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The relationship between Entrepreneurial Education and the Sustainable Development of SMEs in China: the mediating effect of Innovation Capability

Zhao Fei, Tee Poh Kiong
Universiti Tun Abdul Razak, Kuala Lumpur, Malaysia
*Corresponding e-mail: renc39854@gmail.com

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ABSTRACT

This study explores the relationship between entrepreneurship education, innovation capabilities and the sustainable development of small and medium-sized enterprises in China, especially the mediating effect of innovation capabilities. By analyzing questionnaire data from SMEs in different regions of China, this study uses SPSS 27 and Process Model 4 to verify the impact of entrepreneurship education on the sustainable development of SMEs and the mediating effect of innovation capabilities. The results show that entrepreneurship education significantly positively predicts innovation ability ($\beta=0.691$, $p<0.001$), and indirectly promotes the sustainable development of small and medium-sized enterprises through innovation ability. The indirect effect accounts for 78.6% of the total effect, confirming the partial mediation of innovation ability. effect. In addition, the direct effect ($\beta=0.152$, $p<0.001$) also shows that entrepreneurship education has a direct positive impact on SMEs. These findings highlight the importance of entrepreneurship education in promoting corporate innovation capabilities and sustainable growth and provide policy makers with policy recommendations to enhance the innovation capabilities and sustainable development of small and medium-sized enterprises.

1. Introduction

Entrepreneurial Education, as an educational approach to cultivate Innovation Capability, has received great attention globally(Lei et al., 2020). In China, with the rapid economic development and the implementation of the innovation-driven strategy, Entrepreneurial Education has become an important part of higher education and vocational education (Chandra et al., 2021). The government and educational institutions have invested significant resources in developing entrepreneurship programmes, aiming to cultivate students' innovative thinking and practical skills to adapt to the rapidly changing market demands and economic environment (Yang et al., 2022). Entrepreneurial Education in China not only focuses on theoretical teaching, but also emphasises practical and hands-on practice, effectively combining theory and practice through a variety of methods such

as entrepreneurship internships, entrepreneurship competitions and incubator projects (Álvarez Rodríguez et al., 2016).

As an important part of China's economy, SMEs play a key role in economic growth, innovation, employment and social stability. However, SMEs face challenges in their development such as limited resources and rapid market changes, which often limit their long-term sustainable development (Lei et al., 2020).Entrepreneurial Education is recognised as an effective way to enhance the Innovation Capability of entrepreneurs and their teams, which is particularly important for SMEs(Chandra et al., 2021). Especially in China, Innovation Capability is seen as a key factor for SMEs to be able to maintain competitiveness and sustainability in a highly competitive market(Álvarez Rodríguez et al., 2016). Therefore, studying how Entrepreneurial Education can promote the sustainable development of SMEs by enhancing Innovation Capability can not only provide education providers with a basis for curriculum design, but also provide policy makers with strategies to promote the development of SMEs (Yang et al., 2022).

The main purpose of this study is to explore the impact of Entrepreneurial Education on the sustainable development of SMEs in China, and in particular to analyse the mediating effect of Innovation Capability. The specific research questions are what is the current situation of Entrepreneurial Education in China and what is the relevance of its impact on SMEs, and what is the mediating effect of Innovation Capability between Entrepreneurial Education and SMEs sustainable development? How does Innovation Capability mediate between Entrepreneurial Education and the sustainable development of SMEs? Through what mechanisms can Entrepreneurial Education enhance SMEs' Innovation Capability and through this enhancement influence their sustainable development?

This study deepens the understanding of the mechanism of Entrepreneurial Education's impact on the sustainable development of Chinese SMEs by using Innovation Capability as a mediating variable. It adds to the existing literature, especially in revealing how Entrepreneurial Education contributes to long-term business development by enhancing Innovation Capability. In addition, the findings provide practical guidance for education policy makers and SME managers, suggesting that innovation training should be strengthened in Entrepreneurial Education programmes and that firms should be encouraged to use educational resources to enhance Innovation Capability in order to support firm growth and innovation. These findings can help policymakers to develop more effective support measures to promote the sustainable development of SMEs.

