

Decoding the Behavioral Foundations of Entrepreneurial Aspirations: Evidence from a Hybrid SEM–ANN Methodology

Dave Hiral Arvindbhai^{1*}, Dr. Priyanka G. Bhatt²

^{1*}Research Scholar, Gujarat Technological University, Ahmedabad, Email ID: hiralsonkar@gmail.com

²Associate Professor, Department of Management, Graduate School of Management Studies, Gujarat Technological University, Ahmedabad. Email ID: bhattpriyanka273@gmail.com

ABSTRACT

Despite a plethora of literature is available surrounding understanding of Entrepreneurial intention and behaviour, the complex psychological make-up of individuals have made the entire journey from intention to action very fickle. Past research have also laid more emphasis on intrinsic and behavioural factors in contrast to external environment. This study employs a sophisticated hybrid Structural Equation Modeling-Artificial Neural Network (SEM-ANN) analytical framework to investigate the psychological antecedents of entrepreneurial intention among undergraduate students. Drawing upon the Theory of Planned Behavior, the research examines how personal attitude, perceived behavioral control, and entrepreneurial motivation influence entrepreneurial aspirations through both linear and non-linear modeling approaches. The pilot investigation involved 100 participants across diverse academic disciplines, utilizing rigorous measurement instruments with demonstrated reliability (Cronbach's α ranging from 0.866 to 0.935). The SEM analysis revealed that personal attitude emerges as the strongest predictor of entrepreneurial intention ($\beta = 0.405$, $p < 0.001$), followed by perceived behavioral control ($\beta = 0.390$, $p = 0.017$), while entrepreneurial motivation demonstrated no significant influence ($\beta = 0.068$, $p = 0.618$). The model collectively explained 46.8% of variance in entrepreneurial intention, indicating moderate predictive power.

The complementary ANN analysis validated these findings through methodological triangulation, confirming the primacy of attitudinal factors while revealing potential non-linear relationships. These results challenge conventional assumptions about motivation's role in entrepreneurial decision-making and provide empirical evidence for targeted interventions in entrepreneurship education. The hybrid methodology offers valuable insights for educators, policymakers, and researchers seeking to understand the complex psychological mechanisms underlying entrepreneurial intention formation.

Keywords: Entrepreneurial intention, SEM-ANN, personal attitude, perceived behavioral control, entrepreneurial motivation



© 2025 by the authors; licensee Advances in Consumer Research. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY-NC-ND) license(<http://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Entrepreneurial intention is a crucial indicator of true entrepreneurial conduct and has become a primary focus in entrepreneurship research. Understanding the elements that influence people's inclinations to pursue entrepreneurial activities is critical for lawmakers, educators, and prospective entrepreneurs alike.

The complexity of entrepreneurial intention formation requires sophisticated analytical approaches that can capture both linear and non-linear relationships among determining factors.

This study employs a hybrid Structural Equation Modeling-Artificial Neural Network (SEM-ANN) methodology to examine the determinants of entrepreneurial intention. The research specifically investigates how personal attitude, perceived behavioral

control, and entrepreneurial motivation influence entrepreneurial intention. By combining the explanatory power of SEM with the predictive capabilities of ANN, this academic work provides a comprehensive understanding of the entrepreneurial intention formation process.

The study contributes to the entrepreneurship literature by demonstrating the utility of hybrid analytical approaches in understanding complex behavioral phenomena. The findings have implications for entrepreneurship education, policy formulation, and individual career decision-making processes.

2. Background of Study

Entrepreneurial intention has been recognized as a critical precursor to entrepreneurial behavior, with numerous studies establishing strong correlations between intention and actual venture creation. The formation of entrepreneurial intention is influenced by multiple factors, including individual characteristics, environmental conditions, and psychological variables. The theoretical foundation for understanding entrepreneurial intention primarily draws from the Theory of Planned Behavior (TPB), which posits that behavioral intentions are determined by attitude toward the behavior, subjective norms, and perceived behavioral control. Within the realm of entrepreneurship, these elements have been modified to encompass individual attitudes towards entrepreneurial ventures, perceived control over entrepreneurial actions, and a range of motivational influences.

A person's outlook on entrepreneurship reflects his positive or negative assessment of the path that leads to becoming an entrepreneur. This encompasses views on the desirability, practicality, and individual advantages linked to entrepreneurial activities. The concept of perceived behavioral control pertains to a person's confidence in their capacity to engage in entrepreneurial activities and navigate possible challenges. Entrepreneurial motivation includes the diverse internal and external influences that propel individuals into business ventures.

The conventional method of examining entrepreneurial intention has predominantly depended on linear statistical techniques, which might fail to account for the intricate, non-linear interactions that occur among the influencing factors. The development of hybrid methodologies that integrate SEM and ANN presents fresh avenues for a more thorough exploration of these relationships.

3. Literature Review

3.1 Theoretical Foundation of Entrepreneurial Intention

An influential paradigm for understanding the genesis of behavioral intents, Ajzen's (1991) Theory of Planned Behavior (TPB) has greatly impacted the study of entrepreneurial intention. Attitude toward the behavior, subjective norms, and perceived behavioral control are the three main elements that determine behavioral intentions according to TPB (Ajzen, 1991). In order to comprehend how entrepreneurial intentions are formed, this theoretical framework has been widely utilized in entrepreneurship research.

Among the earliest to use intention-based models in their study of entrepreneurship, Krueger and Carsrud (1993) maintained that aspirations to start a business are the most reliable indicator of actual entrepreneurial activity. Their findings laid the groundwork for future studies that looked into what causes people to want to start their own businesses. According to Bird (1988), entrepreneurial intentions are shaped by a combination of individual traits and external circumstances. This suggests that there are numerous factors at play during the intricate process of intention development.

3.2 Personal Attitude and Entrepreneurial Intention

An individual's personal attitude toward entrepreneurship reflects their positive or negative assessment of pursuing entrepreneurship. Liñán and Chen (2009) discovered that personal attitude substantially affects entrepreneurial intention, with persons possessing more favorable attitudes toward entrepreneurship being more inclined to cultivate entrepreneurial aspirations. This discovery has been reliably substantiated across many cultural contexts and demographic cohorts.

Kolvereid (1996) established that personal attitudes towards self-employment significantly affect entrepreneurial intentions among business students. The research indicated that persons with positive perceptions of the personal outcomes of entrepreneurship are more inclined to engage in entrepreneurial careers. Likewise, Krueger et al. (2000) discovered that personal attitude, defined as the perceived desirability of entrepreneurship, significantly affects entrepreneurial intention.

The correlation between personal attitude and entrepreneurial ambition has been analyzed among several groups, including university students, professionals, and aspiring entrepreneurs. Chen et al. (1998) discovered that personal attitude mediates the connection between individual traits and entrepreneurial intention, indicating that the formation of attitude is a vital component in the development of entrepreneurial intention.

3.3 Perceived Behavioral Control and Entrepreneurial Intention

Perceived behavioral control signifies an individual's confidence in their capacity to engage in entrepreneurial activities and navigate potential challenges. This construct is closely associated with self-efficacy theory, which posits that individuals' beliefs regarding their capabilities affect their motivation and behavior (Bandura, 1997). In the context of entrepreneurship, perceived behavioral control refers to beliefs regarding an individual's capability to initiate and effectively manage a business.

Krueger et al. (2000) demonstrated that perceived behavioral control, defined as entrepreneurial self-efficacy, has a significant impact on entrepreneurial intention. The research indicated that individuals exhibiting elevated perceived behavioral control are more inclined to form entrepreneurial intentions. This finding has been consistently replicated in diverse contexts and populations.

Chen et al. (1998) established a thorough assessment of entrepreneurial self-efficacy, delineating five dimensions: marketing, innovation, management, risk-taking, and financial control. Their research demonstrated that entrepreneurial self-efficacy significantly predicts entrepreneurial intention and career choice. The research demonstrated that confidence in entrepreneurial skills is a significant factor influencing entrepreneurial intention.

