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Analysing the impact of post-pandemic factors on entrepreneurial intentions: the enduring significance of self-efficacy in student planned behaviour

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ABSTRACT

After the pandemic, there has still been an increased interest in examining university students' entrepreneurial goals. In this study, we looked at the practicality and validity of using self-efficacy to broaden the theory of planned behavior (TPB) in assessing students' intent to be entrepreneurs. Additionally, we looked at how students' geographic location and gender affected their plans to start their businesses. Following the epidemic, we analyzed data obtained from a number of university students in both urban and rural regions of India using PLS-SEM and ANN methods. Our study confirmed the pivotal role that university students' self-efficacy had in their entrepreneurial goals. The results of multi-group analysis (MGA) reported the insignificant moderating role of gender for the students' entrepreneurial intentions. Still, they found a statistically significant difference in their said behavior control for entrepreneurial intentions regarding location. Based on their perceived behavioral control, the findings also suggest that youths in rural areas had lower entrepreneurial inclinations than urban students. The study indicated that considering the importance of student self-efficacy, universities should focus on improving students' skill sets and problem-solving mindsets while constructing education courses.

Introduction

The global COVID-19 outbreak has caused many individuals to lose their jobs and enterprises, resulting in a global employment decline (Jha & Kumar, 2020). Most countries' policymakers face substantial difficulty addressing the employment issue (Nazneen et al., 2023; Omidi Najafabadi et al., 2016). There has always been considerable discussion about millennial entrepreneurship and the prevalence of entrepreneurial aspirations among this generation (Akhtar et al., 2022). Since entrepreneurial activity has been proven to aid in a country's economic development, it may be the best course of action here (Liñán, Rodríguez-Cohard et al., 2011). This is essential because it paves the way for implementing policies that can guarantee economic recovery and the creation of fresh businesses in the future. Improving entrepreneurial intentions, which may influence entrepreneurial behaviour, is the starting point in raising the entrepreneur population (Miriti, 2020). In light of the recent health and economic problems, it is essential to study the motivations of young adults who may one day seize opportunities as business owners (Rodriguez-Gutierrez et al., 2020). Since the motivation behind an individual's actions is essential to their

success, we can identify entrepreneurial intents as the ideas that inspire people to launch enterprises (Auna, 2020).

The value of higher education institutions (HEIs) in stimulating economic development and improving the well-being of communities has been shown in previous research (Ratten, 2017). HEIs are indeed being found liable for the educational experiences they offer (Agarwal et al., 2020). This implies that students must be equipped with the skills required in the workforce (Ratten, 2020). In contrast, some people resist entrepreneurship because they lack the requisite skills (Yurrebaso et al., 2021). At this point, self-efficacy starts playing a role in elevating business aspirations (Chahal et al., 2023). People with high self-efficacy in the field of entrepreneurship are convinced of their capacity to launch a successful firm (Cardon & Kirk, 2015; McGee et al., 2009). In addition, self-efficacy is a significant precursor to developing entrepreneurial intent (Pihie & Bagheri, 2013; Zhao et al., 2005). Furthermore, the mediating effect of self-efficacy on entrepreneurial inclinations has been the subject of several studies (Elnadi & Gheith, 2021; Yeh et al., 2021; Zhao et al., 2005). Further, a substantial body of research reveals that entrepreneurs' market success decisions are heavily influenced by their self-efficacy (Wu et al., 2022). Entrepreneurial intent is perceived differently depending on geographical area and gender type. However, there is a shortage of discussion on how self-efficacy affects entrepreneurial intention across different regions and genders. Consequently, the following questions serve as the basis for the present investigation:

RQ1. Does self-efficacy still play a role in generating students' entrepreneurial intentions after the pandemic?

RQ2. Do college students' gender and geographical area still influence their entrepreneurial intentions after the pandemic?

Therefore, the purpose of this study is to examine the relationship between HEI students' entrepreneurial aspirations and self-efficacy as an additional variable in TPB. We will also look at how gender and geography moderate this relationship. To do this, we proposed the research model based on TPB (Ajzen, 2002) and extended it with self-efficacy. We applied PLS-SEM, PLS Predict, IPMA, and ANN to check the importance of self-efficacy. Further, the study used multi-group analysis to evaluate the significant difference between college students based on male vs. female and rural vs. urban.

Until now, the influence of various internal factors like character quirks, inventiveness, creativity, and self-efficacy (Indra Diputra, 2021; Markman et al., 2002; Miriti, 2020; Yeh et al., 2021) as well as external factors like demographic variables (Akhtar et al., 2022; Indra Diputra, 2021; Mozahem, 2021) on the entrepreneurial intentions are reported. Various authors have discovered that geographical region characteristics and some personality traits are significantly connected with entrepreneurial inclination (Yurrebaso et al., 2021). According to Shah et al. (2020), earlier research has demonstrated a high association between self-efficacy, demographic variables, and entrepreneurship education with local students' entrepreneurial intention. Nonetheless, few studies look at how students' backgrounds play a role in shaping their entrepreneurial mindset (Wang & Wong, 2004). It is essential to have an entrepreneurial environment that addresses gender issues (Gohar et al., 2022).

With these research gaps, the present study has contributed in several ways. First, by responding to the need and focusing on the moderating influence of gender and geographical location of higher education students, this research gives insights into the antecedents of entrepreneurial intents in an untapped domain, especially for college students in India. Secondly, it integrates self-efficacy with TBP as an external variable that would provide the entrepreneurship education authorities with insights into how to boost students' entrepreneurial self-efficacy, resulting in a greater willingness to become an entrepreneur. Third, it adds to the current literature on entrepreneurial intentions by employing deep learning technology of artificial neural networks (ANN) in conjunction with the traditional structural equation modeling method.