2. Literature Review and Theoretical Basis

2.1 Entrepreneurial Education and SME Development

Entrepreneurial Education is defined as a range of educational activities and processes designed to provide the necessary knowledge, skills, and mindset to encourage and support entrepreneurship (Bayar et al., 2022). Research worldwide has shown that Entrepreneurial Education is an important driver of innovation and business success (Naushad, 2022). In China, with the development of the market economy and policy support, Entrepreneurial Education is increasingly recognised as a key driver of growth and innovation for SMEs (Chu & Astillero, 2022). Research shows that entrepreneurs who have received high quality Entrepreneurial Education are more likely to achieve rapid business growth and market expansion(Saah, 2022).

2.2 Innovation capacity as a competitive advantage

Innovation capability is the core ability of an enterprise to sustain competition and adapt to market changes, covering product, process, organisational and market innovations (Bayar et al., 2022). Product and process innovations directly improve firms' productivity and market performance, while organisational and market innovations help firms optimise their management structure and explore new market segments (Naushad, 2022). Empirical studies have shown that improved innovation capabilities are significantly associated with business expansion and sustainable growth of SMEs(Chu & Astillero, 2022).

2.3 Relationship between Entrepreneurial Education and Innovative Capabilities

Entrepreneurial education provides the basis for entrepreneurs to create and implement innovations by developing the necessary knowledge and skills(Bayar et al., 2022). The breadth and depth of the educational content, the practicality of the teaching methods and the availability of resources have a direct impact on the effectiveness of the education and its contribution to innovation capacity(Saah, 2022). For example, case studies and hands-on exercises can significantly improve the ability of entrepreneurs to identify market opportunities, which, in turn, can contribute to the development of innovative practices(Chu & Astillero, 2022).

2.4 Theoretical and empirical foundations of innovativeness as a mediating variable

According to the Resource-Based View (RBV), a firm's core resources (e.g., innovation capabilities) are key to its competitive advantage(Bayar et al., 2022). In the relationship between Entrepreneurial Education and SMEs sustainable development, innovation capability acts as a mediator variable to convey the role of education in influencing firm performance(Naushad, 2022). Comparative studies at home and abroad can not only show the general applicability of the mediation model, but also explore its particular manifestations in different cultural and economic contexts(Chu & Astillero, 2022).

2.5 Critical appraisal and research gaps between the literature

Although existing studies provide some theoretical and empirical support for the relationship between Entrepreneurial Education and SME development, there are still some research gaps. For example, most studies focus on the direct effects of Entrepreneurial Education, while the mechanisms through which it indirectly affects SME growth through innovation capabilities are under-explored (Saah, 2022). There are also relatively few studies on the long-term effects of educational interventions and the impact of different types of innovations (e.g. green innovation)(Naushad, 2022). This study aims to fill these gaps and provide a more comprehensive understanding through in-depth analyses and empirical validation.

3. Research methodology

3.1 Study design

This study utilised a quantitative research methodology, specifically a cross-sectional survey design. This design allows for the collection of a large amount of data at a specific point in time and is suitable for assessing the relationship between Entrepreneurial Education, Innovation Capability and SMEs sustainable development. In the first step Entrepreneurial Education was set as the independent variable and SMEs sustainable development was set as the dependent variable to test the main effects of the model. The second step set Entrepreneurial

Education as the independent variable and Innovation Capability as the dependent variable to test the first half of the mediation model. The third step sets Entrepreneurial Education and Innovation Capability as independent variables and SME sustainability as dependent variable to test the mediation model, The fourth step uses Model 4 in "process" to test the mediating effect of Innovation Capability.

3.2 Sample and data collection

The sample will be randomly selected from SMEs in different regions of China to ensure coverage of a wide range of industries and geographical locations to enhance the generalisability of the findings. The target sample size is 500 organisations, involving business owners and top management who have received Entrepreneurial Education. Data collection will be conducted through a structured online questionnaire that includes questions related to quantitatively assessing Entrepreneurial Education, Innovation Capability and business sustainability. To increase the response rate, a link to the questionnaire will be sent via email and social media platforms, and small incentives will be offered to encourage participation.