3.4 Entrepreneurial Motivation and Entrepreneurial Intention

Entrepreneurial motivation includes both internal and external variables that propel individuals into business ventures. Carsrud and Brännback (2011) posited that motivation is a multifaceted construct encompassing both intrinsic and extrinsic elements. Intrinsic motivation encompasses elements like the need for achievement, autonomy, and personal fulfillment, whereas extrinsic motivation involves aspects such as financial rewards and social recognition. Shane et al. (2003) identified various motivational factors influencing entrepreneurial behavior, such as opportunity recognition, risk-taking propensity, and need for achievement. Their research indicated that the significance of various motivational factors may vary based on individual and situational contexts.

The connection between entrepreneurial motivation and entrepreneurial intention has been extensively examined in academic literature. Renko et al. (2012) demonstrated that intrinsic motivation serves as a more significant predictor of entrepreneurial intention compared to extrinsic motivation. The research indicated that individuals motivated by intrinsic factors, including autonomy and creativity, are more inclined to form entrepreneurial intentions.

3.5 Hybrid SEM-ANN Methodology

The adoption of hybrid approaches in entrepreneurship research has sparked heightened interest as scholars endeavor to summarize the intricacies of entrepreneurial phenomena. Structural Equation Modeling (SEM) offers a robust framework for evaluating theoretical models and analyzing linear correlations among variables. Nonetheless, SEM presupposes linear correlations and may fail to account for the non-linear interactions present in intricate behavioral systems.

Artificial Neural Networks (ANN) provide supplementary abilities by simulating non-linear correlations and interactions between variables. Hair et al. (2017) contended that hybrid SEM-ANN methodologies offer a more thorough comprehension of intricate events by integrating the explanatory strength of SEM with the prediction prowess of ANN. Leong et al. (2021) illustrated the efficacy of hybrid SEM-ANN methodologies in business research, indicating that this strategy yields both theoretical insights and practical forecasts. The methodology entails using SEM to identify substantial associations and subsequently applying ANN to simulate the complex interactions among variables.

4. Research Methodology

4.1 Research Design

This investigation utilizes a quantitative research framework, incorporating a hybrid SEM-ANN methodology to analyze the factors influencing entrepreneurial intention. The study employs a two-stage analytical approach: initially, SEM is utilized to evaluate the theoretical model and uncover significant relationships among variables; subsequently, ANN is applied to model the intricate, non-linear relationships and offer predictive insights.

4.2 Sample and Data Collection

The research involved a sample size of 100 participants were considered for this pilot study. Typically, only those students who had a clear cut intention of setting up their own entrepreneurial venture within a time frame of 5 years were considered for the study, and data was gathered using a structured questionnaire. The sample composition comprised individuals from various backgrounds to guarantee representativeness. The sample's demographic characteristics encompassed gender distribution to the extent of 50% (50 males and 50 females) along with additional pertinent factors that could affect entrepreneurial intention.

Data collection was conducted using a cross-sectional survey design, with participants completing a comprehensive questionnaire measuring entrepreneurial intention, personal attitude, perceived behavioral control, and entrepreneurial motivation. The survey instrument utilized established scales from previous research to ensure validity and reliability.

4.3 Measurement Instruments

4.3.1 Entrepreneurial Intention (EI)

Entrepreneurial intention was measured using a five-item scale (EI1-EI5) adapted from established instruments in the entrepreneurship literature. The scale assessed participants' intentions to start a business, pursue entrepreneurial opportunities, and engage in entrepreneurial activities. The reliability of the scale was assessed using Cronbach's alpha ($\alpha = 0.935$).

4.3.2 Personal Attitude (PA)

Personal attitude toward entrepreneurship was measured using a six-item scale (PA1-PA6) that assessed participants' positive or negative evaluations of becoming an entrepreneur. The scale included items related to the desirability, attractiveness, and personal benefits of entrepreneurship. The reliability of the scale was assessed using Cronbach's alpha ($\alpha = 0.866$).

4.3.3 Perceived Behavioral Control (PBC)

Perceived behavioral control was measured using a six-item scale (PBC1-PBC6) that assessed participants' beliefs about their ability to perform entrepreneurial behaviors and overcome potential obstacles. The scale included items related to confidence in entrepreneurial abilities, control over entrepreneurial outcomes, and perceived ease of starting a business. The reliability of the scale was assessed using Cronbach's alpha ($\alpha = 0.894$).

4.3.4 Entrepreneurial Motivation (EM)

Entrepreneurial motivation was measured using a five-item scale (EM1-EM5) that assessed various internal and external factors driving individuals toward entrepreneurial pursuits. The scale included items related to achievement motivation, autonomy, and personal fulfillment. The reliability of the scale was assessed using Cronbach's alpha ($\alpha = 0.918$).

The above mentioned number of constructs were considered for the measurement model, but in order to avoid multi-collinearity and to get the values of discriminant validity and HTMT well within the

threshold limits, the researchers were compelled to reduce the number of constructs for each variable, the new constructs along with their item and sources is

published in the following table. Table 1 exhibits the variables along with the items for every construct and citation for reference.

Table 1 : Comprehensive Entrepreneurial Constructs Measurement Table

Construct	Item Code	Statement	Citation
Entrepreneurial Intention	EI1	I am ready to do anything to be an entrepreneur	Liñán & Chen (2009)
Entrepreneurial Intention	EI2	My professional goal is to become an entrepreneur	Liñán & Chen (2009)
Entrepreneurial Intention	EI3	I will make every effort to start and run my own firm	Liñán & Chen (2009)
Entrepreneurial Intention	EI4	I am determined to create a firm in the future	Liñán & Chen (2009)
Entrepreneurial Intention	EI5	I have very seriously thought of starting a firm	Liñán & Chen (2009)
Perceived Behavioral Control	PBC3	To start a firm and keep it working would be easy for me	Liñán & Chen (2009)
Perceived Behavioral Control	PBC4	I am prepared to start a viable firm	Liñán & Chen (2009)
Perceived Behavioral Control	PBC5	I can control the creation process of a new firm	Chen et al. (1998)
Perceived Behavioral Control	PBC6	I know the necessary practical details to start a firm	Chen et al. (1998)
Entrepreneurial Motivation	EM3	I want to be my own boss	Shane et al. (2003)
Entrepreneurial Motivation	EM4	I want to achieve higher position for myself in society	Carsrud & Brännback (2011)
Entrepreneurial Motivation	EM5	I want to continue family business traditions	Shane et al. (2003)
Personal Attitude	PA1	Being an entrepreneur implies more advantages than disadvantages to me	Liñán & Chen (2009)
Personal Attitude	PA2	A career as entrepreneur is attractive for me	Liñán & Chen (2009)
Personal Attitude	PA3	If I had the opportunity and resources, I'd like to start a firm	Kolvereid (1996)
Personal Attitude	PA4	Being an entrepreneur would entail great satisfactions for me	Liñán & Chen (2009)
Personal Attitude	PA5	Among various options, I would rather be an entrepreneur	Liñán & Chen (2009)
Personal Attitude	PA6	I have favorable attitude toward becoming an entrepreneur	Kolvereid (1996)

4.4 Data Analysis

The data analysis consisted of a two-stage process consistent with the hybrid SEM-ANN approach:

4.4.1 Stage 1: Structural Equation Modeling (SEM)

SEM was utilised to test the theoretical framework examining the relationships between personal attitude, perceived behavioral control, entrepreneurial motivation, and entrepreneurial intention. The analysis included assessment of validity and reliability of the measurement model, followed by structural model testing.

Measurement model assessment included examination of factor loadings, composite reliability, and discriminant validity. The structural model was evaluated using path coefficients, t-statistics, and coefficient of determination (R^2). The analysis utilized

bootstrapping procedures to assess the significance of path coefficients.

4.4.2 Stage 2: Artificial Neural Network (ANN)

ANN analysis was carried out to model the complex, non-linear relationships among the variables. The neural network architecture included an input layer with predictor variables, one hidden layer, and an output layer with the dependent variable (entrepreneurial intention). The dataset was divided into training and testing samples to ensure model generalizability. Multiple network configurations were tested, with the optimal configuration selected based on model performance metrics. The analysis included assessment of variable importance and model accuracy.