Here is the outline for the rest of the paper. The following section provides the literature supporting the proposed model and related hypotheses. Section 3 gives the methodology details for this study. In Section 4, study results are reported. Section 5 discusses outcomes in detail. The last section discusses the work's shortcomings, potential future research avenues, and theoretical and practical consequences.

Theoretical underpinning and literature review

Theory of planned behavior (TPB)

TPB enhances the theory of reasoned action (TRA) by adding PBC to forecast intents. The substantial direct influence of TPB variables on intention has been demonstrated in several investigations (Qalati et al., 2022). TPB model developed by Ajzen (2020) mentions that an individual's behavior at any time is predicted or elucidated by his intentions. Those entrepreneurial intentions, in turn, are identified based on three explanatory constructs (i.e. attitude toward behavior, subjective norms, and perceived behavioral control). Earlier intention-related research in the field of entrepreneurship popularly uses TPB as entrepreneurship is a planned behavior. A stronger intention will lead to a high probability of realizing that behavior in reality (Kor & Mullan, 2011). Entrepreneur intention significantly affects a person's behavior, so focusing on cognitive aspects can fetch noteworthy information.

Prior research shows that there are two approaches; one proposed by Aizen is TPB theory, which considers self-efficacy and PBC as the same (Liñán & Chen, 2009), and the other one considers both of these are different (Bandura, 1977; Maheshwari & Kha, 2022; Terry & O'Leary, 1995). Perceived behavior control (PBC) refers to peripheral control factors (depending on whether people perceive any behavior as simple or complex); however, self-efficacy refers to intrinsic control factors affecting behavior (Armitage & Conner, 2001). Correspondingly, we used the second approach in our study by trying to identify the role of self-efficacy and different components of TPB on entrepreneurial intentions among HEI students (see Figure 1).

Entrepreneurial intentions

Intention impacts planned behavior, mainly when it is irregular and is identified by a person and situation (Kor & Mullan, 2011). However, people and situations have low explanatory power, so their impact on entrepreneurship indirectly affects attitude and motivation (Krueger et al., 2000). Individualism and collectivism are not two extremes of the same continuum. At the national level, both can add to entrepreneurship. Individualism can help generate new ideas, enhance creativity, and speed up innovations, and collectivism can help leverage resources, efficient and effective implementation, and improve those ideas (Tiessen, 1997).

Although educational and structural support (Sulaiman et al., 2023a) affects university students' entrepreneurial intention, the prior one plays a more crucial role (Turker & Selcuk, 2009; Yaqub et al., 2015). As entrepreneurial education creates a positive attitude toward self-employment, this relation is
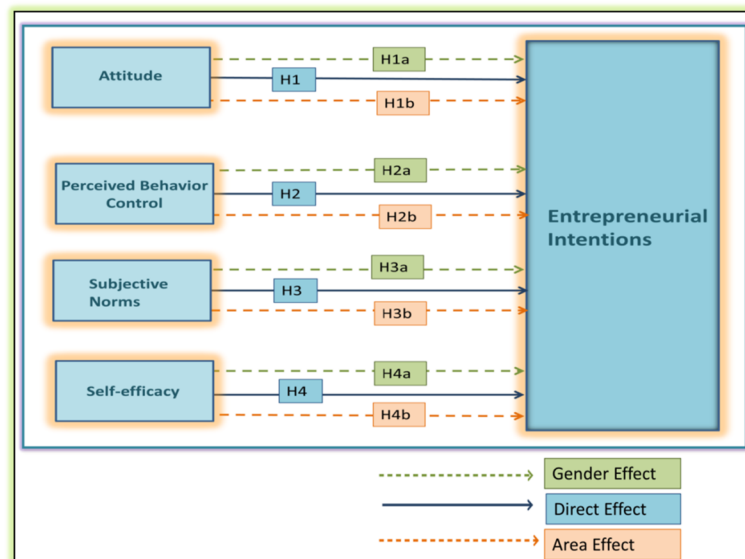

Figure 1. Proposed research model.

mediated by passion (Iyortsuun et al., 2021) and motivation (Chahal et al., 2023). So, to be an entrepreneur. Initially, entrepreneurial intention needs to be present (Molino et al., 2018). The entrepreneurial intention has already been studied concerning entrepreneur education, entrepreneurial ecosystem, TPB, self-efficacy, human capital, emotional intelligence, innovativeness, personality, and social support on entrepreneurial intention (Elnadi & Gheith, 2021; Law & Breznik, 2017; Molino et al., 2018; Passaro et al., 2018). Since COVID-19 has been studied on entrepreneurial intention (Krichen & Chaabouni, 2022; Li et al., 2021; Zulfiqar et al., 2021), our study uses the TPB model and self-efficacy to examine how these factors affect business startups.

Attitude towards behavior (ATT)

ATT is a vital determinant of behavioral intention (Ajzen, 1991). It is reflected by the degree to which a behavior is evaluated as favorable or unfavorable, depending on an evaluation of outcomes associated with executing that behavior (Ajzen, 1991). If the positives of behavioral beliefs outweigh the negatives, the individual will intend to demonstrate the desired behavior (Shaw, 2016). Attitude depends on three antecedents: affection, conation, and cognition (Jena, 2020). Appreciation reflects a person's emotional state or sentiments based on experience, motivation, etc., and is a cognitive component encompassing a person's thoughts or beliefs. Further conation is how you react to a particular situation based on your aims, resulting in exhibiting a specific behavior.

