

Education and Business Performance in Women-Led Ventures: A Moderated Moderation Analysis of Entrepreneurial Personality

A. Rathnakumar^{1,*}, S. Dhanalakshmi², M. Deepa³, R. Jeya Rani⁴, S. Shahul Hameed⁵, András Szeberényi⁶

^{1,2,3,4}Department of Management Studies, Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India.

⁵Department of Business Administration, Sadakathullah Appa College, Tirunelveli, Tamil Nadu, India.

⁶Department of Marketing and Communication, Budapest Metropolitan University, Budapest, Hungary.

rathnakumar.a.soms@sathyabama.ac.in¹, dhanalakshmi.s.soms@sathyabama.ac.in², deepa.m.soms@sathyabama.ac.in³, jeyarani.r.soms@sathyabama.ac.in⁴, profshahulmba@gmail.com⁵, aszeberenyi@metropolitan.hu⁶

*Corresponding author

Abstract: Women-led ventures play a crucial role in promoting inclusive economic growth; however, noticeable differences in business performance continue to pose challenges. This study examines the impact of education on the performance of women-owned businesses, with special reference to the role of entrepreneurial personality. The study explores the moderated-moderation relationship between education and business performance with respect to entrepreneurial personality traits (innovativeness, risk-taking ability, proactiveness) and, using the moderated-moderation framework, investigates differences in this relationship across various contextual conditions. The primary data were collected from women entrepreneurs and analyzed statistically using the appropriate techniques. The findings suggest that education has a positive impact on business performance, with this impact increasing with the presence of positive entrepreneurial personality traits. The results also illustrate the complex and dynamic relationship between entrepreneurial success, as it is a combined interaction effect that varies across levels of the moderating variables. This study provides relevant information for designing educational programs and developing policy and entrepreneurship support programs to enhance women's entrepreneurship and business performance.

Keywords: Women-Led Ventures; Education and Business Performance; Entrepreneurial Personality; Moderated Moderation Analysis; Economic Growth; Women Entrepreneurship.

Cite as: A. Rathnakumar, S. Dhanalakshmi, M. Deepa, R. J. Rani, S. S. Hameed, and A. Szeberényi, "Education and Business Performance in Women-Led Ventures: A Moderated Moderation Analysis of Entrepreneurial Personality," *AVE Trends in Intelligent Social Letters*, vol. 3, no. 2, pp. 67–77, 2026.

Journal Homepage: <https://avepubs.com/user/journals/details/ATISL>

Received on: 02/04/2025, **Revised on:** 25/06/2025, **Accepted on:** 04/10/2025, **Published on:** 05/06/2026

DOI: <https://doi.org/10.64091/ATISL.2026.000318>

1. Introduction

In recent years, entrepreneurship has played a growing role in fostering inclusive economic growth, employment, and socio-economic development, and is led by women [1]. Women entrepreneurs are increasingly recognized in both developed and developing economies, not just for their contribution to diversifying economic participation, but also for their role in innovation and resilience-building in local and national economies [2]. Despite the increasing relevance, there is still considerable diversity in business performance among women-led businesses, underscoring the need for a deeper understanding of what facilitates success in some businesses but not others. Entrepreneurship is generally considered a vital factor in educational success [3].

Copyright © 2026 A. Rathnakumar *et al.*, licensed to AVE Trends Publishing Company. This is an open access article distributed under [CC BY-NC-SA 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/), which permits copying, remixing, redistributing, transformation, and building upon the material in any medium so long as the original work is properly cited.

Recent studies have found that education enhances entrepreneurial learning, strategic awareness, and managerial skills, which are essential for business operations in the competitive, uncertain landscape of the business world [4]. Education is especially vital for women entrepreneurs because it builds self-confidence, improves decision-making, and enables better access to business networks and resources [5]. However, recent evidence suggests that education does not lead to better business performance; other factors related to individual traits and environment are involved [6]. In recent years, entrepreneurial personality has emerged as an important pathway for education and its outcomes. Innovativeness, risk-taking, proactiveness, and self-orientation are traits that affect entrepreneurs' identification of opportunities, handling of uncertainty, and strategic decision-making [7].

Social restrictions, perceived risk, and discrimination from outside sources could influence the entrepreneurial decisions of women entrepreneurs, particularly in WBE [8]. A recent study demonstrates that personality characteristics can have a positive or negative effect on venture performance, depending on how entrepreneurs interact with their venture environment and, therefore, on the role that educational capital plays [9]. The role of education in improving women's entrepreneurial potential is crucial, as it enhances their knowledge, skills, and management capabilities. Entrepreneurship education enhances female entrepreneurs' skills in identifying opportunities, utilizing resources effectively, and making informed decisions to sustain their businesses [10]. In addition, research shows that education improves cognitive functions, self-confidence, and problem-solving abilities – key skills for dealing with competitive and uncertain business conditions. Education plays a pivotal role in enhancing the economic empowerment and resilience of women entrepreneurs, especially in situations with poor access to formal support mechanisms [11]. When evaluating the performance of a business owned by women, one should consider the following indicators: business performance, long-term sustainability, business stability, revenue growth, and sales [12]. Earlier research indicates that women entrepreneurs with higher educational backgrounds and stronger entrepreneurial skills perform better in their businesses, as they possess stronger managerial skills [21].