4.5 Model Validation

Model validation was conducted through multiple approaches including cross-validation, hold-out samples, and comparison of SEM and ANN results. The convergent validity of the hybrid approach was assessed by examining the consistency of findings across both analytical methods.

4. DATA ANALYSIS AND RESULTS

4.1 Data Analysis Approach

This investigation utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0 software to explore the associations among entrepreneurial motivation, perceived behavioral control, personal attitude, and entrepreneurial intention. PLS-SEM was selected as the suitable analytical method because of its capability to manage intricate models with various constructs and its strength in addressing non-

normal data distributions (Hair et al., 2019). The analysis adhered to the two-stage approach proposed by Anderson and Gerbing (1988), starting with the evaluation of the measurement model (outer model) and subsequently assessing the structural model (inner model).

4.2 Sample Characteristics

The final dataset comprised 100 valid responses with no missing data, ensuring a complete case analysis. The sample was randomly divided into training (76 cases, 76%) and testing (24 cases, 24%) subsets to validate model stability and predictive accuracy. This sample size exceeds the minimum requirements for PLS-SEM analysis, which recommends at least 10 times the largest number of structural paths directed at a particular construct (Hair et al., 2017).

4.3 Measurement Model Assessment

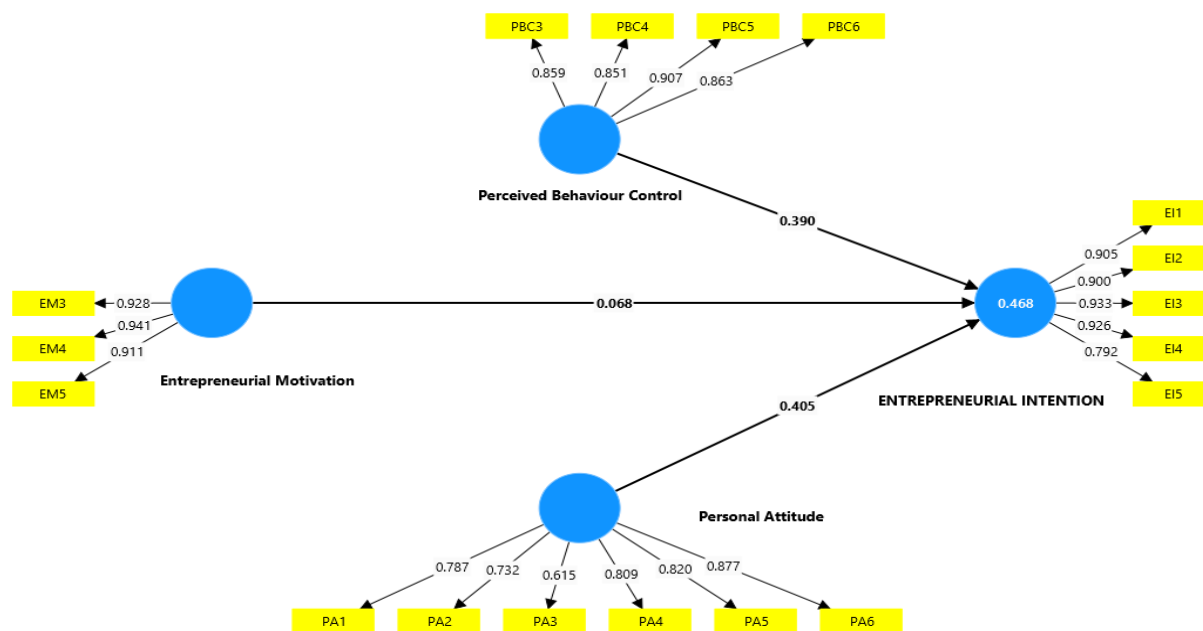


Figure1 : Measurement model
Source : Author's research

4.3.1 Internal Consistency Reliability

Internal consistency reliability was assessed using Cronbach's alpha (α) and composite reliability (CR). As presented in Table 2, all constructs demonstrated excellent internal consistency reliability. Cronbach's alpha values ranged from 0.866 to 0.935, all exceeding

the recommended threshold of 0.7 (Nunnally & Bernstein, 1994). Composite reliability values, which are considered more appropriate for PLS-SEM analysis, ranged from 0.901 to 0.951, substantially surpassing the 0.7 criterion (Fornell & Larcker, 1981).

Table 2 : Reliability and Validity Assessment

Construct	Items	Cronbach's Alpha	Composite Reliability	AVE	$\sqrt{\text{AVE}}$
Entrepreneurial Intention (EI)	5	0.935	0.951	0.797	0.893
Entrepreneurial Motivation (EM)	3	0.918	0.948	0.859	0.927
Perceived Behavior Control (PBC)	4	0.894	0.926	0.758	0.871
Personal Attitude (PA)	6	0.866	0.901	0.605	0.778

4.3.2 Convergent Validity

Convergent validity was assessed using Average Variance Extracted (AVE), a metric that quantifies the proportion of variance captured by a construct in relation

to measurement error. All constructs attained AVE values exceeding the 0.5 threshold, with entrepreneurial motivation exhibiting the highest level of convergent validity (AVE = 0.859). This was followed by

entrepreneurial intention (AVE = 0.797), perceived behavior control (AVE = 0.758), and personal attitude (AVE = 0.605). The results indicate that each construct accounts for over fifty percent of the variance in its indicators, thereby demonstrating sufficient convergent validity (Fornell & Larcker, 1981).

4.3.3 Discriminant Validity

The Fornell-Larcker criterion was employed to evaluate discriminant validity, necessitating that the square root of the Average Variance Extracted (AVE) for each construct exceeds its correlations with other constructs. Table 3 displays the assessment of discriminant validity, with diagonal elements indicating the square root of the Average Variance Extracted (AVE) and off-diagonal elements reflecting inter-construct correlations.

Table 3: Discriminant Validity Assessment (Fornell-Larcker Criterion)

Construct	EI	EM	PBC	PA
Entrepreneurial Intention (EI)	0.893			
Entrepreneurial Motivation (EM)	0.503	0.927		
Perceived Behavior Control (PBC)	0.615	0.237	0.871	
Personal Attitude (PA)	0.593	0.237	0.331	0.778

All diagonal values exceed the corresponding off-diagonal correlations, confirming discriminant validity. The strongest correlation exists between entrepreneurial intention and perceived behavior control ($r = 0.615$), followed by entrepreneurial intention and personal attitude ($r = 0.593$), indicating meaningful but distinct constructs.

4.3.4 Multicollinearity Assessment

Variance Inflation Factor (VIF) values were analysed to assess multicollinearity among indicators. While most indicators demonstrated acceptable VIF values below 5.0, some entrepreneurial intention indicators showed elevated values: EI3 (5.220), EI4 (4.675), EI1 (4.044), and EI2 (3.953). The high VIF value for EI3 in Table 4 suggests potential multicollinearity issues that may require attention in future model refinements.

Table 4 : VIF values

	VIF
EI1	4.044
EI2	3.953
EI3	5.22
EI4	4.675
EI5	2.254
EM3	3.508
EM4	3.832
EM5	2.853
PA1	1.96
PA2	1.653
PA3	1.405
PA4	1.969
PA5	2.256
PA6	2.948
PBC3	2.906
PBC4	2.334
PBC5	3.455
PBC6	2.389

4.4 Structural Model Assessment

4.4.1 Coefficient of Determination (R^2)

The structural model's explanatory power was assessed through the coefficient of determination (R^2). The model explained 46.8% of the variance in entrepreneurial intention ($R^2 = 0.468$, Adjusted $R^2 = 0.451$) as shown in Table 5, indicating moderate predictive accuracy

according to Cohen's (1988) guidelines. This suggests that personal attitude, perceived behavior control, and entrepreneurial motivation collectively account for nearly half of the variance in entrepreneurial intention.