3.3 Measurement of variables

Entrepreneurial Education: This variable was quantified through multiple-choice questions in the questionnaire on educational content, teaching methods, participation and availability of resources.

Innovation Capability: by assessing the firm's ability to innovate in terms of product, process, market and organisational innovation. A set of self-assessment scales will be used, which will include frequency and effectiveness evaluations for each indicator.

Sustainable development of SMEs: use of composite indicators that include economic, environmental and social dimensions, such as revenue growth rate, degree of reduction of environmental impacts, and participation in social responsibility activities.

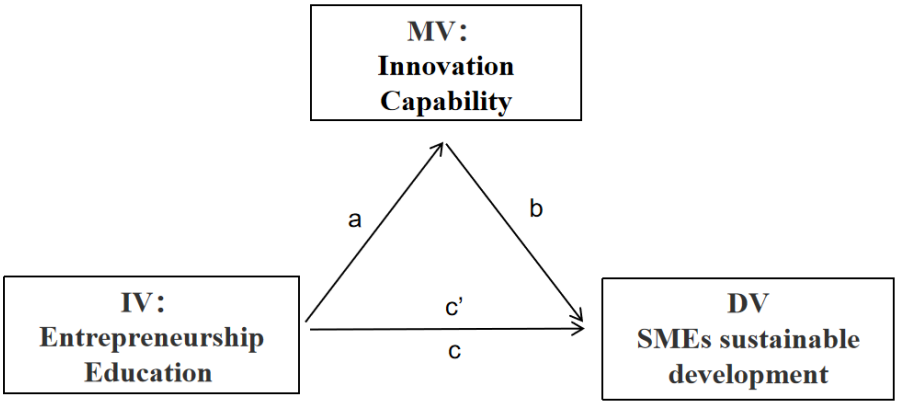

Figure 1: Structural model of the impact of Entrepreneurial Education on the sustainable development of SMEs

3.4 Data analysis methods

The data collected in this study will be analysed using the statistical software spss27. Firstly, descriptive statistical analysis will be carried out to find out the distribution of the variables. Secondly, reliability analysis will be used to verify the construct validity of the questionnaire. Then, the mediating effect of the mediating variables will be measured and finally, the mediating effect will be tested using "PROCESS".

The study will also set a significance level of 0.05 and effect sizes will be calculated to assess the actual significance of the relationship between the variables(Nahm, 2015). Any outliers or biased data that may occur in the study will be processed through appropriate statistical methods to ensure the accuracy and reliability of the results.

4. Results of data analysis

4.1 Descriptive analysis

In this study from the sample data in different regions of China's small and medium-sized enterprises randomly selected, through e-mail and social media platforms to send the questionnaire link, a total of 506 recovered samples, valid questionnaires 493, effective rate of 97% (Table 1). Participants in the survey were all business owners, managers and general employees of SMEs in various regions of China. Among them, 244 were male and 249 were female. In terms of sample regions, the Central region has the largest sample size, suggesting that SMEs in the Central region may have a higher level of participation in Entrepreneurial Education. In the industry classification, the category of "trade/retail" appears most frequently, suggesting that the trade/retail industry is particularly dependent on rapid response to market changes and sensitive capture of new market trends, and that the Entrepreneurial Education programme may pay special attention to courses and content that are highly relevant to the trade/retail industry, such as supply chain management, supply chain management, and retailing. Courses and content, such as supply chain management, customer relationship management, digital marketing, etc., which attracts the active participation of practitioners in the sector. The highest percentage of positions are at the junior management level, which may be a result of the fact that companies may need junior managers to adapt quickly to new technologies, processes and market trends when faced with rapidly changing market conditions. By participating in Entrepreneurial Education, these individuals are able to meet these challenges more effectively. In terms of the number of years of Entrepreneurial Education, the highest number was "3-5 years", indicating that most of the participants had a certain amount of time of background in Entrepreneurial Education, which may be useful for understanding the development and application of Innovation This may be particularly crucial for understanding the development and application of Innovation Capability. The highest number of highest educational attainment was a bachelor's degree, indicating a higher level of tertiary education among the survey respondents, which may reflect the openness and acceptance of business owners and managers with higher educational backgrounds to new knowledge and innovative approaches.