Empirical research also suggests that performance outcomes differ significantly across individuals, depending on access to resources and contextual barriers [13]. In such a context, education and skills are important aspects of the internal business environment that can play a very important role in female entrepreneurs' success [14]. Entrepreneurial skills are very important for transforming educational inputs into observable commercial performance [15]. Opportunity recognition, creativity, risk-taking, leadership skills, resilience, and self-efficacy are some of these competencies. Research indicates that women entrepreneurs with strong entrepreneurial skills in their businesses are more effective at managing uncertainty, adapting to changing markets, and remaining competitive [16]. Also, schooling, training courses, and on-the-job experience can all help develop entrepreneurial capabilities [17]. This helps women business owners to address socio-economic and structural barriers to achieve long-term business growth [18]. The main aim of this study is to explore the correlation and interaction among entrepreneurial education, entrepreneurial personality, and business performance in women entrepreneurship, highlighting the role of individual characteristics and customer acceptance mechanisms in the effectiveness of the education inputs [19]. The study aims to examine the impact of education on the performance of women entrepreneurs and how entrepreneurial personality traits – innovativeness, risk-taking, proactiveness, and self-efficacy – moderate the relationship between education and performance [20].

2. Literature Review

2.1. Education and Entrepreneurial Outcomes

The results of a systematic review by Brüne and Lutz [4] show that entrepreneurship education positively affects entrepreneurial objectives, skills, and post-startup outcomes. But this effect is not the same across all educational designs and settings. Education is more crucial for women entrepreneurs, as it helps them overcome institutional obstacles such as limited access to networks, funding, and market knowledge. Compared to their less educated counterparts, educated women entrepreneurs typically exhibit greater confidence and strategic orientation, which enables better company success.

2.2. Education and Business Performance in Women-Led Ventures

Both quantitative metrics (sales growth, profitability, and employment creation) and subjective metrics (owner happiness and perceived success) affect business performance in women-led businesses. Empirical data show that education greatly improves managerial effectiveness and innovative capacity, which, in turn, enhances corporate performance. Fairlie and Robb [16] discovered that performance discrepancies between male- and female-owned businesses can be partially explained by differences in education and experience. In addition to arguing that variations in women's start-up motivations (necessity vs opportunity) affect performance outcomes through learning motivation and competencies, the author offers a conceptual model linking entrepreneurial motivation, learning motivation, and female entrepreneurial competencies to business performance.

2.3. Education and Returns to Entrepreneurship

Van der Sluis et al. [18] examined empirical data on entrepreneurs' educational returns compared with those of wage workers. Their analysis revealed that, while returns differ by industry and experience, education has a positive impact on entrepreneurial performance and income. The writers concluded that education improves entrepreneurs' analytical abilities and flexibility, both of which are essential for sustained business success.

2.4. Entrepreneurial Personality and Business Performance

Many studies have examined the characteristics of the entrepreneurial personality, such as risk-taking propensity, inventiveness, proactivity, success orientation, and internal locus of control, as predictors of entrepreneurial success. Personality qualities have a major impact on both venture development and long-term business performance, according to a meta-analysis by Rauch and Frese [19]. Personality traits are indirectly related to business success through entrepreneurial activities and objectives, as reported by Huang et al. [1]. Having the right personality traits is crucial to success with gender-specific challenges in women's business ventures. Female entrepreneurs were better equipped to sustain company performance in the face of environmental challenges when they had strong motivation to achieve and resilience. These results demonstrate the applicability of personality-based explanations in comprehending women's entrepreneurial outcomes.

2.5. Moderating Role of Entrepreneurship Education

Recent studies on entrepreneurship highlight the moderating effect of education on the relationship between personality traits and entrepreneurial outcomes. By offering opportunities for experiential learning and practical knowledge, entrepreneurship education can enhance the positive benefits of entrepreneurial personality traits. Some individuals may benefit from formal entrepreneurship training to better profit from taking risks. Furthermore, Brüne and Lutz [4] have shown that education affects entrepreneurial cognition and behavior, thereby enhancing the effectiveness of entrepreneurial traits. This means that schooling is a contextual factor that can modify the relationship between personality traits and economic outcomes, and that it also predicts performance.

2.6. Research Hypotheses

Based on this, the following hypotheses serve as the basis for the structural model in this study and will be tested using path analysis.

- **H1:** Women entrepreneurs' business performance improves with education.
- **H2:** Entrepreneurial traits greatly enable women's business performance.
- **H3:** Entrepreneurial traits influence how education translates into business performance among women entrepreneurs.

3. Research Methodology

The present study adopted a cross-sectional quantitative research design to examine the influence of Education and Entrepreneurial Traits on Business Performance among women entrepreneurs in the MSME sector in Tirunelveli district, Tamil Nadu. A structured questionnaire survey method was employed to collect primary data from women entrepreneurs engaged in various forms of business activities across the district. The quantitative approach was considered appropriate because it enables the researcher to measure relationships among variables systematically and statistically test the proposed hypotheses. The cross-sectional design was particularly suitable for this study, as it enabled data collection from respondents at a single point in time, thereby providing an overall understanding of the current entrepreneurial conditions and performance levels of women-owned MSMEs in Tirunelveli. The study primarily focused on women entrepreneurs because women's participation in entrepreneurship has increased significantly in recent years, especially in small- and medium-scale enterprises. Though the number of women entrepreneurs has increased, barriers still hinder their progress in education, skill development, business registration, access to capital, and market exposure. Tirunelveli district has a significant proportion of women entrepreneurs who are either engaged in informal or home-based industries or have not availed the opportunity to join government-initiated schemes/registration process for entrepreneurs. The study aimed to explore the direct impact of education and entrepreneurial traits on business performance, and to assess whether education plays a role in business registration, entrepreneurial awareness, and skill-building amongst women entrepreneurs.