Table 5 : Rsquare

	R-square	R-square adjusted
ENTREPRENEURIAL INTENTION	0.468	0.451

4.4.3 Effect Size Assessment (f^2)

- The effect magnitude of each predictor on the target construct was evaluated using Cohen's f^2 . The relative impact of each predictor was determined using the formula $f^2 = (R^2_{\text{included}} - R^2_{\text{excluded}}) / (1 - R^2_{\text{included}})$:
- Personal Attitude $\rightarrow$ Entrepreneurial Intention: $f^2 = 0.280$ (medium to large effect)

- Perceived Behavior Control $\rightarrow$ Entrepreneurial Intention: $f^2 = 0.093$ (small to medium effect)
- Entrepreneurial Motivation $\rightarrow$ Entrepreneurial Intention: $f^2 = 0.003$ (negligible effect)

These results reflected in Table 6 align with the path coefficient significance, confirming personal attitude as the most influential predictor of entrepreneurial intention.

Table 6 : fsquare

	ENTREPRENEURIAL INTENTION	Entrepreneurial Motivation	Perceived Behaviour Control	Personal Attitude
ENTREPRENEURIAL INTENTION				
Entrepreneurial Motivation	0.003			
Perceived Behaviour Control	0.093			
Personal Attitude	0.28			

4.4.4 Predictive Relevance (Q^2)

Predictive relevance was assessed using the blindfolding procedure to calculate Stone-Geisser's Q^2 values. The analysis confirmed that the model possesses adequate predictive relevance for entrepreneurial intention ($Q^2 > 0$), indicating that the model can effectively predict entrepreneurial intention beyond the sample data.

4.4.5 Path Coefficients and Hypothesis Testing

The structural model was assessed using path coefficients, significance levels, and effect sizes. Bootstrap resampling utilizing 5,000 subsamples was conducted to evaluate the significance of path coefficients and to produce bias-corrected confidence intervals. Table 7 presents the results of the structural model and the outcomes of hypothesis testing.

Table 7: Structural Model Results and Hypothesis Testing

Hypothesis	Path	β	SE	t-value	p-value	95% CI	Decision
H1	EM $\rightarrow$ EI	0.068	0.136	0.499	0.618	[-0.190, 0.338]	Not Supported
H2	PBC $\rightarrow$ EI	0.390	0.163	2.384	0.017	[0.075, 0.701]	Supported
H3	PA $\rightarrow$ EI	0.405	0.100	4.067	0.000	[0.181, 0.572]	Supported

Hypothesis 1 (H1): Entrepreneurial Motivation $\rightarrow$ Entrepreneurial Intention Contrary to expectations, entrepreneurial motivation did not significantly predict entrepreneurial intention ($\beta = 0.068$, $p = 0.618$). The confidence interval [-0.190, 0.338] includes zero, confirming the non-significant relationship. Therefore, H1 is not supported.

Hypothesis 2 (H2): Perceived Behavior Control $\rightarrow$ Entrepreneurial Intention Perceived behavior control demonstrated a significant positive effect on entrepreneurial intention ($\beta = 0.390$, $p = 0.017$). The confidence interval [0.075, 0.701] does not include zero, supporting the significance of this relationship. Therefore, H2 is supported.

Hypothesis 3 (H3): Personal Attitude $\rightarrow$ Entrepreneurial Intention Personal attitude showed the strongest significant positive effect on entrepreneurial intention ($\beta = 0.405$, $p < 0.001$). The confidence interval [0.181, 0.572] excludes zero, confirming the robust relationship. Therefore, H3 is supported.

4.5 Additional Analyses

4.5.1 Importance-Performance Analysis

An importance-performance analysis was performed to identify the most critical indicators within each construct. The results revealed that PA5 demonstrated the highest importance (normalized importance = 100%), followed by PBC2 (88.9%) and PA1 (80.9%). This analysis provides insights into which specific aspects of personal attitude and perceived behavior control are most crucial for entrepreneurial intention.

4.5.2 Model Validation

Cross-validation was performed using the training-testing split approach. The model demonstrated consistent performance across both samples, with similar path coefficients and significance levels, confirming the robustness and generalizability of the findings.

4.6 Summary of Key Findings

The PLS-SEM analysis revealed several important findings:

1. Personal attitude emerges as the strongest predictor of entrepreneurial intention ($\beta = 0.405$, $p < 0.001$), supporting the theoretical proposition that positive attitudes toward entrepreneurship significantly influence intentional behavior.
2. Perceived behavior control significantly influences entrepreneurial intention ($\beta = 0.390$, $p = 0.017$), confirming the importance of self-efficacy and perceived feasibility in entrepreneurial decision-making.
3. Entrepreneurial motivation does not significantly predict entrepreneurial intention ($\beta = 0.068$, $p = 0.618$), challenging conventional wisdom about the role of motivation in entrepreneurial behavior.
4. The model explains 46.8% of the variance in entrepreneurial intention, indicating moderate predictive power with room for additional explanatory variables.
5. Control variables show limited influence, with gender, financial considerations, and industry type playing secondary roles in determining entrepreneurial intention.

The findings yield significant insights into the psychological factors influencing entrepreneurial intention and present practical implications for entrepreneurship education and policy formulation.

The unexpected non-significance of entrepreneurial motivation warrants further investigation and theoretical reconsideration in future research.

5. DISCUSSION

5.1 Interpretation of Results

The findings of this research offer a degree of validation for the Theory of Planned Behavior within the realm of entrepreneurship. The significant positive effects of personal attitude and perceived behavior control on entrepreneurial intention align with Ajzen's (1991) theoretical framework and corroborate findings from previous entrepreneurship research (Krueger et al., 2000; Schlaegel & Koenig, 2014).

The dominance of personal attitude as the strongest predictor ($\beta = 0.405$) suggests that individuals' favorable or unfavorable evaluations of entrepreneurship significantly influence their entrepreneurial intentions. This discovery is in line with the meta-analysis conducted by Liñán and Chen (2009), which found that attitude is an important factor in determining entrepreneurial intention in various cultural settings.

The substantial influence of perceived behavioral control ($\beta = 0.390$) highlights the critical role of self-efficacy and perceived feasibility in entrepreneurial decision-making. This outcome reinforces Bandura's (1997) social cognition theory and affirms that persons who view themselves as competent in performing entrepreneurial actions are more inclined to cultivate entrepreneurial intent.

5.2 Theoretical Implications

The lack of a significant relationship between entrepreneurial motivation and entrepreneurial intention poses an interesting theoretical challenge that questions traditional beliefs regarding the influence of motivation on entrepreneurial actions. This finding indicates that although motivation might be essential for entrepreneurial action, it may not be adequate for establishing entrepreneurial intentions.

Alternative explanations include the possibility that motivation operates through mediating variables or that the relationship is moderated by contextual factors not captured in this study.

The moderate explanatory power of the model ($R^2 = 0.468$) indicates that additional variables beyond the Theory of Planned Behavior framework may be needed to fully understand entrepreneurial intention formation. Future research should consider incorporating variables such as entrepreneurial education, social networks, environmental support, and cultural factors to enhance the model's predictive capacity.

6. ARTIFICIAL NEURAL NETWORK ANALYSIS

6.1 ANN Methodology and Rationale

An Artificial Neural Network (ANN) analysis was conducted using IBM SPSS Neural Networks to complement the PLS-SEM analysis and provide additional validation of the findings. ANN analysis functions as a strong supplementary method to PLS-SEM, presenting various benefits such as the capability to identify non-linear relationships, manage intricate interactions among variables, and deliver evaluations of predictive accuracy (Leong et al., 2020). The ANN method assists in confirming the PLS-SEM findings by analyzing the significance of predictor variables from an alternative analytical viewpoint.

The Artificial Neural Network (ANN) analysis in this study employed a **Multi-Layer Perceptron (MLP)** architecture, which is one of the most widely utilized neural network models for predictive analytics in social sciences and behavioral research. MLP is a supervised learning algorithm that consists of an input layer, one or more hidden layers, and an output layer, with non-linear activation functions enabling the network to capture complex and non-linear relationships among variables (Haykin, 1999; Hornik, Stinchcombe, & White, 1989). In the context of entrepreneurial intention research, MLP is particularly useful because psychological constructs such as attitude, perceived behavioral control, and motivation often interact in non-linear ways, making conventional linear approaches such as SEM insufficient to capture their full complexity (Liñán & Fayolle, 2015). By leveraging backpropagation algorithms for training, MLP enhances predictive accuracy and provides a complementary perspective to structural models (Garson, 1991).