Entrepreneurial-minded individuals are creative risk-takers, have a strong sense of control, aim high, and can handle ambiguity (Mahmood et al., 2020; Soomro et al., 2020). ATT is also changed differently by gender. For instance, for students from Vietnam, ATT is found to have a direct effect on EIs (Doanh & Bernat, 2019). Female EIs are more significantly affected by ATT; however, for male students, the impact of innovativeness is more significant (Jena, 2020). Moreover, the intention to indulge in a start-up is more evident in male than female students (Sitaridis & Kitsios, 2019; Vamvaka et al., 2020). A positive association is hypothesized between ATT and EIs (Zampetakis et al., 2009) along with entrepreneurial development courses (Ahmed et al., 2021). Even the Pandemic research indicated a strong link between ATT and EI (Duong et al., 2022; Gomes et al., 2021; Mustafa et al., 2021). Thus, our initial hypotheses are:

Hypothesis 1. Attitude has a significant influence on the entrepreneurial intentions of HEI students in post-COVID-19.

Hypothesis 1a. There is a significant difference between male and female students' attitudes toward their entrepreneurial intentions post-COVID-19.

Hypothesis 1b. There is a significant difference between rural and urban students' attitudes toward their entrepreneurial intentions post-COVID-19.

Perceived behavior control (PBC)

PBC is associated with external factors affecting the belief that the person's behavior can be controlled (Manstead & Eekelen, 1998). It is concerned with perceiving a behavior as easy or complex to be performed (Ajzen, 1991). So, if something is feasible, individuals will perceive it can be controlled (Krueger et al., 2000). PBC accounts for non-voluntary elements of behavior, focusing on results to check if perceived behavior will help achieve desired results. So, execution or non-execution of behavior controls the person (Ajzen, 2002). A favorable link between PCB and EI has been shown in earlier research (Nguyen et al., 2020; Otchengco & Akiate, 2021). Even studies conducted during the pandemic show a significant association between these two latent variables (Almohammad et al., 2021; Godswill Agu et al., 2022). In light of the preceding discussion, we propose the following tests of the putative relationships between PCB and EI:

Hypothesis 2. PCB has a significant influence on the entrepreneurial intentions of HEI students post-COVID-19.

Hypothesis 2a. There is a significant difference between male and female students' PCB for their entrepreneurial intentions post-COVID-19.

Hypothesis 2b. There is a significant difference between rural and urban students' attitudes toward their entrepreneurial intentions post-COVID-19.

Subjective norms (SN)

Subjective norm is a component of TPB impacting behavioral intention. When people's expectations of them from their families, friends, spouses, and other social groups cause them to feel pressured to act in a certain way, this is known as a subjective norm (Ajzen, 2002). Hence, an individual tries to find how significant behavior is for others (i.e. approval or rejection of a particular behavior by others) (Ajzen, 2020). The degree to which you adopt a behavior is influenced by how you perceive essential people in your life approving or disapproving of it (Krueger et al., 2000). SN is a construct in our model since an individual's behavior is impacted by the attitude of his referent group towards that behavior. However, it was found to have low predictive power (Armitage & Conner, 2001). Previous studies have shown the direct impact of SN on EI (Tsai et al., 2016), which in turn will affect your motivation to demonstrate or not intention to be an entrepreneur.

Furthermore, Tseng et al. (2022) found that the linkage of SN and EI to establish an online start-up is moderated by entrepreneurship education, and males display more subjective norms. Even during COVID-19, SN significantly affects EIs (Ruiz-Rosa et al., 2020; Sohu et al., 2022). Yet, throughout the pandemic era, a few research discovered weak connections between two concepts (Duong et al., 2022; Gomes et al., 2021). Moreover, research on post-COVID-19 is lacking in examining the impact of SN in terms of genders (male and female) and geographical location (ruler and urban) on EIs. Consequently, we develop the following hypotheses:

Hypothesis 3. Subjective norms significantly influence the entrepreneurial intention of HEI students during COVID-19.

Hypothesis 3a. There is a significant difference between male and female students' subjective norms for their entrepreneurial intentions post-COVID-19.

Hypothesis 3b. There is a significant difference between rural and urban students' subjective norms for their entrepreneurial intentions post-COVID-19.

Self-efficacy (SE)

Predicting the likelihood of an entrepreneur's aim relies heavily on their level of self-efficacy. Self-efficacy expectations are built based on accomplishment derived from performance, vicarious experience, and persuading verbal and physiological states. It depends not only on possessing the skills needed. Still, it must be paired with confidence in one's skills, capacities, and competence to complete a job to achieve a target (Bandura & Locke, 2003). Planning, searching, and marshaling are essential variables of self-efficacy in developing entrepreneurial intention; however, its other constructs, namely people and finance, are not essential (Nowiński et al., 2019).

High self-efficacy enhances the chances of performing a task rather than circumventing it. Self-efficacy does not explain females' lower venture-starting intentions, even as gender does not influence SE (Kurczewska & Białek, 2014). SE and EI are linked in previous research (Liñán, Santos et al., 2011; Pihie & Bagheri, 2013). However, the inverse linkage of SE on EI was explored for a course with a theoretical orientation, though direct connections exist between them in the case of practical courses (Piperopoulos & Dimov, 2015). Moreover, studies conducted during the COVID phase also concluded that a significant association exists between SE and EIs (Al-Qadasi & Gongyi, 2020; Alvarez-Risco et al., 2021), along with optimism (Wang et al., 2021). Consistent results were observed in China, even in a study done after the pandemic phase (Zhang & Huang, 2021). Thus, the four sent of our proposed hypotheses aim to explore the below-mentioned relation:

Hypothesis 4. Self-efficacy significantly influences HEI students' entrepreneurial intentions post-COVID-19.

Hypothesis 4a. There is a significant difference between male and female students' self-efficacy for their entrepreneurial intentions post-COVID-19.

Hypothesis 4b. There is a significant difference between rural and urban students' self-efficacy for their entrepreneurial intentions post-COVID-19.

Methodology

Data collection

The data was collected after the lockdown period as it is evident that many people were fired from their jobs during a lockdown, which can further enhance students' intentions to become entrepreneurs. 310 responses were used for data analysis out of 327 total responses collected via Google form. As results are shown in Table 1, the majority of responses are from female students (58.40%). Students are primarily graduates (51.30%), while some are postgraduate. The majority (56.5%) were urbanites.