To obtain a broader representation of women entrepreneurs across various geographical and economic settings, the researcher selected respondents from all taluks in Tirunelveli district. The study included women entrepreneurs, regardless of the nature or size of their businesses, engaged in manufacturing, retail, services, tailoring, food processing, beauty services, and

handicrafts. The study has been conducted on women entrepreneurs, irrespective of the nature and size of the business, engaged in manufacturing, retail, services, tailoring, food processing, beauty services, handicrafts, etc. Due to the large number of unregistered enterprises, it was difficult to determine the exact number of women entrepreneurs, as no comprehensive list or official database was available. A large proportion of women entrepreneurs are engaged in business without the help of their homes and are not registered with entrepreneurial associations or recognized schemes. Thus, the population was considered unknown and studied as such. The researcher used convenience sampling because there was no clearly defined sampling frame. Convenience sampling was deemed practical and appropriate for the study, given the conditions, which enabled the researcher to reach people who were available and willing to participate. Probability sampling methods offer greater generalizability but were not readily applicable in this case because the population was hidden and scattered. Convenience sampling has been adopted in entrepreneurship and behavioral studies, especially when the population is hard to reach or cannot be formally registered. The respondents of the present work were 500 women entrepreneurs. The large sample size was based on methodological and statistical reasons. Huang et al. [1] stated that sample sizes of 200-400 are generally sufficient for Structural Equation Modeling (SEM) analysis.

Similarly, Xie and Wu [3] recommended using 5 to 10 respondents per variable in multivariate statistical analysis to achieve stability and reliability. Moreover, Pulka et al. [10] stressed that in quantitative research, larger sample sizes would enhance the reliability of results, reduce sampling error, and minimize the influence of extreme values. Thus, choosing 500 respondents made the findings of this study more robust and accurate, and ensured the accuracy of the statistical analysis. The data collection tool was questionnaires. The questionnaire was organized into various parts: demographic data, educational background, entrepreneurial characteristics, and business performance. The demographic section included factors such as age, marital status, educational level, business type, years of business experience, and monthly income. The education construct concerned the extent to which formal education, training, and knowledge acquired in the business world contribute to entrepreneurial activities. Entrepreneurial dimensions were innovativeness, leadership ability, risk-taking behavior, self-confidence, creativity, persistence, and proactiveness. Indicators used to evaluate business performance included sales growth, profitability, customer satisfaction, business sustainability, and overall business development. The questionnaire included 12 constructs; each was measured on a 5-point Likert scale ranging from Strongly Disagree (1) to Agree (5) Strongly. A Likert scale approach was used, as it is one of the most widely used methods in the social sciences and management research to measure attitudes, perceptions, and behavioral responses. It enables respondents to respond to statements with an easy-to-understand answer indicating their agreement or disagreement. The standardized measurement scale also enabled statistical analysis and comparison of variables.

The last survey was preceded by scrutiny of the questionnaire to ensure the items measured were clear, relevant, and consistent. The researcher ensured that the questionnaire statements were consistent with the goals of this study and supported by previous literature on entrepreneurship, human capital theory, and entrepreneurial trait theory. Data collection was conducted in the field and involved interactions with women entrepreneurs across various parts of Tirunelveli district. Participants were informed about the study's objectives, and all were given the option to participate. Structural Equation Modeling (SEM) was used to analyze the data in AMOS. SEM was selected because it is an advanced multivariate statistical technique that allows the examination of multiple relationships among observable and latent variables. The analysis process consisted of two steps: measurement model analysis and structural model analysis. The reliability and validity of the constructs were measured using the measurement model analysis. This involved analyzing factor loadings, composite reliability, convergent validity, and discriminant validity of these measurement items. Ensuring the measurement model is adequate is vital, as it ensures the observed variables accurately measure the latent construct under investigation. The measurement model was validated, and the structural model was co-assessed to test the proposed hypotheses, examine variable relations, and assess interaction effects. Structural model analysis helped the researcher identify the strength and significance of the direct and moderating effects of the study variables. The AMOS software was especially advantageous for this study, as it offers graphical data representation, and the model path analysis and model fit indices are useful for assessing the overall fit of the proposed research framework.

3.1. Interpretation

3.1.1. Demographic Profile

Table 1 summarises the respondents' demographic profile. After a thorough review, 427 of the more than 500 questionnaires sent to respondents were completed. Of those, the majority (46%, $n = 196$) were aged 25-36. Next, the majority of female entrepreneurs (31%, $n = 132$) have undergraduate degrees.

Table 1: Performance benchmark results across processing frames

Variable	Category	Frequency	Percent
Age	Below 25	60	14%
	26–35	196	46%

	36–45	137	32%
	Above 45	34	8%
Education Qualification	Illiterate	4	1%
	Up to Primary Education	21	5%
	Up to Secondary Education	64	15%
	Higher Secondary	68	16%
	Diploma/Certificate/Professional Course	60	14%
	UG	132	31%
	PG	68	16%
	Above PG	9	2%
Marital Status	Unmarried	175	41%
	Married	222	52%
	Divorced/Separated	17	4%
	Widows	13	3%
Annual Income	Less than 2,00,000	125	29%
	2,00,001–4,00,000	147	34%
	4,00,001–6,00,000	102	24%
	Above 6,00,000	52	12%
Previous Work Experience	Yes	260	61%
	No	167	39%
Type of Ownership	Sole Proprietorship	277	65%
	Partnership	61	14%
	Family ownership	73	17%
	Franchises	15	4%

Regarding marital status, most respondents (52%, $n = 222$) were married. Regarding the annual income of female entrepreneurs, the majority (34%, $n = 147$) earn between \$ 2,00,001 and \$ 4,00,000. Most female entrepreneurs (61%, $n = 260$) had prior work experience before launching their businesses. Regarding ownership structure, the majority are sole proprietors (65%, $n = 277$).