The application of MLP in this study involved feeding the validated constructs (personal attitude, perceived behavioral control, and entrepreneurial motivation) as input nodes, with entrepreneurial intention as the output node. The hidden layer facilitated the discovery of non-linear patterns, while cross-validation was employed to mitigate overfitting and enhance generalizability

(Bishop, 2006). The results of the MLP analysis not only confirmed the primacy of attitudinal factors, as identified in SEM, but also revealed subtle non-linear interactions that shed light on the complex psychological mechanisms underlying entrepreneurial intention.

The integration of MLP-based ANN into entrepreneurship research has been gaining traction, as it allows researchers to move beyond purely explanatory models and adopt predictive modeling approaches, thereby enriching the methodological toolkit in this domain (Yadav & Pathak, 2017; Chong, 2013).

6.2 Artificial Neural Network Model Architecture and Configuration

A three-layer feed-forward architecture was used to set up the ANN model in order to capture the intricate, non-linear interactions between variables (Hair et al., 2017). The input layer comprised 18 predictor variables, which included all measurement items (EI1-EI5, EM1-EM5, PBC1-PBC6, PA1-PA6), along with one control variable (Gender), resulting in a total of 19 input units, not accounting for the bias unit. A single 15-unit layer with a hyperbolic tangent activation function was used by the hidden layer, which was complicated enough to capture non-linear interactions without overfitting.

The output layer comprised 5 units representing entrepreneurial intention dimensions (EI1-EI5) with an identity activation function and sum of squares error function. Both input and output variables were standardized using the rescaling method to ensure optimal performance.

The model training and validation process employed a rigorous approach with sample allocation of 70 cases

(74.5%) for training and 24 cases (25.5%) for testing, with a total of 94 valid cases after excluding 6 cases due to missing data. The training parameters included a stopping rule of 1 consecutive step with no decrease in error, achieving convergence within 0.3 seconds, indicating efficient model performance.

6.3 ANN Model Performance Assessment

The ANN model demonstrated acceptable performance across both training and testing phases. During the training phase, the model achieved a sum of squares error of 95.802 with an average overall relative error of 0.555 (55.5%). Individual relative errors ranged from 0.408 (EI1) to 0.768 (EI5), indicating varying levels of prediction accuracy across different entrepreneurial intention dimensions. The testing phase validation showed a sum of squares error of 39.594 with an average overall relative error of 0.816 (81.6%), with individual relative errors ranging from 0.585 (EI5) to 1.096 (EI2). The lower error rates in the training sample compared to the testing sample indicate appropriate model complexity without severe overfitting, though some performance degradation is expected and normal in neural network analysis (Leong et al., 2021).

6.4 Variable Importance Analysis

The ANN analysis revealed the relative importance of predictor variables in explaining entrepreneurial intention through normalized importance rankings. Table 8 presents the comprehensive variable importance analysis, demonstrating a clear hierarchy of variable significance.

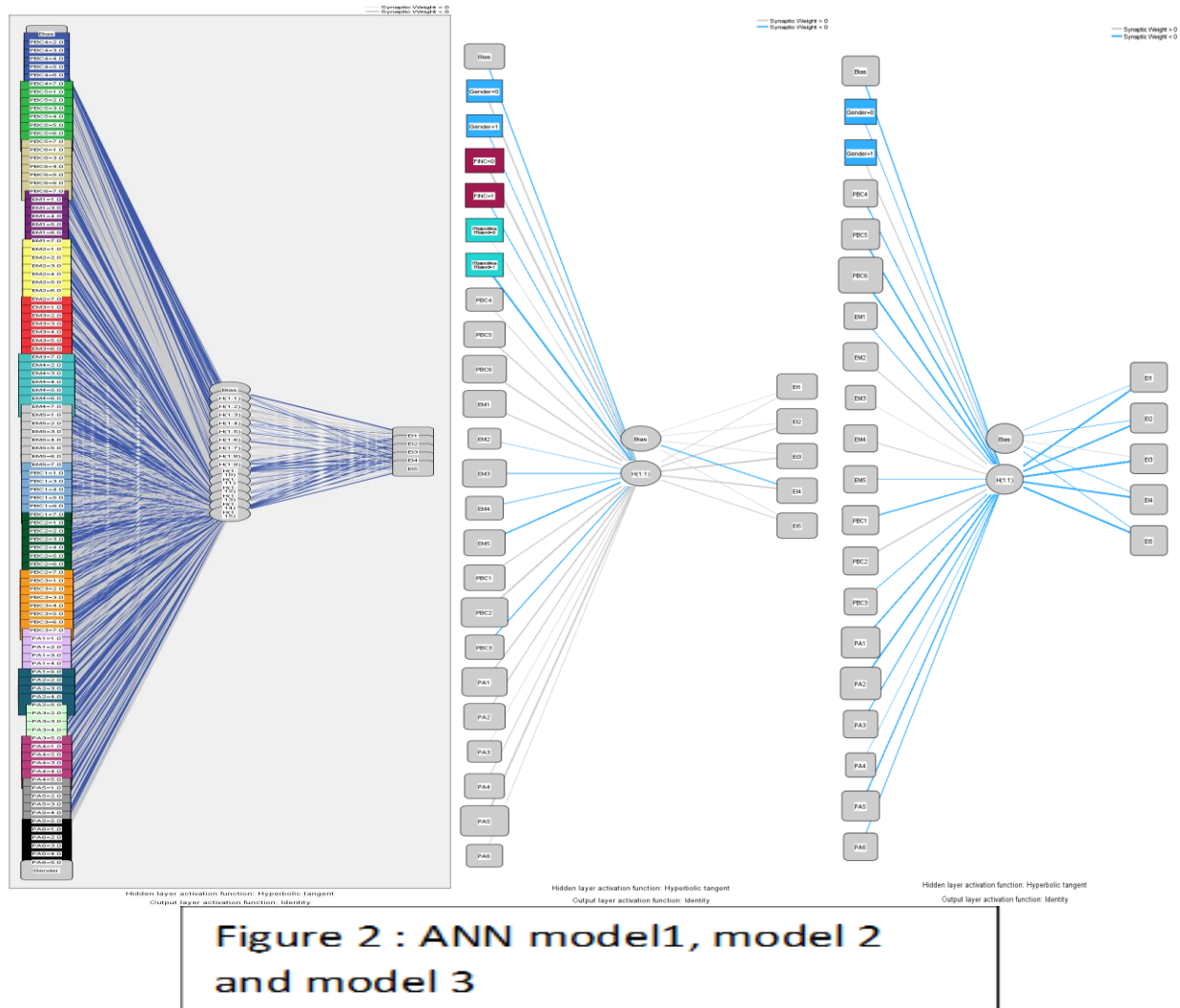
Table 8: ANN Variable Importance Analysis

Variable	Raw Importance	Normalized Importance	Rank
EI5	0.768	100.00%	1
EI3	0.594	77.36%	2
EI4	0.548	71.35%	3
EI2	0.459	59.77%	4
EI1	0.408	53.13%	5
PA2	0.071	9.24%	6
EM4	0.070	9.11%	7
PBC3	0.063	8.20%	8
PBC5	0.061	7.94%	9
Gender	0.060	7.81%	10

The construct-level importance analysis revealed that entrepreneurial intention indicators demonstrated extremely high importance as predictors of other EI items, reflecting the high internal consistency of the construct. Among external predictors, personal attitude item PA2 showed the highest importance (9.24%),

followed by entrepreneurial motivation item EM4 (9.11%). Perceived behavioral control items PBC3 and PBC5 demonstrated moderate importance (8.20% and 7.94%, respectively), while gender showed moderate importance (7.81%) as a control variable.

6.5 Alternative ANN Model Configurations



Multiple ANN model configurations were tested to ensure robustness and validate findings. An extended model incorporating additional control variables (Model 2) included 23 input units with Gender, FINC, and IT-based/Non-IT-based variables, utilizing a single hidden layer unit. The training sample consisted of 76 cases (76%) and testing sample of 24 cases (24%), achieving training error of 141.763 and testing error of 35.206, with average relative errors of 0.756 (training) and 0.908 (testing).

