2, Model 3) were compared to assess their predictive power and it was observed that through the incorporation of three additional factors in Model 1 (i.e. entrepreneurial personality traits, entrepreneurial knowledge and perceived career option), the predictive power of Model 1 ($R^2 = 0.36$) was higher than the predictive power of Model 2 (Base TPB model) ($R^2 = 0.27$). Moreover, the fit indices of the proposed structural model was better than the base TPB model (Table 6), which suggested that the inclusion of entrepreneurial personality trait, entrepreneurial knowledge and perceived career option increased the explanatory power of base TPB, in case of entrepreneurial intention. In addition, for the mediated model (Model 3) $R^2 = 0.41$ for entrepreneurial intention. Notably, the R^2 for entrepreneurial intention jumps by 5% on the treatment of perceived self-efficacy as a mediator between entrepreneurial personality traits and entrepreneurial intention.

Table 6 Goodness of fit indices and explanatory power of the model

Fit Indices	Model 1 (Proposed framework model) (Direct effect model)	Model 2 (TPB model)	Model 3 (Mediated model)	Norms	Sources
χ^2	324.46	176.43	172.17	N/A	
χ^2/df	1.67	1.89	1.12	>1 and <5	Wheaton et al. 1977
GFI	0.92	0.94	0.91	$\geq 0.90^*$	Shevlin and Miles 1998
TLI	0.94	0.96	0.92	≥ 0.90	Hu and Bentler 1999
CFI	0.91	0.95	0.91	$\geq 0.90^{**}$	Hu and Bentler 1999
IFI	0.98	0.94	0.9	≥ 0.90	Bagozzi and Yi 1988
RMSEA	0.04	0.04	0.03	≤ 0.05	MacCallum et al. 1996
AIC	234.34	344.9	215.89		Akaike 1987
R^2 Adjusted (Entrepreneurial Intention)	0.36	0.27	0.41		

GFI Goodness of fit index, *NFI* Normative fit index, *TLI* Tucker-lewis index, *CFI* Comparative fit index, *IFI* Incremental fit index, *RMSEA* Root mean square error approximation, *AIC* Akaike information criterion

Hypothesis testing

To test the proposed hypotheses (H1, H2, H3, H4, H5 and H6), we analysed the three structural models (Model 1, Model 2 and Model 3). It was observed that the basic factors of TPB i.e. personal attitude ($\beta = 0.32, t = 3.45, p < 0.001$), subjective norm ($\beta = 0.12, t = 2.87, p < 0.01$) and perceived self-efficacy ($\beta = 0.24, t = 3.12, p < 0.01$) were significant and positively associated with entrepreneurship intention of science and technology graduates. Thus providing supports for H1(a), H1 (b) and H1(c) respectively. In addition, the two external factors that were included in TPB model, namely, entrepreneurial knowledge ($\beta = 0.38, t = 4.57, p < 0.01$) and perceived career option ($\beta = 0.18, t = 3.73, p < 0.01$) also exert positive influence on the intention to pursue entrepreneurship. Thereby, providing support for H4 and H6. Furthermore, it was observed that entrepreneurial knowledge ($\beta = 0.45, t = 5.19, p < 0.01$) and perceived career option ($\beta = 0.24, t = 3.34, p < 0.05$) also exert significant positive relationship with personal attitude, which supported the hypotheses H2 and H5 respectively. Moreover, hypothesis H3 was significantly supported by a positive relationship between entrepreneurial knowledge ($\beta = 0.14, t = 3.16, p < 0.001$) and subjective norm.