Table1: Descriptive frequency analysis table for the total sample

Characteristic term	Form	Frequency	percent	Effective percentage
distinguishing between the sexes	male	244	49.49	49.49
	women	249	50.51	50.51
district (not necessarily formal administrative unit)	eastern seaboard	99	20.08	20.08
	central section	104	21.10	21.10
	western part	94	19.07	19.07
	northern part	77	15.62	15.62
	southern part	62	12.58	12.58
	the rest	57	11.56	11.56
sector	service industry	79	16.03	16.03

	services sector	87	17.65	17.65
	IT/Technology	81	16.43	16.43
	Trade/retail	89	18.05	18.05
	agriculture	78	15.82	15.82
	the rest	79	16.02	16.02
office	owner of enterprise	104	21.10	21.10
	Senior management	94	19.07	19.07
	Middle management	86	17.44	17.44
	Grassroots management	119	24.14	24.14
	workers	90	18.26	18.26
Years of Entrepreneurial Education	Less than 1 year	50	10.14	10.14
	1-3 years	153	31.03	31.03
	3-5 years	192	38.95	38.95
	More than 5 years	98	19.88	19.88
academic qualifications	High school and below	97	19.68	19.68
	three-year college	95	19.27	19.27
	undergraduate	145	29.41	29.41
	bachelor's degree	107	21.70	21.70
	doctoral	49	9.94	9.94

4.2 Reliability analysis

In this study, SPSS 27 software was used to analyse the reliability of the questionnaire. Firstly, the reliability of the questionnaire was assessed using Cronbach's alpha coefficient through internal consistency criteria. The results of the reliability analysis showed that the reliability coefficients of the variables performed well: 0.879 for Entrepreneurial Education, 0.931 for Innovation Capability, and 0.941 for SMEs sustainable development.According to the conventional criterion, the Cronbach 's alpha coefficient between 0.65 and 0.70 is considered acceptable, 0.70 to 0.80 is good, while 0.80 to 0.90 is considered very good (Kilic, 2016). Therefore, the overall reliability of the questionnaire in this study performed very well and ensured the reliability of the questionnaire.

Further, exploratory factor analysis (EFA) was used in this study to assess the validity of the questionnaire. The coefficient value of the Kaiser-Meyer-Olkin (KMO) test was 0.894, which was much higher than the baseline value of 0.6 indicating that the data was well suited for factor analysis. The significance of the Bartlett's test of sphericity was close to zero, which is significant and thus confirms the validity of the questionnaire .

Table 2: Results of reliability and validity analyses

variable name	After deleting the item Cronbach factor	Cronbach factor	KMO	Bartlett

Entrepreneurial Education	0.877	0.879		P=0.000***
Innovation Capability	0.908	0.931	0.894	Approximate chi-square = 5687.645
SMEs sustainable development	0.929	0.941		DF=138

4.3 Intermediary model testing

In this study, SPSS27 was used to measure the mediating effect and PROCESS was used to test the mediating effect.

- Based on the linear regression analysis of the independent variable "Entrepreneurial Education" on the dependent variable "Sustainable development of small and medium-sized enterprises", the main effect of the model is tested under the secondary premise (Table 3);
- Based on the linear regression analysis of the independent variable "Entrepreneurial Education" on the mediating variable "Innovation Capability", on this basis, the significance verification of the effect value in the first half of the mediation model was carried out (Table 4);
- Based on the linear regression analysis of the independent variable "Entrepreneurial Education" and the mediating variable "Innovation Capability" on the dependent variable "Sustainable Development of Small and Medium-sized Enterprises", on this basis, the significance verification of the effect value in the second half of the mediation model was carried out to This judgment is that the mediation effect is "full mediation" or "partial mediation" (Table 5);

Table 3: Regression analysis of Entrepreneurial Education on SMEs sustainable development

Independent variable	R^2	F	B	Bata	t	p
Entrepreneurial Education	0.641	1261.658	0.707	0.800	35.520***	<0.001

Dependent variable: SMEs sustainable development

***P<0.001

Table 4: Regression Analysis of Entrepreneurial Education on Innovation Capability