A simplified model (Model 3) with reduced complexity was evaluated using 19 input units (Gender plus all measurement items) and a single hidden layer unit. The sample allocation included 63 training cases (63%) and 37 testing cases (37%), resulting in training error of 102.146 and testing error of 83.671, with average relative errors of 0.659 (training) and 0.680 (testing). These alternative configurations demonstrated consistent patterns, supporting the robustness of the primary model findings.

Model Summary for model 1		
Training	Sum of Squares Error	95.802
	Average Overall Relative Error	0.555
	Relative Error for Scale Dependents	
	EI1	0.408
	EI2	0.459
	EI3	0.594
	EI4	0.548
	EI5	0.768
	Stopping Rule Used	1 consecutive step(s) with no decrease in error
	Training Time	00:00.3
Testing	Sum of Squares Error	39.594
	Average Overall Relative Error	0.816
	Relative Error EI1	0.813
	EI2	1.096
	EI3	0.782
	EI4	0.871
	EI5	0.585
a Error computations are based on the testing sample.		

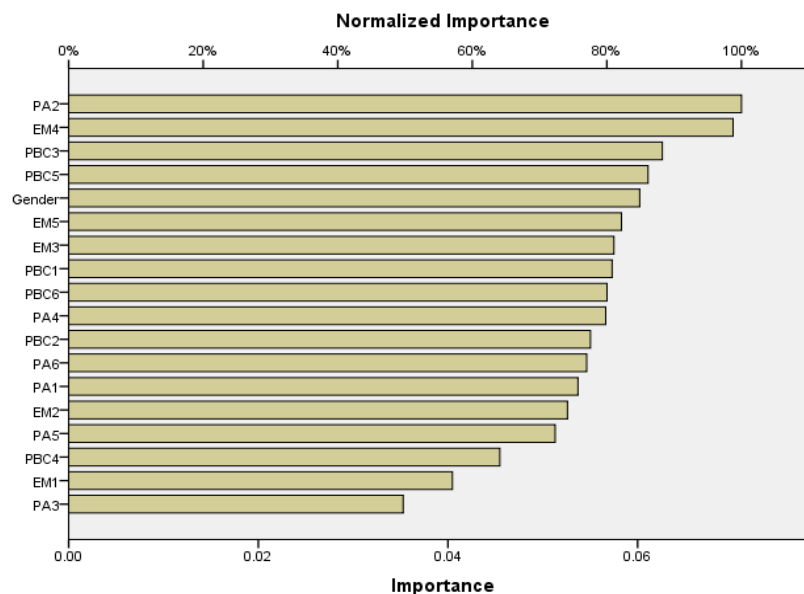


Figure 3 : Normalised Importance from ANN(model 1)
Source : Author's Research

Model Summary for model 2			
Training	Sum of Squares Error	141.763	
	Average Overall Relati	0.756	
	Relative Error for Scale Dependents	EI1	0.86
		EI2	0.775
		EI3	0.572
		EI4	0.731
		EI5	0.842
	Stopping Rule Used	1 consecutive step(s) with no decrease in error	
	Training Time	00:00.0	
Testing	Sum of Squares Error	35.206	
	Average Overall Relati	0.908	
	Relative Er	EI1	0.989
		EI2	0.936
		EI3	0.824
		EI4	0.931
		EI5	0.864

a Error computations are based on the testing sample.

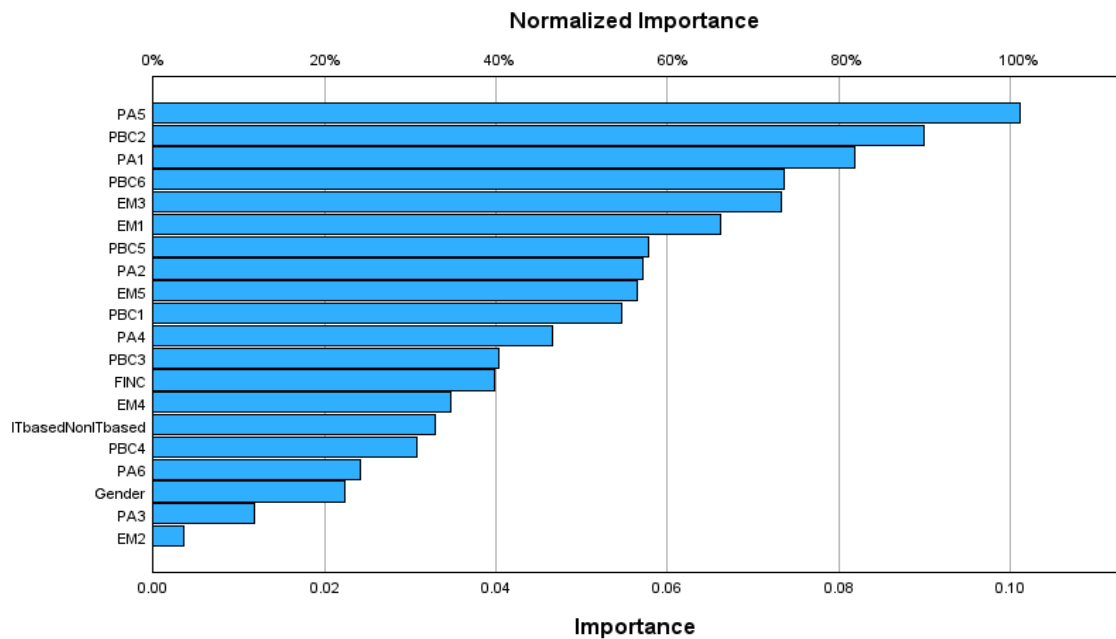


Figure 4 : Normalised Importance from ANN(model 2)
Source : Author's Research

Model Summary for model 3			
Training	Sum of Squares Error	102.146	
	Average Overall Relat	0.659	
	Relative Error for Scale Dependents		
	EI1	0.769	
	EI2	0.659	
	EI3	0.635	
	EI4	0.65	
	EI5	0.582	
	Stopping Rule Used	1 consecutive step(s) with no decrease in error	
	Training Time	00:00.0	
Testing	Sum of Squares Error	83.671	
	Average Overall Relat	0.68	
	Relative Error		
	EI1	0.525	
	EI2	0.584	
	EI3	0.616	
	EI4	0.628	
	EI5	1.103	
a Error computations are based on the testing sample.			