3.2. Confirmatory Factor Analysis (CFA)

Figure 1 illustrates the measurement model that the researcher developed using Confirmatory Factor Analysis (CFA). To verify the model's fitness, several indices were calculated based on the measurement model. Compared to the standard, the CMin/Df value is 1.118; values below 3.0 are considered good, and 2.0 is excellent. The recommended threshold above this is 0.90, and the goodness-of-fit index is 0.943. The root mean square error of approximation (RMSEA) is 0.017; a value less than 0.05 denotes a close fit. Other indices with values greater than 0.95 are regarded as highly reliable, such as the CFI (0.996), the Tucker-Lewis Index (0.996), and the Normed Fit index (0.967).

3.3. Convergent Validity, Construct Reliability, and Discriminant Validity

The measurement model was evaluated using convergent and discriminant validity. The standardized factor loadings for all items on the variables are above 0.70, ranging from 0.757 to 0.908, as shown in Table 2 of Construct Validity (see Table 2 below). Moreover, the model's convergent validity is supported by the Average Variance Extracted (AVE) for each construct: Education (AVE = 0.767), Entrepreneurial Traits (AVE = 0.654), and Business Performance (AVE = 0.625), all of which exceed the minimum value of 0.50. The reliability of all constructs was very high, with composite reliabilities (CR) ranging from 0.938 to 0.967 and Cronbach's Alpha (α) values ranging from 0.936 to 0.966, which are above the desirable limit of 0.80. The Fornell-Larcker criterion was used to verify discriminant validity. The values in bold along the diagonal represent the square roots of the AVEs for Business Performance (0.791), Entrepreneurial Traits (0.809), and Education (0.876). These diagonal values are all above the inter-construct correlations (ranging from 0.637 to 0.762) and meet the criterion that each construct should have more variance within its indicators than across other variables. For example, Entrepreneurial Traits and Business Performance have a lower correlation (0.762) than their corresponding AVE square roots (0.809 and 0.791). This shows that all the model's constructs are statistically independent and distinct. Figure 1 shows the measurement model and the correlations among the three latent constructs: "Education", "Entrepreneurial Traits", and "Business Performance". Multiple observed indicators are used to measure each construct. The results show that the latent construct of education has 9 indicators (EDU_1 to EDU_9), the Entrepreneurial Traits have 8 indicators (ET_1 to ET_8), and Business Performance has 9 indicators (BP_1 to BP_9). The factor loadings of the indicators are generally above the acceptable level, indicating that the observed variables are good indicators of the constructs they represent.

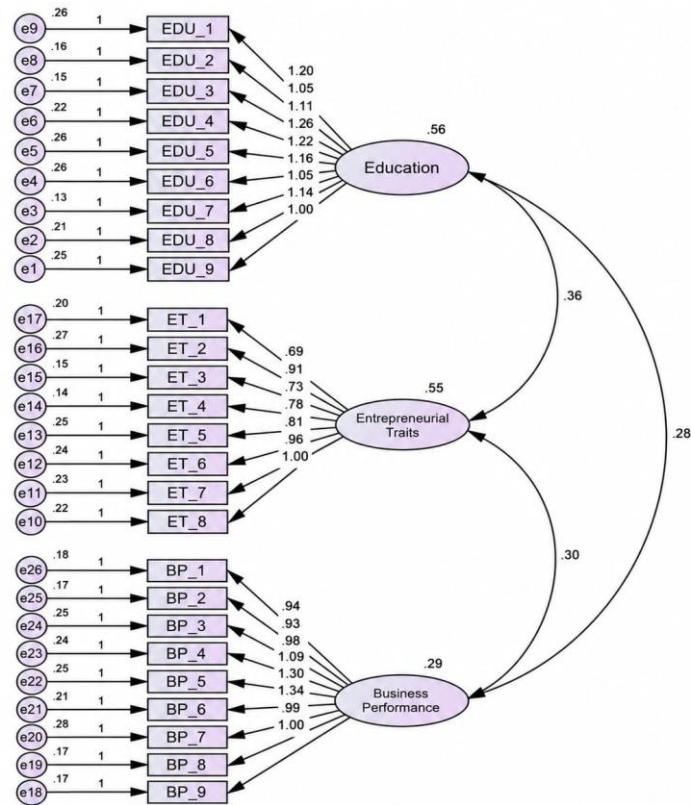


Figure 1: Structural model of education, entrepreneurial traits, and business performance

The relationships among the constructs are positive. There is a moderate positive correlation between education and Entrepreneurial Traits ($r = 0.36$), suggesting that higher levels of education are associated with greater entrepreneurial traits. Likewise, Business Performance is positively correlated with education ($r = 0.28$), suggesting that education is associated with better business results. Also, Entrepreneurial Traits showed a positive relationship with Business Performance ($r = 0.30$), indicating that stronger entrepreneurial traits are associated with better business performance. The variance values reported above each latent construct represent the amount of variance accounted for by that construct. The variance estimates are 0.56 for education, 0.55 for Entrepreneurial Traits, and 0.29 for Business Performance. According to these values, the constructs can be reasonably attributed to the indicators, except for Business Performance, which shows a lower explained variance. The overall results indicate that the model shows strong relationships among the constructs and support the assumption that education and entrepreneurial characteristics have an important influence on business performance.