Instrument of study

The study uses a questionnaire to accumulate data from students belonging to HEIs. The questionnaire further has two dimensions. The first portion concerns responder demographics. The second part comprises twenty statements/items on a 7-point Likert scale from 'strongly disagree (1)' to 'strongly agree (7)' for measuring latent variables of TPB and five statements corresponding to an external variable (i.e. self-efficacy). For each latent variable, four to six items were used. Items of EI were taken from (Liñán & Chen, 2009) with five statements. ATT, PBC, and SN components were taken from (Solesvik, 2013) and had 4, 4, and 6 elements respectively. In the case of external variables of SE, five items were adapted from (Wilson et al., 2007).

Common method bias

To investigate potential common method biasness issues in a dataset, we utilized SPSS 24 and Harman's single factor test using 25 items from the suggested model. Below the 50% threshold, one component of the total variation has a variance of 46.28 percent, showing no issue of common method biasness (Podsakoff et al., 2003). The values of the inner model VIF were also tested and found to be less than 3.3 (Kock, 2015); hence, it can be concluded that our data is free from common approach biases.

Data analysis strategy

This study uses dual-stage analysis instead of PLS-SEM, distinguishing it from past empirical studies on HEI students' entrepreneurial inclinations. The hypothesized model is tested using partial least square structural equation modeling (PLS-SEM) using version 3.3.9. PLS-SEM is currently a prevalent methodology utilized in various social science studies (Chahal, 2022; Elnadi & Gheith, 2021; Ringle et al., 2020; Shoukat et al., 2023; Yeh et al., 2021). In addition, it investigated the moderating effects of gender and geography, both of which were explored using PLS-SEM in conjunction with measurement invariance analyses of variables (MICOM) (Henseler, Hubona, et al., 2016) and multi-group analysis technique. Furthermore, the PLS prediction approach was also used to assess the recommended model's predictive capabilities. The importance and efficacy of the individual components of the research model are then evaluated using an IPMA. In the second part of this research, the artificial neural network (ANN) method is used to corroborate and verify the PLS-SEM findings. The non-linear connection between dependent and independent variables is assessed using ANN as a function of the approximation tool (Akour et al., 2022).

Table 1. Profile of respondents.

Variable	Categories	Frequencies	Percentage
Gender	Male	129	41.60%
	Female	181	58.40%
Education Qualification	Postgraduate	159	51.30%
	Undergraduate	151	48.70%
Area	Urban	175	56.50%
	Rural	135	43.50%

Results

Construct reliability and validity

Table 2 indicates the indicator reliability. The latent variable explains over 50% of item variation since its factor loadings are above 0.7 and its average variance extracted (AVE) is over 0.50 (Hair et al., 2014). All AVEs vary from 0.612 to 1, showing that all constructs exhibit convergent validity. Cronbach's alpha values for all Latent variables/factors are more significant than 0.8, indicating excellent levels of internal consistency, reliability, and composite dependability. Now, we have proof of convergent validity (Hair et al., 2019).

Discriminant validity is also proved through Fornell and Larcker (1981) criterion as the square root of average variance extracted (represented by diagonal values of Table 3) is more than their correlation with other constructs. As per HTMT criteria, there is no discriminant validity issue as all the values in Table 3 lie between 0.386 and 0.717 (i.e. less than 0.85) (Henseler et al., 2015). Having demonstrated indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, an outer model is now considered acceptable.

Structural model assessment

The inner model is evaluated based on R square, effect size F, path coefficient & their statistical significance, Q2. VIF values for all the constructs are <3 Indicating there is no collinearity problem so

Table 2. Constructs reliability and validity.

Constructs	Items	Factor Loadings	Cronbach's Alpha	CR	AVE	VIF
Attitude Towards Behavior	ATT1	0.861	0.911	0.934	0.738	2.518
	ATT2	0.848				2.394
	ATT3	0.844				2.393
	ATT4	0.854				2.444
	ATT5	0.887				2.939
Entrepreneurial Intentions	EI1	0.861	0.920	0.940	0.759	2.551
	EI2	0.883				2.925
	EI3	0.860				2.614
	EI4	0.879				2.874
	EI5	0.871				2.690
Perceived Behavior Control	PBC1	0.763	0.841	0.893	0.676	1.687
	PBC2	0.849				2.157
	PBC3	0.850				2.137
	PBC4	0.824				1.750
Self-efficacy	SE1	0.768	0.851	0.893	0.627	1.741
	SE2	0.796				1.836
	SE3	0.811				1.890
	SE4	0.770				1.771
	SE5	0.810				1.983
Subjective Norms	SN1	0.826	0.921	0.939	0.718	2.333
	SN2	0.849				2.595
	SN3	0.849				2.632
	SN4	0.809				2.181
	SN5	0.870				2.840
	SN6	0.880				3.021

Table 3. Fornell-Larckers criterion and HTMT ratio.

Constructs	1	2	3	4	5
1. ATT	0.859				
2. EI	0.609	0.871			
3. PBC	0.343	0.524	0.822		
4. SE	0.632	0.661	0.401	0.792	
5. SN	0.574	0.637	0.457	0.635	0.848
HTMT ratio					
1. ATT	_				
2. EI	0.663	_			
3. PBC	0.386	0.589	_		
4. SE	0.717	0.743	0.470	_	
5. SN	0.625	0.691	0.517	0.717	_

that the structural relationship can be assessed now (Becker et al., 2015). R2 value (see Figure 2) is 0.672, reflecting that ATT, PBC, SN, and SE explain a 67.2% change in entrepreneurial intention. Hence, it indicates substantial predictive power in-sample (Cohen, 1988). Small, medium, and high effect sizes are shown if F^2 values are above 0.02, 0.15, and 0.35, respectively (Cohen, 1988). The F square value of perceived behavioral control, self-efficacy, attitude towards behavior, and subjective norms was 0.10, 0.096, 0.064, and 0.061, respectively, showing a medium effect size on entrepreneurial intention.