Independent variable	R^2	F	B	Bata	t	p
Entrepreneurial Education	0.640	1256.861	0.691	0.800	35.452***	<0.001

Dependent variable: Innovation Capability

***P<0.001

Table 5: Regression analysis of Entrepreneurial Education and Innovation Capability on SMEs sustainable development

independent variable	R^2	F	B	Bata	t	p
Entrepreneurial Education	0.863	2225.020	0.152	0.172	7.417***	<0.001
Innovation Capability			0.804	0.786	33.863***	<0.001

Dependent variable: SMEs sustainable development
***P<0.001

After analysing the data above, Table 3 shows that the coefficient of the independent variable "Entrepreneurial Education" (t=35.520, p<0.001) is significant, with a main effect value of c=0.707, so we can carry out the second step of the test.

The second step uses "Entrepreneurial Education" as the independent variable and "Innovation Capability" as the dependent variable to test the first half of the mediation model. As can be seen from Table 4, the coefficient of the independent variable "Entrepreneurial Education" (t=35.452, p< 0.001) is significant, and the effect value in the first half of the mediation model is a=0.691, so we can conduct the third step of testing.

The third step uses "Entrepreneurial Education" and "Innovation Capability" as independent variables, and "SMEs sustainable development" as the dependent variable to test the second half of the mediation model. As can be seen from Table 4, the coefficient of the mediating variable "Entrepreneurial Education" (t=33.863, p<0.001) is significant, and the effect value is b=0.804; the coefficient of the independent variable "Entrepreneurial Education" (t=7.417, p<0.001) is significant, and the effect value is c'=0.152.

Based on the above three-step test, we can know the path relationship between the model and variables, and find that the mediating effect of "Entrepreneurial Education" is established. In the first step, the regression coefficient of the main effect is c=0.707. In the third step, the main effect is The regression value c'=0.152, so the "indirect effect value" is 0.629. Finally, we can find that the "indirect effect value" accounts for 78.6% of the "total effect value", and part of the mediating effect is established (Figure 2).

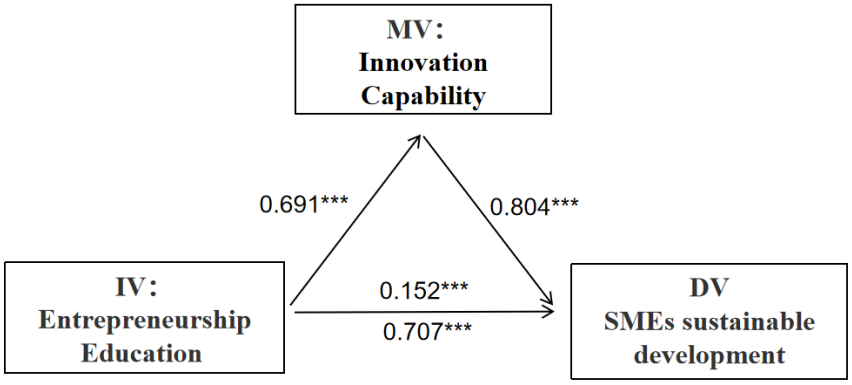

Figure 2: Innovation Capability Mediation Pathway

In order to further verify the accuracy of the results, this study also used Model 4 in "process4" to test the mediating effect of "Innovation Capability" in the impact of "Entrepreneurial Education" on "SMEs sustainable development". The specific results are shown in Table 6 and Table 7.

Table 6: Regression analysis of the relationship between variables in the mediation model

variant	Model 1 DV:SMEs sustainable development		Model 2 DV:Entrepreneurial ability		Model 3 DV:SMEs sustainable development	
	β	t	β	t	β	t
Entrepreneurship Education	0.707	35.520***	0.691	35.452***	0.152	7.417***
Innovation Capability					0.804	33.863***
R^2	0.641		0.640		0.863	
F	1261.658		1256.861		2225.020	

The Process analysis results are highly consistent with the SPSS linear regression analysis results. The results show (Table 6) that Entrepreneurial Education can significantly positively predict Innovation Capability (β=0.691, t=35.452, p<0.001). When both Entrepreneurial Education and Innovation Capability enter When regressing the equation, both Entrepreneurial Education (β=0.152, t=7.417, p<0.001) and Innovation Capability (β=0.804, t=33.863, p<0.001) can significantly and positively predict the level of belonging needs.