Table 2: Reliability and validity analysis of constructs

Construct	Code	Item Loadings	AVE	CR	α
Education	EDU 9	0.833	0.767	0.967	0.966
	EDU 8	0.880			
	EDU 7	0.871			
	EDU 6	0.862			
	EDU 5	0.875			
	EDU 4	0.892			
	EDU 3	0.908			
	EDU 2	0.890			
	EDU 1	0.870			
Entrepreneurial Traits	ET 8	0.847	0.654	0.938	0.936
	ET 7	0.829			
	ET 6	0.825			
	ET 5	0.772			
	ET 4	0.829			

	ET 3	0.812			
	ET 2	0.793			
	ET 1	0.757			
Business Performance	BP 9	0.789	0.625	0.938	0.936
	BP 8	0.786			
	BP 7	0.777			
	BP 6	0.842			
	BP 5	0.812			
	BP 4	0.764			
	BP 3	0.808			
	BP 2	0.772			
	BP 1	0.764			

The findings from the measurement model assessment are presented in Table 3 below for the constructs: Education, Entrepreneurial Traits, and Business Performance. The assessment covers the factor loadings, Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha (α), commonly used to assess reliability and convergent validity in SEM analysis. A total of nine indicators (EDU_1 to EDU_9) were used to measure the construct Education. The factor loadings for the indicators ranged from 0.833 to 0.908 and exceeded the 0.70 cut-off, indicating good indicator reliability. The construct demonstrated acceptable convergent validity, with an AVE of 0.767, which exceeds 0.50. Moreover, the internal consistency and reliability of the construct were excellent, with Composite Reliability (CR = 0.967) and Cronbach's alpha (α = 0.966). Alpha (α = 0.966) is significantly higher than the recommended level of 0.70. Eight indicators (ET_1 to ET_8) were included in the Entrepreneurial Traits construct. Indicator reliability was acceptable (0.757-0.847), and the factor loadings were satisfactory. The AVE indicates high convergent validity, with a value of 0.654, accounting for more than 50% of the variance explained by the indicators. Moreover, the CR value of 0.938 and Cronbach's alpha value of 0.936 showed good reliability and high internal consistency among the measurement items. Likewise, factor loadings for the Business Performance construct ranged from 0.764 to 0.842 with nine indicators (BP_1 to BP_9). All loading values were above the minimum acceptable value, and therefore, the indicators were representative of the construct. The AVE value of .625 is considered satisfactory for convergent validity. Furthermore, the reliability and internal consistency of the construct are excellent, as indicated by the Composite Reliability (CR = 0.938) and Cronbach's Alpha (α = 0.936).

Table 3: Discrimination validity

No.	Construct	1	2	3
1	Education	0.876		
2	Entrepreneurial Traits	0.637	0.809	
3	Business Performance	0.688	0.762	0.791

The measurement model has good reliability and convergent validity, with all constructs meeting the recommendations for factor loadings, AVEs, CRs, and Cronbach's alphas. These results show that the items in the measures are reliable and suitable for further structural model analysis. The discriminant validity analysis data for the Education, Entrepreneurial Traits, and Business Performance constructs, using the Fornell-Larcker criterion, are shown in the table. Discriminant validity: Testing whether each construct is adequately distinct from the other constructs in the model. The Average Variance Extracted (AVE) for each construct is provided diagonally, and the correlations between constructs are provided off-diagonal in the table. The square root of AVE should be larger than its correlations with other constructs according to the Fornell-Larcker criterion. The square root of the AVE for the construct Education is 0.876, which is higher than the square roots of the AVEs for Entrepreneurial Traits (0.637) and Business Performance (0.688). This suggests that the construct of education is not confused with other constructs and is empirically distinct. Likewise, the square root of the AVE for the construct Entrepreneurial Traits is 0.809, which is higher than the correlations of Entrepreneurial Traits with Education (0.637) and Business Performance (0.762). The correlation with Business Performance is also acceptable, albeit relatively high, indicating acceptable discriminant validity. The construct Business Performance has an AVE of 0.791, higher than those of the other constructs (Education: 0.688 and Entrepreneurial Traits: 0.762). This finding also helps establish the construct's discriminant validity. Overall, the results confirm that all constructs satisfy the Fornell-Larcker criterion, demonstrating adequate discriminant validity. Therefore, each construct is statistically distinct and measures different conceptual dimensions within the study model.

3.4. Structural Model Assessment - Path Analysis

Regarding the structural model, the findings show that education (β = 0.243, p < 0.001) and entrepreneurial traits (β = 0.469, p < 0.001) have a significant positive impact on business performance, thereby supporting H1 and H2. Most significantly, the

interaction term (InterCEDuxCET) was used to investigate the moderating function of entrepreneurial traits. A significant interaction effect on business performance was found ($\beta = -0.102$, $p = 0.008$). The moderating effect is acknowledged, and H3 is supported because the p-value is less than 0.05. The negative coefficient indicates a substitution or buffering effect, where entrepreneurs with lower natural traits are most affected by education. The final structural model explained 16% ($R^2 = 0.16$) of the variation in business performance among Tirunelveli's women-led enterprises. Figure 2 presents the structural model analysis examining the influence of Education (MeanEDU), Entrepreneurial Traits (MeanET), and their interaction effect (InterCEDuxCET) on Business Performance (MeanBP). The model also illustrates the correlations among the independent variables and the explained variance of the endogenous construct. The results indicate that education has a positive effect on Business Performance with a standardized path coefficient of $\beta = 0.24$. This implies that education is a factor influencing business performance.