Model fit

Model fitness shows that the Standardized Root Mean Square Residual (SRMR) is 0.044 (less than 0.08) along with a normal fit index value equivalent to 0.902 (more than 0.9 is acceptable) (Henseler, Hubona, et al., 2016). If the SRMR value is less than 0.05, it shows a good model fit (Henseler, Hubona, et al., 2016). RMSE theta correlates with measurement model residuals value (see Table 4). The lower the RMS_theta, the better it is. RMS_ theta value of 0.12 indicates a well-fitting model (Henseler et al., 2014).

Hypotheses testing using PLS-SEM

To test the direct effect of all exogenous factors on endogenous factors (H1, H2, H3, and H4), a bootstrapping of 5000 samples was performed. Outcomes for hypotheses testing (Table 5) revealed all four direct hypotheses were supported. The results showed a direct and positive relationship among all constructs. The attitude of college students was found to be a significant and positive influencing factor for their EI with (β=0.198, p=0.022); in the case of perceived behavior control (β=0.255, p=0.000), results are significant and positive. The same results were found in subjective norms (β=0.185, p=0.042) and self-efficacy (β=0.351, p=0.002), respectively.

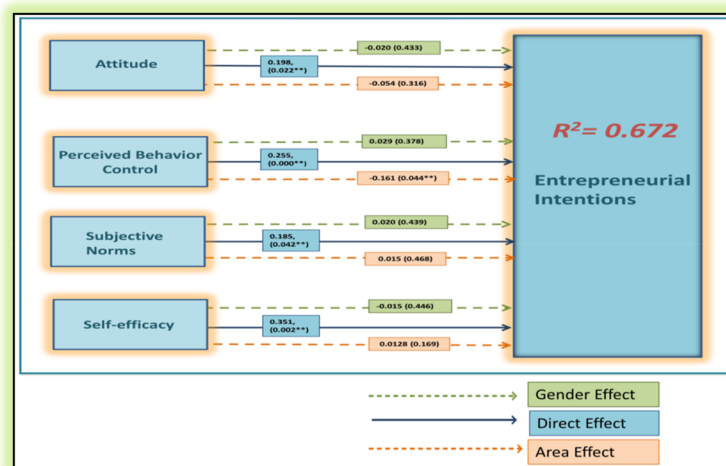**Figure 2.** Structural model.

Table 4. Model fit results.

	Estimated Model
SRMR	0.044
d_ULS	0.642
d_G	0.292
Chi-Square	529.664
NFI	0.902
RMS_theta	0.12

Table 5. Results of hypotheses.

Hypothesis	Path	Path Co-efficient Value	Standard Deviation	t-values	P Value	F2	Remarks
H1	ATT -> EI	0.198	0.086	2.294	0.022**	0.064	Supported
H2	PBC -> EI	0.255	0.056	4.546	0.000**	0.100	Supported
H3	SN -> EI	0.185	0.091	2.035	0.042**	0.061	Supported
H4	SE -> EI	0.351	0.155	3.056	0.002**	0.096	Supported

$**p < 0.05.$

Table 6. Multi-group hypothesis testing (gender).

Hypotheses	Relationship	Path Coefficient		Difference	Confidence Interval (2.5%; 97.5%)	p-Value	Results
		Female	Male				
H1a	ATT -> EI	0.209	0.230	−0.020	(−0.250; 0.256)	0.433	Not Supported
H2a	PBC -> EI	0.245	0.216	0.029	(−0.195; 0.185)	0.378	Not Supported
H3a	SN -> EI	0.230	0.211	0.020	(−0.256; 0.255)	0.439	Not Supported
H4a	SE -> EI	0.287	0.302	−0.015	(−0.298; 0.283)	0.446	Not Supported

Table 7. Multi-group hypothesis testing (area).

Hypotheses	Relationship	Path Coefficient		Difference	Confidence Interval (2.5%; 97.5%)	p-Value	Results
		Rural	Urban				
H1b	ATT -> EI	0.175	0.229	−0.054	(−0.249; 0.256)	0.316	Not Supported
H2b	PBC -> EI	0.147	0.307	−0.161	(−0.193; 0.175)	0.044**	Supported
H3b	SN -> EI	0.245	0.230	0.015	(−0.253; 0.265)	0.468	Not Supported
H4b	SE -> EI	0.360	0.231	0.128	(−0.289; 0.286)	0.169	Not Supported

Multi-group analysis results for gender and area

In the next part, all the above hypotheses were tested concerning the gender (H1a, H2a, H3a, and H4a) (see Table 6) and area (H1b, H2b, H3b, H4b) of the students (see Table 7). To do so, we performed the Multi-group analysis based on gender and area of students. To carry out the multi-group analysis, we first used the measurement invariance test of variables (MICOM) (Gelashvili et al., 2021; Hair et al., 2022; Henseler, Ringle et al., 2016; Rasoolimanesh et al., 2017). The results showed that the sample had completed the invariance conditions for all constructs in both cases, and full measurement invariance was established in gender and location. Owing to these findings, we conducted a multi-group analysis to see if the intents of college students for entrepreneurship varied significantly by gender and geographical region.

Table 6 shows no significant difference was found based on gender for their entrepreneurial intentions. The hypotheses H1a, H2a, H3a, and H4a were rejected as the concerned p-values are greater than 0.05 at a five percent significance level. In the multi-group analysis based on location, H2b was observed as supported, and the rest of the hypotheses (H1b, H3b, and H4b) were rejected (see Table 7).