Mediation analysis

As we hypothesized that perceived self-efficacy will mediate the effect of entrepreneurial personality traits on entrepreneurial intention, thus, we analysed our model through two approaches i.e. the direct effect of entrepreneurial personality on entrepreneurial intention, followed by the indirect effect of entrepreneurial personality on entrepreneurial intention with perceived self-efficacy as the mediating variable (Fig. 2). It was observed that there was a rejection of the alternative model (Model 1) that included a direct path from entrepreneurial personality to entrepreneurial intention, suggesting that the effect of entrepreneurial personality is fully mediated by perceived self-efficacy, thus providing support to hypothesis 7 ($\beta_{EPT-EI} = 0.03, t = 1.02, p > 0.05$; $\beta_{EPT-PSE} = 0.53, t = 7.02, p < 0.01$). As stated earlier the final model (Model 3) explained 41% of the variance in entrepreneurial intention as compared to 36% of variance (Model 1) (see Table 6).

Discussion

This study adds to the existing literature on the application of the theory of planned behaviour in explaining entrepreneurial intentions. We instrumentalized three new constructs in the base TPB, while designing our conceptual model to increase the feasibility of the study. Results of this study signify associations among a set of individual and external factors contributing to Indian S&T graduates' entrepreneurial intentions. It was observed that among the basic constructs of TPB (i.e. attitude, subjective norm and perceived self-efficacy), attitude had the most significant relationship with entrepreneurial intention, which illustrates that Indian S&T graduates are more concerned with their attitudinal issues while anticipating entrepreneurship as a prospective career option. Here, our results regarding the effect of attitude on intention

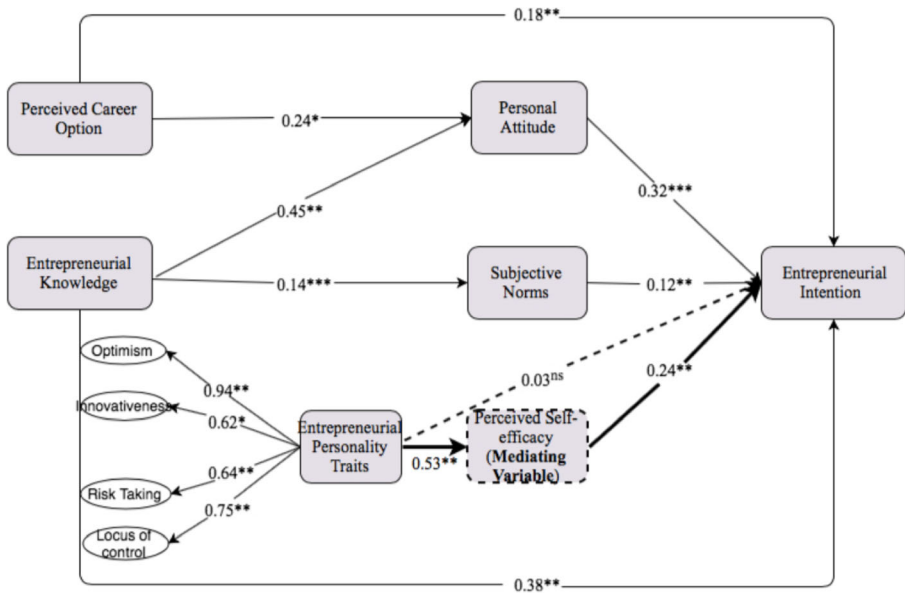


Fig. 2 Final model (Alternative Model 3). Parameter estimates are from the fully standardized solution. Note: Solid arrows represent hypothesized paths; dotted arrow represents a path that was not significant; * $p < .05$. ** $p < 0.01$, *** $p < 0.001$