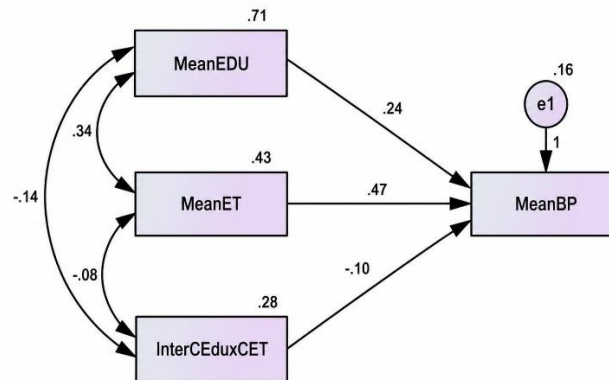


Figure 2: Structural model showing the effects of education and entrepreneurial traits on business performance

Similarly, Entrepreneurial Traits had a higher path coefficient ($\beta = 0.47$) and a positive correlation with Business Performance, indicating that entrepreneurial characteristics are important for improving business performance. The interaction term (InterCEDuxCET) is negative with $\beta = -0.10$, indicating a negative impact on Business Performance. This indicates that the moderating interaction of Education and Entrepreneurial Traits slightly harms the positive impact on business performance. That is, the interaction between education and entrepreneurial characteristics did not have the desired strengthening effect on business performance, suggesting a weak negative moderation effect. This model also illustrates the correlations between the exogenous variables. The Entrepreneurial Traits are positively correlated with education ($r = 0.34$), meaning that people with higher education scores also score higher on entrepreneurial traits. There is a weak negative correlation between education and the interaction construct ($r = -0.14$) and a weak negative correlation between Entrepreneurial Traits and the interaction construct ($r = -0.08$). Squared multiple correlations (R^2 values) are used to show the variance accounted for by each construct. Business Performance has an R^2 of around 0.16, indicating that education + Entrepreneurial Traits + their interaction account for 16% of the variance in business performance. The numbers above the independent constructs (.71, .43, and .28) are their respective variances or explained proportions in the model. The results indicate that both Education and Entrepreneurial Traits contribute positively to Business Performance, with Entrepreneurial Traits having the greatest effect. The interaction between Education and Entrepreneurial Traits, however, appears to affect business performance slightly negatively.

Table 4: Hypothesis testing results for the effects of education and traits on BP

Hypothesis	Path	Result (β)	P-Value	Decision
H1	Education $\rightarrow$ BP	0.243	***	Accepted
H2	Traits $\rightarrow$ BP	0.469	***	Accepted
H3	(EDU $\times$ ET) $\rightarrow$ BP	-0.102	0.008	Accepted

The results of hypothesis testing for the structural model of the relationship between Education, Entrepreneurial Traits, and the interaction between Education and Entrepreneurial Traits on Business Performance are presented in Table 4 below. The results confirmed H1, which suggested that education positively influences business performance. The path coefficient, $\beta = 0.243$, indicates that education has a moderately positive relationship with business performance. The significance level of the relationship is $p < 0.001$, indicating statistical significance. Thus, the hypothesis is accepted, indicating that individuals with better education are more likely to have better business performance. H2, in turn, studied the correlation between Entrepreneurial Traits and Business Performance. The results show a strong, positive, and statistically significant effect with $\beta = 0.469$ and $p < 0.001$. This indicates a significant effect of entrepreneurial characteristics on business performance. The

relationship is important and accepted as H2. Among the predictors, entrepreneurial characteristics have the greatest effect on business performance. The study also proposed a new interaction between the variables Education and Entrepreneurial Traits, which affects Business Performance (H3). The interaction effect has a negative coefficient ($\beta = -0.102$) and is significant ($p = 0.008$). The combined moderating effect of education and entrepreneurial traits slightly reduces business performance. Though the effect is negative, it is still statistically significant and hence, H3 is accepted. The results indicate that the relationship between education and entrepreneurial competencies is not necessarily positive in improving entrepreneurs' success and may even weaken the positive effect when both factors co-occur. Overall, the results showed that both variables (Education and Entrepreneurial traits) positively and significantly influenced the variable (Business Performance), and that the interaction effect between the two variables had a small but significant negative effect.

3.5. Discussion on Findings

In the present study, the moderating interaction effect of Education and Entrepreneurial Traits on Business Performance was examined, as well as the influence of Education and Entrepreneurial Traits on Business Performance. The results give insights into the factors that determine business success and are relevant for the entrepreneurship and business performance literature. This study aimed to investigate the complex linkage between education, entrepreneurial traits, and business performance among female entrepreneurs in the MSME sector. The results indicate that entrepreneurial traits ($\beta = 0.469$, $p < 0.001$) and education ($\beta = 0.243$, $p < 0.001$) are significant and direct predictors of business performance. The results are consistent with the Human Capital Theory, which suggests that formal education equips women with technical knowledge and skills to run their businesses successfully. Likewise, psychological trait theory, which suggests that internal factors in a business, such as risk-taking and proactiveness, are key determinants of competitive success, is also strongly supported by the high impact of entrepreneurial traits. The confirmation of the moderating effect of entrepreneurial personality ($\beta = -0.102$, $p = 0.008$) is the most important contribution of the research. The significant interaction effect implies that entrepreneurial traits moderate the positive impact of education on business performance, thereby making it less significant in their presence. That is, women entrepreneurs who possess entrepreneurial attributes such as innovativeness, self-confidence, leadership, and resilience might not need formal education to make their businesses successful. On the other hand, education is a critical tool for women who lack strong entrepreneurial traits to improve their managerial capabilities, strategic thinking, and problem-solving skills. This discovery sheds light on the interrelatedness of education and entrepreneurial characteristics and suggests a complementary and compensatory role for both in determining business outcomes.