IPMA results

Importance performance analysis (Abalo et al., 2007; Matzler et al., 2003) results in Figure 3 specifies that among all the explanatory variable, attitude is the least important (0.220) and underperforming (60.829) in terms of affecting entrepreneurial intention. So, the performance and importance of both parameters need to be improved. Moreover, self-efficacy plays the most important (62.494) role among all other independent constructs; however, it is underperforming concerning subjective norms (63.783) and perceived behavioral control (63.468). However, the performance of self-efficacy is not very low. Hence, self-efficacy is essential, and its performance is satisfactory. So, to enhance students' EI, the focus must be on improving their self-efficacy.
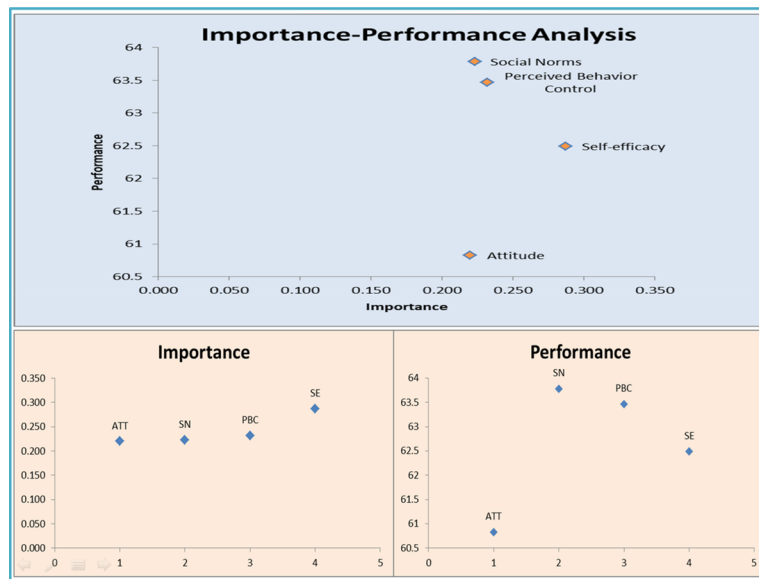
Figure 3. IPMA results.

Table 8. PLS predict results.

	PLS Predict (PLS)				PLS Predict (LM)			
	RMSE	MAE	MAPE	Q^2_predict	RMSE	MAE	MAPE	Q^2_predict
EI4	1.225	0.972	26.8	0.426	1.263	0.991	27.255	0.389
EI3	1.274	0.997	27.77	0.387	1.322	1.053	29.46	0.340
EI5	1.213	0.958	25.616	0.470	1.249	0.992	26.016	0.438
EI1	1.145	0.909	23.377	0.428	1.186	0.934	24.023	0.386
EI2	1.236	0.971	28.67	0.437	1.265	0.978	28.704	0.410

PLS predict

The endogenous construct of the model Q2 predicts values are found to be more than zero, so we can proceed further to check the predictive relevance of the model (see Table 8). Results show that RMSE, MAE, and MAPE values obtained through PLS are lower for all items than LM. This means the errors in the PLS model are lower. Furthermore, PLS prediction results also showed higher values of Q^2 in the case of PLS as compared to LM. Hence, PLS prediction results display that the model has high out-of-sample predictive power (Hair et al., 2019; Shmueli et al., 2019).

ANN results

We have applied the SEM-ANN approach for further analysis. In the first step through SEM, we figured out factors that significantly influence the dependent construct (see Table 9). So that those exogenous factors can act as input neurons (Xiong et al., 2022). Further ANN analysis is conducted through a statistical package for social science. As ANN fails to test the hypothesized relationship due to the hidden layer (lying between the input and output layer), it fails to identify a causal connection between variables (Leong et al., 2019). Combining the SEM-ANN approach can provide benefits by overcoming the loopholes these approaches encounter individually and exploiting the advantages associated with each (see Figure 4).

ANN is applied for analysis as it is free from the assumption of distribution's normality. It works even if the relation between outcome and input variables is linear or non-linear (Leong et al., 2020). ANN is a good performance measure of data as sample size, outliers, or any noise do not impact it. It is a robust, non-compensatory model. A feedforward algorithm is used where inputs are fed into the input layer, and results are estimated in each round; errors are moved in the backward direction. While

Table 9. ANN- RMSE results.

	Training			Testing			
	INPUT: ATT, PBC, SN, SE OUTPUT: EI			INPUT: ATT, PBC, SN, SE OUTPUT: EI			
N	SSE	RMSE	N	SSE	RMSE	Differences (Training-Testing)	Total Sample
212	44.595	0.458643	98	21.122	0.464253	−0.0056	310
225	37.617	0.408885	85	12.822	0.38839	0.0205	310
213	38.714	0.426328	97	14.924	0.392244	0.0341	310
213	34.718	0.403727	97	17.387	0.423376	−0.0196	310
216	34.801	0.401392	94	14.396	0.391342	0.0100	310
223	41.861	0.433264	87	13.322	0.391314	0.0420	310
205	31.502	0.392005	105	15.759	0.387409	0.0046	310
215	32.977	0.391639	95	14.444	0.389926	0.0017	310
221	43.289	0.442581	89	18.103	0.451004	−0.0084	310
228	45.639	0.4474 05	82	17.15	0.457325	−0.0099	310
MEAN		0.420587			0.413658	0.0069	
SD		0.024243			0.032149	−0.0079	