follows the findings of Marques et al. (2012), who also demonstrated that attitude was the major contributor for entrepreneurial intention, specifically among vocational course students. This findings also reaffirm most of the erstwhile empirical results (Liñán and Chen 2009; Souitaris et al. 2007). On measuring the impact of subjective norms on intention, we found though positive but relatively weak (Miralles et al. 2015; Armitage and Conner 2001) relationship which contradicts the outcome of Liñán and Chen (2009), who confirmed insignificant impact of subjective norms on venture creation intention. Other researchers (Autio et al. 2001; Krueger et al. 2000), also have shown similar type of result, either positive but low or negative potential relationship between subjective norms and EI. Our first, extension variable i.e., entrepreneurial knowledge follows the findings from other scholars (Kor et al. 2007 & Lüthje and Franke 2003), who reported a significant positive influence of entrepreneurial knowledge on entrepreneurial intention. Further the influence of entrepreneurial knowledge on attitude (.45) was comparatively high but we found a relatively low effect (.14) of entrepreneurial knowledge on subjective norms, when we compare our results with Miralles et al. (2015), who reported those impacts of .336 and .305 respectively. Thus, following our previous findings i.e., impact of attitude on intention which is quite strong, we can further illustrate that knowledge resonates a high impact on intention. Our findings also shows that entrepreneurial knowledge was relatively low among Indian S&T graduates (4.06/5) when compared with the other two extraneous factors i.e. perceived career option (4.24/5) and entrepreneurial personality traits (4.32/5). Therefore, it can be inferred that there is a need to create an awareness and uplift entrepreneurial knowledge among S&T graduates to enhance pro-entrepreneurial mindset in India. Additionally, though most studies have not included specific career options

around entrepreneurship (Wilson et al. 2007), but to increase the feasibility of the study, we have inserted perceived career option as our second extension variable. We found relatively weak direct effect of perceived career option on EI but comparatively higher effect on attitude. This finding implies that perceived career option as an antecedent of EI, far better can be explained if we see the whole process through its impact on attitude. Our result contradicts (Liñán and Chen 2009), who reported that perceived career option could better be expressed through subjective norms in a collectivistic culture. In our findings, such outcome could be the result of specific set of data, where we exclusively considered S&T graduates from Indian premier technology institute, where “pull” factor works while a student think about entrepreneurship rather than “push” factor. Further, erstwhile scholars (Driver 1988; Dimov 2007) found that, it’s both perceived desirability and feasibility pertains to the extent to which entrepreneurship is a valid career option. Hence, crafting the existence of entrepreneurship as a promising career option among the students can instigate them to perceive entrepreneurship more like a gifted job.

Moreover, using perceived self-efficacy as a mediator in the relationship between entrepreneurial personality traits and EI has enriched the existing entrepreneurship literature. Our findings confirmed that the relationship between personality traits and EI, could be better explained when we let the nexus pass through perceived self-efficacy. Through the implementation of this mediation process, we further extend the role of perceived self-efficacy as a super-conductor in the relationship between various personality traits and EI which further increased its predictive power of the conceptual model. We also found that the effects of four personality traits, namely, optimism, innovativeness, risk taking propensity and locus of control is positive and significant. Hence, using perceived self-efficacy as a mediator variable rather than putting it in a group of personality traits, we may see its role as an essential component to improve the feasibility of getting the person back into entrepreneurship research (Rauch and Frese 2007). The overall results validate the insertion of three additional constructs, namely, entrepreneurial knowledge, perceived career option and entrepreneurial personality traits in the original TPB model, while it has significantly improved the predictive power of the proposed conceptual model (mediated model: Model 3; $R^2 = 0.41$) by 14% as compared to the base TPB ($R^2 = 0.27$).

Conclusion

Implications

Our findings from this research can offer several critical implications for both entrepreneurship research and practices. Perceived self-efficacy is found to be fully mediating the relationship between entrepreneurial personality traits and EI. This significant theoretical contribution of this paper, could empirically validate the indirect effect of personality on entrepreneurial intention formation through our model. For a long time, entrepreneurship scholars (Mischel and Shoda 1998) have argued that to describe personality judiciously author must take not only traits components but also mediation process. Again, as perceived self-efficacy refers to cognitive evaluations of personal capabilities in reference to the specific tasks of entrepreneurship, thus, the level of self-

efficacy could be increased through proper training and evolutions. Hence, this finding provides empirical support for the idea that formal academic courses can be used to create a positive impact on students' intentions to initiate entrepreneurial venture. Further, our effort to extend base TPB model by inserting (entrepreneurial knowledge and perceived career option) is supported by the findings of the analysis. This strongly supports the value of well-designed entrepreneurial education program which in turn, will expand the supply of both the potential and nascent entrepreneurs by improving the existence of entrepreneurship as a viable career option of S&T graduates. Hence, creating an atmosphere that generates positive vibes toward being entrepreneurial could serve the purpose.