The study thus highlights that entrepreneurial success is not the result of a single factor, but rather a combination of several factors related to the entrepreneur and their level of knowledge. Further, these findings have policy and program implications for entrepreneurship development programs and MSME policy. Entrepreneurial training programs should aim to strengthen both entrepreneurial skills and the educational profiles of women entrepreneurs in tandem. These comprehensive supportive mechanisms can reinforce business sustainability, boost women entrepreneurs' roles in the economy, and enable them to make greater contributions to economic development in their regions and countries. The results showed that education has a significant positive impact on Business Performance ($\beta = 0.243$, $p < 0.001$). This discovery implies that education can improve people's knowledge, management, decision-making, and problem-solving skills, leading to better business results. Knowledgeable entrepreneurs are better able to understand trends, manage finances, plan creatively, and adapt to competitive business environments. This result aligns with the human capital theory, which argues that education enhances productivity and performance by developing skills and knowledge. The findings also corroborate previous research showing that education is positively associated with entrepreneurs' efficiency and organizational expansion. The study also revealed that Entrepreneurial Traits positively and significantly affected Business Performance ($\beta = 0.469$, $p < 0.001$). This means that entrepreneurial characteristics, such as innovativeness, risk-taking ability, self-confidence, leadership, creativity, and proactiveness, are more likely to lead to better business performance. Of the factors, entrepreneurial characteristics were the most significant in predicting business performance.

This result supports the entrepreneurial trait theory, which posits that certain individual traits significantly affect entrepreneurial success. Entrepreneurs with strong entrepreneurial characteristics are likely to successfully recognize opportunities, respond to market turbulence, and maintain a competitive advantage, thereby enhancing business performance. The outcome is also consistent with earlier empirical research emphasizing the positive relationship between entrepreneurial orientation, entrepreneurial personality traits and firm performance. The interaction effect between Education and Entrepreneurial Traits had a significant negative effect on Business Performance ($\beta = -0.102$, $p = 0.008$), which is interesting. While education and entrepreneurial attributes are individually found to contribute positively to business performance, their combined impact is slightly undermined. This indicates that over-education and entrepreneurial attributes may not always lead to better business results. A possible reason is that highly educated entrepreneurs might be more likely to be rational and carefully consider their options, rather than relying on intuition and taking risks; such a shift may dampen entrepreneurial inclinations towards flexibility, intuition, and risk-taking. Likewise, an entrepreneur with strong entrepreneurial traits may rely more on hands-on experience and creativity than on formal education. Hence, the combined effect of these two factors can lead to opposing

strategies in business decision-making, thereby resulting in a smaller overall effect. The discriminant validity and reliability analyses also supported the conclusion that the constructs used in the study were statistically valid and conceptually distinct. The factor loadings were higher than the recommended value, and the AVE, composite reliability, and Cronbach's alpha values were greater than the recommended values, suggesting good internal consistency and convergent validity.

Furthermore, the Fornell–Larcker criterion ensured satisfactory discriminant validity for the constructs Education, Entrepreneurial Traits, and Business Performance. The interaction effect indicates that the relationship between education and business performance varies depending on the degree of entrepreneurial characteristics. The negative interaction coefficient indicates a substitution or compensation effect. This implies that women who are less entrepreneurial and talented can benefit the most from formal education. Academic empowerment is, in essence, a tool that links women who aren't naturally high-risk takers or proactive with organized resources and confidence to help them pursue business success. The incremental gains from formal education, on the other hand, are less apparent for women with high natural entrepreneurial attributes, as they already have a strong drive to succeed without it. The "it depends" quality of the interaction highlights that education is a conditional asset, not a "one size fits all". These insights offer policymakers in Tirunelveli and the broader Indian MSME sector a deeper perspective. While skill-based education is a potent equalizer for women with lower "natural" traits, growth-oriented businesses run by "natural" entrepreneurs might need to concentrate more on advanced networking and technical scaling than on basic business education. Overall, the study highlights that both Education and Entrepreneurial Traits are critical factors for enhancing business performance. The interaction effect, however, suggests that a careful balance between formal education and entrepreneurial attributes is crucial in achieving optimal business success. The results have practical implications for entrepreneurship development programs, highlighting the importance of blending academics with entrepreneurial thinking and business exposure.

4. Conclusion

This study aimed to determine whether education itself could affect the success of women entrepreneurs. The story of women entrepreneurs in MSMEs from Tirunelveli is more interesting and encouraging. The findings show that while education and entrepreneurial attributes affect business performance, they do not necessarily have the same effect; rather, they complement each other. Educational programs serve as powerful equalizers, offering women the structure, knowledge, and confidence they may not naturally possess to turn ideas into sustainable business results. Females with strong entrepreneurial traits, however, have to rely somewhat more on their own motivation, experience, and strength than on formal education to be successful. The exchange shows that being a successful entrepreneur is not a one-size-fits-all affair. Empowerment strategies, however, should be flexible and offer advanced, growth-oriented learning experiences for self-motivated entrepreneurs, as well as provide further education and training support for those who need it. Conclusively, this study highlights that the success of women entrepreneurs is not based on conformity to a single pattern but on the adaptation and integration of women entrepreneurs' innate and learned abilities to make a substantial contribution to the social and economic development of Tirunelveli and beyond.

Additionally, the results of this study have significant policy and institutional implications for entrepreneurial development agencies. Financial support is essential to the government's entrepreneurial empowerment programs for women entrepreneurs, but so are entrepreneurial training, mentorship programs, digital literacy, and skill-building workshops. These could help women entrepreneurs improve their decision-making, innovation, and business sustainability. Many Women in rural/semi-city areas, such as Tirunelveli, are at a disadvantage due to social, cultural, and economic constraints in accessing business opportunities. These barriers can be overcome through education, which can boost self-confidence, communication skills, and market awareness. Entrepreneurial qualities such as risk-taking, creativity, resilience, and leadership help women harness the knowledge gained from education to the best effect. Hence, a favorable combination of educational traits and entrepreneurial traits is a good basis for long-term entrepreneurial success. The findings of this study also indicate that other factors, such as family support, financial access, and the use of technology and social networks, can influence women entrepreneurs' entrepreneurial journeys in developing economies, which this study does not explore.

Acknowledgement: The authors would like to express their sincere gratitude to Sathyabama Institute of Science and Technology, Sadakathullah Appa College, and Budapest Metropolitan University for their valuable support, encouragement, and academic assistance throughout this research.