Note: SSE = sum square of errors, RMSE = root mean square of errors, N = sample size, SE = self-efficacy, PBC = perceived behavior control, ATT = attitude, SN = subjective norms and EI = entrepreneurial intentions.
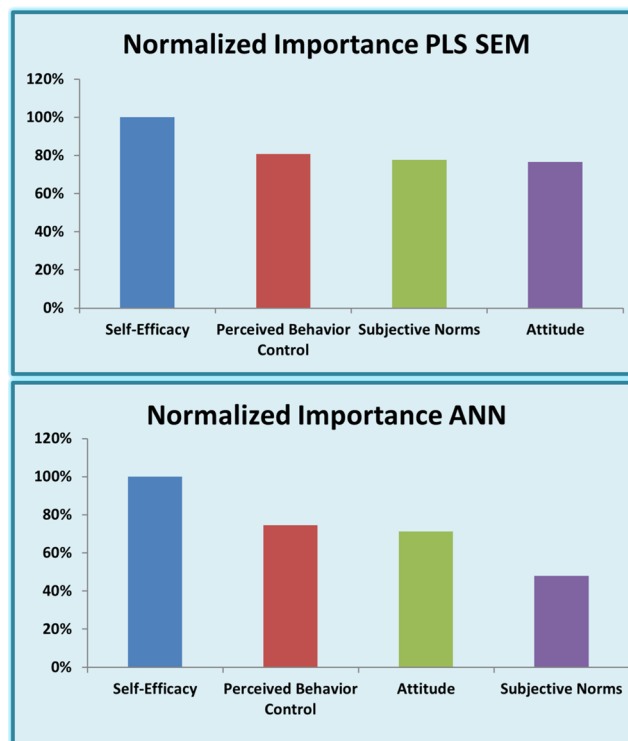
Figure 4. PLS-SEM and ANN normalized importance.

doing ANN analysis, it uses a multi-layer perceptron algorithm to minimize errors and enhance prediction capability (see Figure 5). 70% of samples are used for training and the rest for testing. RMSE is obtained ten times while performing Cross-validation in different rounds/folds. RMSE value of training and testing procedure is not very high as they are 0.426 and 0.414, respectively, indicating high prediction accuracy.

Sensitivity analysis

Sensitivity analysis is conducted to figure out the comparative importance of different inputs. Through this analysis, we can report each predictor variable's status by modifying the control variable's value and checking its impact on the prediction done by the network model (Chong, 2013). It helps to determine each input construct's predictive power based on normalized importance (Leong et al., 2020). Among the
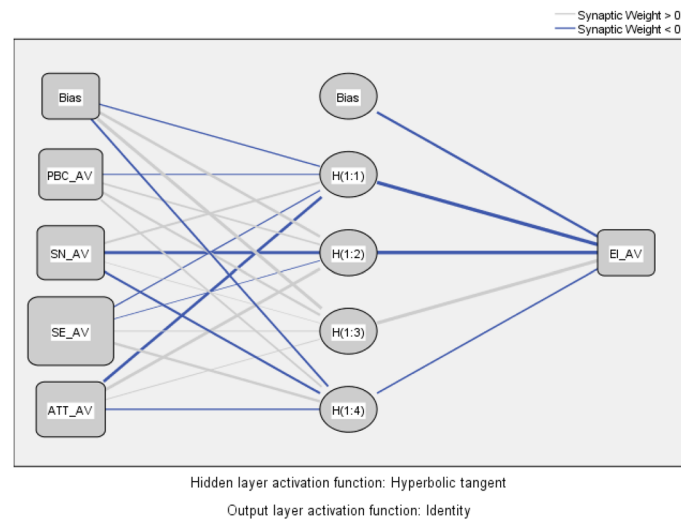
Figure 5. ANN model.

Table 10. Sensitivity analysis.

Sensitivity Analysis Importance	PBC	SN	SE	ATT
ANN1	100.0%	86.9%	63.8%	59.1%
ANN2	64.2%	36.9%	100.0%	67.8%
ANN3	73.2%	47.4%	100.0%	83.4%
ANN4	49.9%	38.4%	100.0%	68.1%
ANN5	81.8%	23.6%	100.0%	61.1%
ANN6	56.0%	32.3%	100.0%	53.7%
ANN7	75.8%	19.0%	100.0%	72.2%
ANN8	65.0%	54.3%	100.0%	48.6%
ANN9	89.6%	55.8%	98.0%	100.0%
ANN10	61.0%	67.3%	100.0%	70.7%
Average Importance	0.716	0.462	0.962	0.685
Normalized Importance	74.50%	48.00%	100.00%	71.20%
Rank	2	4	1	3

variables tested, self-efficacy was shown to have the highest predictive power (96.2%), followed by perceived behavioral control (71.6%), attitude towards entrepreneur behavior (68.5%), and subjective norm (6.2%). Results are consistent with normalized importance results obtained in PLS-SEM (see Table 10).

Discussion

Comments on results

This study explored how TPB components (attitude, PCB, and subjective norms) affected entrepreneurial desire with an external variable of self-efficacy among Indian HEI students during post-COVID-19. Path relations were initially investigated using the PLS-SEM. Afterwards, the robustness of the suggested model was assessed using ANN. All independent factors showed a favorable and substantial effect on entrepreneurial inclinations.

For H1, we proposed a positive effect of attitude on EI. Our study's results corroborate previous research conclusions (Almohammad et al., 2021; Liñán & Chen, 2009). Outcomes indicate that college students possessed a favorable disposition and that an alteration in their attitudes resulted in an increased inclination to found their own enterprises. In order for students to showcase their entrepreneurial abilities, HEIs should host a range of entrepreneurial activities, including dynamic workshops, imaginative contests, and presentations on different business ideas (Anjum et al., 2022).

In H2, we postulated that PBC would significantly impact EI. We found that PCB positively impacted EI, which agrees with findings from other studies (Ali & Jabeen, 2022). Furthermore, ANN and sensitivity analysis indicated that PCB is a powerful predictor of EI. Findings demonstrate that college students have

confidence in their abilities and think it's easy to establish a business during a pandemic. This was due to the type of economy. Students with the correct learning, exposure, and expertise may be able to take advantage of post-pandemic government opportunities (Mwiya et al., 2019). Consequently, training in entrepreneurship that focuses on developing one's ability to solve problems is recommended. Also, mastering information-related skills helps people launch Internet businesses (Ratten, 2020).