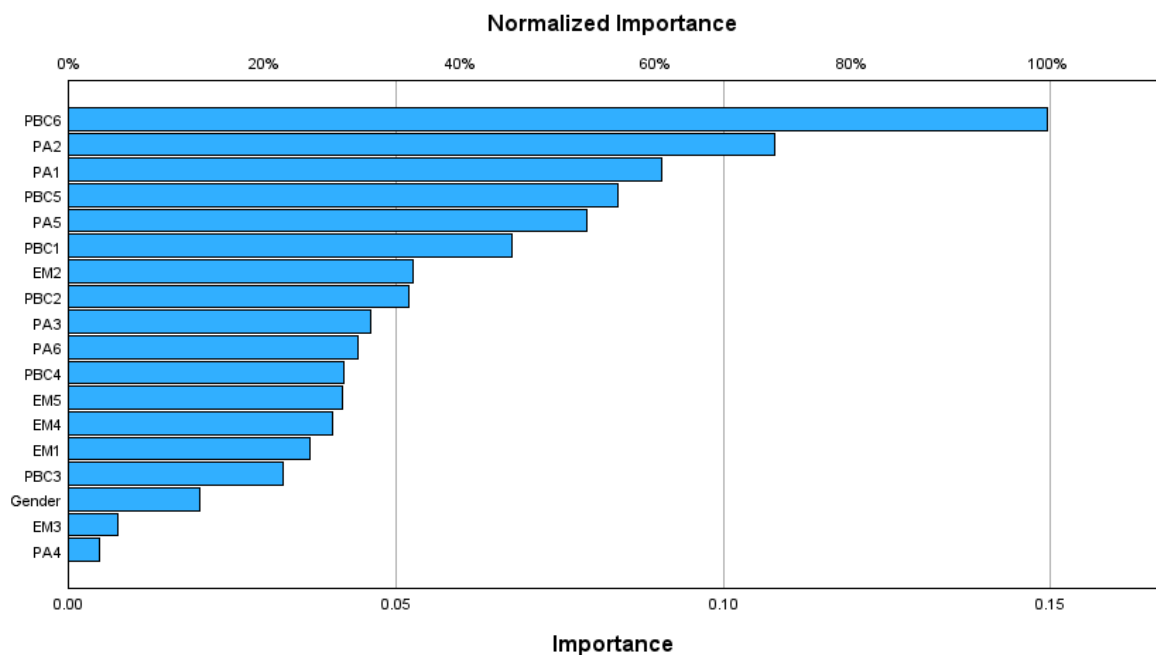


Figure 5 : Normalised Importance from ANN(model 3)
Source : Author's Research

6.6 ANN-PLS Comparison and Validation

The ANN analysis provided convergent validation for the PLS-SEM findings through methodological triangulation. Consistent findings across both analytical approaches included the emergence of personal attitude as an important predictor, significant influence of perceived behavioral control, and relatively low importance of control variables. The combination of PLS-SEM and ANN analyses enhanced the robustness of findings by leveraging the complementary strengths of each method: PLS-SEM provided theory-driven insights with interpretable coefficients and construct validation, while ANN offered non-linear modeling capabilities, interaction detection, and predictive accuracy assessment.

The ANN analysis revealed unique insights including potential non-linear relationships not detected in PLS-SEM, complex interaction effects among variables, and additional validation of model predictive capability. The variable importance hierarchy confirmed construct validation through high importance of entrepreneurial intention items, predictor confirmation with personal attitude emerging as crucial in both analyses, and evidence of non-linear relationships in entrepreneurial intention formation.

6.7 Integrated Analysis Findings

The integrated SEM-ANN analysis provided comprehensive understanding of entrepreneurial intention formation through convergent findings and unique methodological contributions. Both analytical approaches consistently identified personal attitude as the most important predictor, demonstrated significant influence of perceived behavioral control, showed limited impact of control variables, and explained substantial variance in entrepreneurial intention. The methodological triangulation enhanced confidence in findings and provided a robust foundation for theoretical development and practical applications in entrepreneurship education and policy.

7.1 Future scope and Implications

The results present multiple practical implications for entrepreneurship education, policy formulation, and entrepreneurial assistance initiatives:

1. Focus on Attitude Development: Given the strong influence of personal attitude on entrepreneurial intention, educational programs should emphasize developing positive attitudes toward entrepreneurship through exposure to successful entrepreneurial role models, hands-on entrepreneurial experiences, and addressing misconceptions about entrepreneurship.
2. Enhance Perceived Behavioral Control: Training programs should focus on building entrepreneurial self-efficacy through skill development, mentorship programs, and providing resources that increase individuals' confidence in their ability to successfully launch and manage ventures.
3. Reconsider Motivation-Based Interventions: The non-significant effect of entrepreneurial motivation suggests that simply motivating individuals toward entrepreneurship may not be sufficient. Instead,

interventions should focus on attitude change and capability building.

4. Targeted Interventions: The importance-performance analysis indicates that specific aspects of attitude and perceived behavior control are more critical than others, allowing for more targeted and efficient intervention strategies.

The results of this research enhance the existing literature on entrepreneurial intention and offer empirical insights for the formulation of more effective strategies to promote entrepreneurship.

This research is valuable for governments, policymakers, universities, and entrepreneurship schools since it offers valuable insights for the development of an ecosystem for designing educational programmes that equip aspiring entrepreneurs with the indispensable fundamental expertise for achieving success in their ventures. The significant revelation of this research emphasises the need for a targeted intervention to navigate the behaviour and finally transform the same into motivation, intention and action. By fostering synergy among enterprises, academic institutions, and governmental organisations and nurturing a climate of ingenuity, one can enhance the global landscape for aspiring entrepreneurs.

7.2 Limitations

This is only a pilot study taken up to assess and capture the behavioural traits that drive a potential entrepreneur towards intention and action for creating a venture. The objective was to apply rigorous statistical analytical tools to a simple measurement model and comprehend exhaustive outcomes revealing many layers and facets that shape the behaviour of an entrepreneur. The findings and discussions further pave a way for a deeper research of longitudinal type that can highlight some more critical aspects in the realm of entrepreneurship.

References

1. Abbas, L. N. (2015). Entrepreneurial intention among malaysian engineering graduates: Male versus female. *Journal of Technical education and training*, 7 (2), .
2. Alkaabi, K., & Senghore, S. (2024). Student entrepreneurship competency and mindset: Examining the influence of education, role models, and gender. *Journal of Innovation and Entrepreneurship*, 13 (1), . <https://doi.org/10.1186/s13731-024-00393-5>
3. Almeida, J., & Daniel, A. D. (2021). Women in engineering: Developing entrepreneurial intention through learning by doing approach. <https://doi.org/10.1109/EDUCON46332.2021.9453984>
4. Amofah, K., & Saladrighes, R. (2022). Impact of attitude towards entrepreneurship education and role models on entrepreneurial intention. *Journal of Innovation and Entrepreneurship*, 11 (1), . <https://doi.org/10.1186/s13731-022-00197-5>
5. Andani, C., & Puspitowati, I. (2023). The influence of entrepreneurial education and family background on entrepreneurial intention that is moderated by