Data Availability Statement: The data supporting this study are available upon reasonable request to promote transparency and facilitate the reproducibility of the research findings.

Funding Statement: The authors confirm that this research and the preparation of the manuscript were carried out without receiving any external financial support or funding.

Conflicts of Interest Statement: The authors declare that there are no conflicts of interest that may have influenced the conduct of the study or its findings.

Ethics and Consent Statement: All authors have unanimously agreed to make this publication accessible to interested readers for research, education, and learning.

Reference

1. Y. Huang, J. Zhang, Y. Xu, Y. Yuan, M. Zhang, and L. Huang, "Digital entrepreneurial ecosystem and female entrepreneurial activity," *Humanities and Social Sciences Communications*, vol. 12, no. 1, p. 162, 2025.
2. Y. Huang, X. Wang, Y. Yuan, W. Sun, and P. Li, "Entrepreneurial learning and performance of female entrepreneurs: evidence from China," *BMC Psychology*, vol. 13, no. 7, pp. 1-15, 2025.
3. X. Xie, and Y. Wu, "Female entrepreneurs' personality traits and new venture performance: The moderating roles of contextual constraints," *Asia Pacific Journal of Management*, vol. 42, no. 10, pp. 295-331, 2023.
4. N. Brüne and E. Lutz, "The effect of entrepreneurship education in schools on entrepreneurial outcomes: A systematic review," *Management Review Quarterly*, vol. 70, no. 2, pp. 275-305, 2020.
5. C. H. Yeh, H. H. Lin, Y. M. Wang, Y. S. Wang, and C. W. Lo, "Investigating the relationships between entrepreneurial education and self-efficacy and performance in the context of internet entrepreneurship," *The International Journal of Management Education*, vol. 19, no. 3, p. 100565, 2021.
6. P. Patil and Y. Deshpande, "Women entrepreneurship: a road ahead. *International Journal of Economics, Business, and Entrepreneurship*, vol. 1, no. 1, pp. 155-159, 2018.
7. H. Batool and K. Ullah, "Successful antecedents of women entrepreneurs: A case of underdeveloped nation," *Entrepreneurship Research Journal*, vol. 7, no. 2, p. 20160066, 2017.
8. A. E. Davis and K. G. Shaver, "Understanding gendered variations in business growth intentions across the life course," *Entrepreneurship Theory and Practice*, vol. 36, no. 3, pp. 495-512, 2012.
9. D. F. Kuratko, G. Fisher, and D. B. Audretsch, "Unraveling the entrepreneurial mindset," *Small Business Economics*, vol. 57, no. 7, pp. 1681-1691, 2020.
10. B. M. Pulka, A. Ramli, and A. Mohamad, "Entrepreneurial competencies, entrepreneurial orientation, entrepreneurial network, government business support and SMEs performance. The moderating role of the external environment," *Journal of Small Business and Enterprise Development*, vol. 28, no. 4, pp. 586-618, 2021.
11. P. Runst and J. Thomä, "Resilient entrepreneurs?-revisiting the relationship between the Big Five and self-employment," *Small Business Economics*, vol. 61, no. 9, pp. 417-443, 2022.
12. H. R. Kummitha and R. K. R. Kummitha, "Sustainable entrepreneurship training: A study of motivational factors," *The International Journal of Management Education*, vol. 19, no. 1, p. 100449, 2021.
13. L. F. Klapper and S. C. Parker, "Gender and the business environment for new firm creation," *The World Bank Research Observer*, vol. 26, no. 2, pp. 237-257, 2011.
14. M. R. Marvel, J. L. Davis, and C. R. Sproul, "Human capital and entrepreneurship research: A critical review and future directions," *Entrepreneurship Theory and Practice*, vol. 40, no. 3, pp. 599-626, 2016.
15. J. E. Jennings and C. G. Brush, "Research on women entrepreneurs: challenges to (and from) the broader entrepreneurship literature?," *Academy of Management Annals*, vol. 7, no. 1, pp. 663-715, 2013.
16. R. W. Fairlie and A. M. Robb, "Gender differences in business performance: Evidence from the characteristics of business owners survey," *Small Business Economics*, vol. 33, no. 5, pp. 375-395, 2009.
17. A. K. Lingappa, L. Rodrigues LR, and D. K. Shetty, "Women entrepreneurial motivation and business performance: the role of learning motivation and female entrepreneurial competencies," *Industrial and Commercial Training*, vol. 55, no. 2, pp. 269-283, 2023.
18. J. Van der Sluis, M. Van Praag, and W. Vijverberg, "Education and entrepreneurship selection and performance: A review of the empirical literature," *Journal of Economic Surveys*, vol. 22, no. 5, pp. 795-841, 2008.
19. A. Rauch and M. Frese, "Let's put the person back into entrepreneurship research: A meta-analysis on the relationship between business owners' personality traits, business creation, and success," *European Journal of work and organizational psychology*, vol. 16, no. 4, pp. 353-385, 2007.
20. E. McClelland, J. Swail, J. Bell, and P. Ibbotson, "Following the pathway of female entrepreneurs: A six-country investigation," *International Journal of entrepreneurial behavior & research*, vol. 11, no. 2, pp. 84-107, 2005.
21. M. Entrialgo and V. Iglesias, "The moderating role of entrepreneurship education on the antecedents of entrepreneurial intention," *International Entrepreneurship and Management Journal*, vol. 12, no. 3, pp. 1209-1232, 2016.

Publisher's Note: The publisher remains impartial concerning jurisdictional claims in published maps and institutional affiliations. Responsibility for the content rests entirely with the authors and does not necessarily reflect the publisher's perspectives.