According to hypothesis 3, there is a favorable link between EI and subjective norms. As per our findings, SN appears to have a considerable effect on EI and to be a powerful indicator of EI when applied to the setting of HEIs. Our findings are similar to previous research (Armitage & Conner, 2001; Sulaiman et al., 2023b), in which researchers discovered subjective norms to be a substantial predictor of EI. The results align with those of Ruiz-Rosa et al. (2020), who discovered that subjective norms influenced intentions only a little, especially in the case of entrepreneurial endeavors.

The evidence presented in the H4 shows that self-efficacy positively affects EI. Our findings show that it is the most powerful and promising predictor of EI in fostering college students. The TPB model includes self-efficacy as an external variable. The PLS-SEM and ANN analyses, which found SE to be a major predictor of EI, provided further evidence supporting these findings. This finding emphasises the importance of SE in nurturing college students' aspirations for entrepreneurship. Self-assurance in learning the essential skills and abilities to launch a firm appears to be related to developing entrepreneurial objectives (Mouselli & Khalifa, 2017). Findings are in alignment with prior and contemporary research (Bandura, 1977; Rachmawati et al., 2022; Wilson et al., 2007). Entrepreneurs' thoughts and emotional responses are greatly impacted by their sense of self-efficacy (Rachmawati et al., 2022). As a result, there has to be a continuous effort by both the government and educational institutions to boost students' self-efficacy via training in market-based competencies, legislation, and efficient entrepreneurial learning methods. In the aftermath of the epidemic, more effort should be put into fostering students' resilience and self-confidence so that they can make more informed choices.

Gender moderation was shown to be non-significant in the MGA results, suggesting that there are no discernible variations in the entrepreneurial aspirations of male and female students. These findings are in alignment with prior studies (Rodriguez-Gutierrez et al., 2020). Nevertheless, when it came to location moderation, the results showed that students from rural and urban areas differed significantly in the impact of their perceived behavior control on their willingness to establish businesses. Nevertheless, when it came to location moderation, the results showed that students from rural and urban areas differed significantly in the impact of their PBC on their willingness to establish businesses (H2b). Previous studies have shown that a person's geographic location has a substantial effect on their intentions to start a business (Chahal et al., 2023; Yurrebaso et al., 2021). The findings indicate that urban students have more impact of their PBC on intent to start a business than rural students. The reason for this outcome stems from the fact that rural areas have lower infrastructure support and other facilities that are required to boost entrepreneurship compared to urban areas. Consequently, it is suggested that policymakers and HEIs should provide special focus to rural area students in terms of mentorship and other resources to bridge this location diversity gap.

Theoretical contribution

TPB elements and self-efficacy have taken on new meaning with the proliferation of entrepreneurship in the academy. The primary benefit of this study is incorporating external factors (i.e. self-efficacy) into TPB studies, which has dramatically advanced our understanding of this phenomenon. So, altogether, this study looked into how perceived behavior control (PCB), subjective norms (SN) attitude (ATT), and one's sense of competence, i.e. self-efficacy (SE), all influence the desire to start a venture. Both the SEM and ANN analyses confirmed that students' PCB and self-efficacy significantly predicted their plans to start their own businesses. Consequently, our study contributed to the expansion of TPB by means of extrinsic variables (i.e. self-efficacy) and addressed a gap in the current literature. The second unique aspect of this study is its methodology, which incorporates the findings of both PLS-SEM and ANN. This brings a fresh perspective to the existing literature on entrepreneurship. This study fills a gap identified by previous researchers by investigating the TPB outcome using different analytical typologies (i.e. PLS-SEM and ANN). Third, the research background for this study is vast: numerous investigations have been

conducted to learn how the current COVID-19 epidemic has affected people's plans to launch a company in a metropolitan location. Nevertheless, there has been scant investigation to study how TPB factors (PCB, subjective norms, and attitude) and self-efficacy of college students' overview, including rural areas, for their goal to start the venture in post-COVID-19.

Practical contribution

This study's findings have significant ramifications for practitioners, policymakers, and HEI stakeholders in the design of practical approaches to raise HEI students' entrepreneurial inclinations. As a first implication of the linkage between SE and EIs, HEIs should work to increase students' proficiency in critical areas by implementing pedagogical changes (i.e. curriculum revision and offered courses). Non-academic reforms (i.e. organizing symposiums on emerging trends in entrepreneurship and entrepreneurship exposes) by focusing more on student self-efficacy to increase students' entrepreneurial intentions. The second implication from the attitude and entrepreneurial intentions relationship results is that students' positive attitudes can significantly affect their entrepreneurial intentions. HEIs should hold motivational talks by industry professionals to help students develop a positive attitude. According to our findings, attitude greatly influences student choice of action, rewards, incentives, and response to challenges. These industry experts can convey the significance of attitude in new ventures and how it affects your work and business performance.

Thirdly, the multi-group research found that students from urban areas have more favorable attitudes toward entrepreneurship, more self-efficacy, and greater perceptions of their behavioral control than students from rural areas. As a result, HEIs should emphasize urban students and provide them with more opportunities to start new businesses, but they should also provide more resources and other support to rural area students to bridge this gap. HEIs can establish incubation centers on campus to assist students in creating their businesses.

Limitations and future direction

Despite the study's theoretical and practical significance, there are certain limitations to consider. First, the research collected data from HEI students using a cross-sectional approach in the post-COVID-19 period; however, the response at different times should be regarded as using a longitudinal method to eliminate research generalizability. Second, this research considered one external variable (i.e. self-efficacy) in TPB and ignored other potential external variables such as entrepreneurial education (Chahal et al., 2023), entrepreneurial orientation (Nazneen et al., 2023) and social media typologies (McLaughlin et al., 2022) and needs to be investigated in future research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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