The results of this study also have implications for entrepreneurial practice. India being one of the world's fastest growing large economy, with a huge mass of educated and prospering middle class, is currently in the best shape to satiate the techno-entrepreneurial barrenness. In general, our findings can make public policy makers aware of the ground reality and suggest with major mechanism to promote entrepreneurial psyche among S&T graduates in premier technology institutes. Hence, to epitomize the outcomes of this study through real life implications, educationists can use the insights while designing suitable strategies for on-campus technology-entrepreneurship and venturing. Further, the impact of entrepreneurial knowledge has been the strongest among all three external antecedents of intention. So, educational institutions and entrepreneurial ecosystem loads with the accountability to create a customized entrepreneurial knowledge proliferation mechanism. Such efforts can stimulate EI which could result in growing number of venture initiatives. Given the low but positive influence of subjective norms on entrepreneurial intention, further signifies that there may be some effects of social group, family norms and expectation, and peer pressure, while considering to pursue an entrepreneurial career. Hence, the system at large, should take care of building a pro-entrepreneurial atmosphere surrounding venturing at institution level. Mediation results over perceived self-efficacy, intrigued us to confer that the use of consistent persuasion, relevant hands-on projects and using successful contemporary role models can improve the effects of entrepreneurial personality traits toward "being entrepreneurial".

Limitations and future research scope

Like any other exploratory study, this research is not without limitations. First, it is very important to extend studies of EI beyond the more convenient sample of students from few selected technology institutes in India i.e., only S&T graduates from IITs, which comprises of only 0.7% engineers among 1.5 million total engineering pass-out in India every year. Thus, deliberately concluding with the findings from our research that it characterizes all of the Indian S&T graduates, will be erroneous. Another limitation of this study is the use of only self-report measures; a second source of data would be useful. In particular, the self-efficacy construct may suffer from bias since respondents may overstate their perceived ability to accomplish entrepreneurial tasks. A third limitation could be measuring the entrepreneurial intention not the actual entrepreneurial behaviour, i.e., actual venturing. In statistical elucidation, we can roughly say that the explanatory power

of the proposed frame-work is 41% (i.e. $R^2 = 0.41$). It is also noted that the ratio of male-female respondents in the sample could be a fact of concern while generalizing students.

Moreover, to draw casual references among study variables future researchers could take the help of longitudinal data as well as quasi-experimental research designs to establish causal linkages (Wood and Eagly 2009). But such a study is only possible with a long-term cooperation by the institutions and required resources. Potential students can be tested on their EI prior to the joining of the entrepreneurship program, and again after the completion of course, and their real career choice after they are graduated, which will help to validate the entrepreneurial intention. Other list of suggestions can be entitled as, (1) accommodating more S&T graduates from all over India, beginning with the premier technology institutes (IITs), as well as mid-tier private engineering colleges; (2) extending the model up-to actual entrepreneurial behaviour will result in conjoining the relationship between entrepreneurial intention and actual entrepreneurial endeavour; and (3) integrating additional constructs from various entrepreneurial literature will improve the predictive power of the framework. Further, this study could replicate on management students from premier B-schools in India, which will take us one step ahead toward actual behaviour. Because it was constantly observed that most of the MBA aspirants who get selected in top B-schools are from these IITs, and significant portion of those MBA's have seen to be entrepreneurially successful. Finally, future researchers should increase resources and adopt more creative methods to improve validity and generalization of the results.

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