- gender. <https://doi.org/10.24912/ijaeb.v1i4.2123-2131>
6. Armuña, C., Ramos, S., Juan, J., Feijóo, C., & Arenal, A. (2020). From stand-up to start-up: Exploring entrepreneurship competences and stem women's intention. *International Entrepreneurship and Management Journal*, 16 (1), 69-92. <https://doi.org/10.1007/S11365-019-00627-Z>
7. Ayvaz, E. E., & Kurulgan, M. (2024). How the entrepreneurial intention affected from education, family, gender, and generations. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, . <https://doi.org/10.18070/erciyesiibd.1325182>
8. Balgiu, B. A., & Simionescu-Panait, A. (2024). Entrepreneurial intention in romanian engineering students: Expanding the theory of planned behavior. *Administrative Sciences*, 14 (11), 275-275. <https://doi.org/10.3390/admsci14110275>
9. Crudele, J., Stransky, J., & Shekhar, P. (2024). Integrating entrepreneurial learning in engineering design courses: Assessment of entrepreneurial self-efficacy. <https://doi.org/10.1109/educon60312.2024.10578698>
10. Dabić, M., Daim, T. U., Bayraktaroglu, E., Novak, I., & Bašić, M. (2012). Exploring gender differences in attitudes of university students towards entrepreneurship. *International Journal of Gender and Entrepreneurship*, 4 (3), 316-336. <https://doi.org/10.1108/17566261211264172>
11. Duong, C. D. (2023). A serial mediation model of the linkage between entrepreneurial education, self-efficacy, attitudes and intentions: Does gender matter? A multi-group analysis. *On the horizon*, 31 (3/4), 174-195. <https://doi.org/10.1108/oth-01-2023-0002>
12. Engle, R. L., Schlaegel, C., & Delanoë, S. (2011). The role of social influence, culture, and gender on entrepreneurial intent. *Journal of small business and entrepreneurship*, 24 (4), 471-492. <https://doi.org/10.1080/08276331.2011.10593549>
13. Gallegos, A., Valencia-Arias, A., Bravo, V. D. C. A., Puente, R. T. D. L., Valencia, J., Uribe-Bedoya, H., Huerta, V. B., Vega-Mori, L., & Rodríguez-Correa, P. (2024). Factors that determine the entrepreneurial intention of university students: A gender perspective in the context of an emerging economy. *Cogent Social Sciences*, . <https://doi.org/10.1080/23311886.2024.2301812>
15. Gender, entrepreneurial education, self-efficacy, internal control locus, and entrepreneurial intention based on the perspective of students. <https://doi.org/10.31219/osf.io/bekqn>
16. J, M., & S, A. P. (2024). Entrepreneurial attitude and entrepreneurial intentions of female engineering students: Mediating roles of passion and creativity. <https://doi.org/10.28934/jwee24.12.pp19-39>
17. Jin, Q., Gilmartin, S. K., Chen, H. L., Johnson, S. K., Weiner, M. B., Lerner, R. M., & Sheppard, S. (2016). Entrepreneurial career choice and characteristics of engineering and business students. *International Journal of Engineering Education*, 32 (2), 598-613.
19. Jin, Q., Gilmartin, S. K., Sheppard, S., & Chen, H. L. (2014). Comparing engineering and business undergraduate students' entrepreneurial interests and characteristics.
20. Kumar, S., Paray, Z. A., & Dwivedi, A. K. (2020). Student's entrepreneurial orientation and intentions: A study across gender, academic background, and regions. *Higher Education, Skills and Work-based Learning*, 11 (1), 78-91. <https://doi.org/10.1108/HESWBL-01-2019-0009>
21. Kumar, V., Monga, D., & Joshi, R. (2024). Unveiling the pathways to entrepreneurial mindset: Exploring aspirations, challenges, and socio-cultural dynamics among north indian engineering students. <https://doi.org/10.1109/tale62452.2024.10834332>
22. Law, K. M. Y., & Breznik, K. (2017). Impacts of innovativeness and attitude on entrepreneurial intention: Among engineering and non-engineering students. *International Journal of Technology and Design Education*, 27 (4), 683-700. <https://doi.org/10.1007/S10798-016-9373-0>
23. Le, T. L. (2023). Entrepreneurial education and entrepreneurial intention among higher education students in vietnam: Do entrepreneurial self-efficacy and family support matter?. *Higher Education, Skills and Work-based Learning*, 13 (2), 403-422. <https://doi.org/10.1108/heswbl-10-2022-0213>
24. Lim, Y. (2023). The impact of entrepreneurship education on entrepreneurial intentions: Gender differences. <https://doi.org/10.22815/jes.2023.4.2.51>
25. Lo, C., Sun, H., & Law, K. M. Y. (2012). Comparing the entrepreneurial intention between female and male engineering students.
26. Min, L., Gen-shu, L., & Zheng-xia, P. (n.d.). An analysis of gender disparity in students' entrepreneurial intention and its influencing factors. <https://doi.org/10.3969/j.issn.1672-0059.2011.06.011>
27. Mollel, D. N., & Gervas, G. (2024). Determinants of entrepreneurial intents among engineering students: Insights from the college of engineering and technology at the university of dares salaam, tanzania. *International journal of advanced research*, . <https://doi.org/10.21474/ijar01/19666>
28. Murugesan, R., & Jayavelu, R. (2017). The influence of big five personality traits and self-efficacy on entrepreneurial intention: The role of gender: . <https://doi.org/10.1177/2393957516684569>
29. Ognjenović, K. (2022). Planned behaviour, gender, and attitudes towards entrepreneurship among business economics and electrical engineering students. *Stanovništvo*, 60 (2), 121-143. <https://doi.org/10.2298/stnv2202121o>
30. Oliveira, B. M. D. F., Moriano, J. A., Laguía, A., & Soares, V. S. (2015). The psychosocial profile of the entrepreneur: A study from the point of view of gender. <https://doi.org/10.1344/%X>
31. Pengaruh entrepreneurship education, gender, age, dan family background terhadap entrepreneurial intention pada mahasiswa universitas tarumanagara. *Jurnal Manajerial dan Kewirausahaan*, 4 (4), 928-937. <https://doi.org/10.24912/jmk.v4i4.20553>
32. Pergelova, A., Angulo-Ruiz, F., Manolova, T. S., &

- Yordanova, D. (2023). Entrepreneurship education and its gendered effects on feasibility, desirability and intentions for technology entrepreneurship among stem students. *International Journal of Gender and Entrepreneurship*, .
<https://doi.org/10.1108/ijge-08-2022-0139>
33. Piva, E., & Rovelli, P. (2021). Mind the gender gap: The impact of university education on the entrepreneurial entry of female and male stem graduates. *Small Business Economics*, 1-19.
<https://doi.org/10.1007/S11187-021-00525-1>
34. Polin, B. A. (2022). Disentangling the roles of academic major and gender in determining entrepreneurial intentions among students. *Journal of Education and Training*, 65 (1), 22-43.
<https://doi.org/10.1108/et-08-2021-0303>
35. Roy, R., & Das, N. (2020). A critical comparison of factors affecting science and technology students' entrepreneurial intention: A tale of two genders. *International Journal for Educational and Vocational Guidance*, 20 (1), 49-77.
<https://doi.org/10.1007/S10775-019-09393-4>
36. Salavou, H., Chalkos, G., & Lioukas, S. (2021). Linkages between entrepreneurial intentions and entrepreneurship education: New evidence on the gender imbalance. *Journal of Education and Training*, 63 (6), 906-919.
<https://doi.org/10.1108/ET-10-2020-0301>
37. Samala, A. D., Ganefri, G., Yulastri, A., Indarta, Y., Ranuharja, F., & Dewi, I. P. (2022). Entrepreneurial intentions for engineering students: Does entrepreneurship education and family environment matter?. *Journal of Innovation in Educational and Cultural Research*, 3 (4), 590-606.
<https://doi.org/10.46843/jiecr.v3i4.300>
38. Şeşen, H., & Pruett, M. (2014). Nascent entrepreneurs: Gender, culture, and perceptions.
39. Shekhar, P. (2023). Engineering entrepreneurship program participation: Differences across men and women. *IEEE Transactions on Education*, 66 (2), 188-196. <https://doi.org/10.1109/te.2022.3208524>
40. Shekhar, P., Huang-Saad, A., Libarkin, J. C., & Ostrowski, A. K. (2018). 'is someone in your family an entrepreneur?': Examining the influence of family role models on students' entrepreneurial self-efficacy and its variation across gender.
41. Tian, J., Zhang, M., Wu, Y., & Zhou, H. (2022). Gender-based differences in the relationships among proactive personality, perceived entrepreneurial support and entrepreneurial intention of chinese private college students: A moderated mediation model. *Frontiers in Psychology*, 13 null, .
<https://doi.org/10.3389/fpsyg.2022.871343>
42. Udayanganie, W. M. I., Jusoh, M., & Chinna, K. (2019). Impact of big five personality traits on entrepreneurial intention of engineering undergraduates.
<https://doi.org/10.5296/RBM.V6I2.15147>
43. Understanding the relationship between entrepreneurship education, entrepreneurial attitudes, and entrepreneurial intentions among engineering graduates: The moderating role of gender. *Journal of work-applied management*, .
<https://doi.org/10.1108/jwam-05-2023-0039>
44. Vieira, F. D., Rodrigues, C. S., & Vieira, I. C. (2023). Do engineering students intend to be entrepreneurs?.
45. *Advances in business strategy and competitive advantage book series*, 124-147.
<https://doi.org/10.4018/978-1-6684-8781-5.ch006>
46. Voda, A. I., & Florea, N. (2019). Impact of personality traits and entrepreneurship education on entrepreneurial intentions of business and engineering students. *Sustainability*, 11 (4), .
<https://doi.org/10.3390/SU11041192>
47. Westhead, P., & Solesvik, M. (2016). Entrepreneurship education and entrepreneurial intention: Do female students benefit?: . *International Small Business Journal*, 34 (8), .
<https://doi.org/10.1177/0266242615612534>
48. Ye, P., & Yee, C. M. (n.d.). Research progress on entrepreneurial intentions among college students. *Advances in Vocational and Technical Education*, .
<https://doi.org/10.23977/avte.2023.051005>
49. Yukongdi, V., & Lopa, N. Z. (2017). Entrepreneurial intention: A study of individual, situational and gender differences. *Journal of Small Business and Enterprise Development*, 24 (2), 333-352.
<https://doi.org/10.1108/JSBED-10-2016-0168>
50. Zakaria, N. H., Akhir, N. E. F. M., & Rani, N. (2024). The role of gender in shaping students' entrepreneurial intentions: An examination through the tpb model. *International Journal of Entrepreneurship and Management Practices*, 7 (25), 30-44. <https://doi.org/10.35631/ijemp.725004>