Table 7: Mediation Effect Analysis of Innovation Capability

Impact pathways	Effect	Boot SE	Boot95% LLCI	Boot 95 % ULCI	Percentage of total effect
Total effect	0.7073	0.0199	0.6682	0.7464	
Direct effect	0.1521	0.0205	0.1118	0.1923	
Indirect effect	0.5552	0.0561	0.4448	0.6657	78.6%

Table 7 shows that "Innovation Capability" partially mediates the relationship between "Entrepreneurial Education" and "SMEs", with a Total effect of [0.6682,0.7464] and a Direct effect of [0.6682,0.7464] at 95% confidence interval. sustainable development", the Total effect is [0.6682,0.7464], the Direct effect is [0.1118,0.1923], and the Indirect effect is [0.1118,0.1923] at the 95% confidence interval. effect at 95% confidence interval is [0.4448,0.6657], without passing 0, the mediating effect is significant.

5. Discussion

This study aims to explore the relationship between Entrepreneurial Education, innovation capability and SMEs sustainable development in China, especially the mediating effect of innovation capability. By analysing the data, the results of the study confirm that innovation capability does play a mediating effect between Entrepreneurial Education and SMEs sustainable development. This study also found that Entrepreneurial Education not only directly affects SMEs sustainable development, but also indirectly affects their sustainable development by improving their innovation capability. This finding emphasises the key role of Entrepreneurial Education in fostering firms' innovative capabilities and provides a new perspective on SMEs' growth and development.

Firstly, the study found that Entrepreneurial Education can significantly and positively affect the innovation capacity of SMEs. This finding is in line with past studies that have concluded that education can serve as an important resource to increase the innovation potential of firms and the implementation of actual innovation activities. Entrepreneurial Education provides the necessary knowledge and skills to help entrepreneurs identify and take advantage of new opportunities to drive product, process, market and organisational innovation.

Secondly, increased innovation capacity further contributes to the sustainable development of SMEs. This point highlights the key role of innovation in driving economic, environmental and social sustainability. At the economic level, the ability to innovate helps firms to develop new profit models and increase their competitive advantage; at the environmental level, process and product innovations reduce dependence on natural resources and mitigate environmental impacts; and at the social level, organisational innovations improve the working environment and enhance social responsibility.

However, it is worth noting that despite the mediating effect of innovation capacity between Entrepreneurial Education and SMEs sustainable development, the direct effect is still significant, suggesting that the effect of Entrepreneurial Education on SMEs sustainable development is also partially directly generated. This may be due to the fact that Entrepreneurial Education may directly enhance firms' strategic planning and market positioning capabilities in addition to improving innovation capabilities.

6. Conclusion

In summary, this study validates the mediating effect of innovation capabilities between Entrepreneurial Education and SMEs sustainable development. The findings emphasise the key role of Entrepreneurial Education in fostering SMEs' innovation capabilities and reveal how this pathway contributes to the sustainable growth of firms.

For policymakers, this study highlights the importance of developing policies that support Entrepreneurial Education, especially in enhancing the innovative capacity of SMEs and promoting sustainable development. It is suggested that governments and educational institutions may consider increasing their investment in Entrepreneurial Education, especially in terms of updating educational content, improving teaching methods, and providing more opportunities for practice and participation.

In addition, business leaders should recognise that the development of innovation capability does not only depend on external education and training, but that continuous learning and the building of an innovative culture within the enterprise are equally important. By establishing internal training mechanisms and encouraging employees to participate in innovative activities, companies can better utilise the results of Entrepreneurial Education to promote their sustainable development.

This study also has its limitations, for example, the sample is mainly from China, and future research could consider expanding the scope to other countries and regions to explore the relationship between Entrepreneurial Education and corporate sustainability in different cultural and economic contexts. In addition, the specific impact of Entrepreneurial Education on different types of innovations (e.g., green innovations) and how these innovations specifically affect corporate sustainability could also be further explored.

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