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LINKING ENTREPRENEURIAL ATTRIBUTES TO ENTREPRENEURIAL PERFORMANCE: AN EMPIRICAL STUDY OF YOUNG ENTREPRENEURS*

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Abstract. Young entrepreneurs play a major role of entrepreneurship, but their average successful rate is only about 2%, showing very low entrepreneurial performance. The entrepreneurial attribute of young entrepreneurs, which greatly influences entrepreneurial performance, includes many aspects and may interact complicatedly with each other, posing great challenges to the cultivation of entrepreneurial talents. In this paper, the constitution of entrepreneurial attribute was systematically summarized as entrepreneurial personality, entrepreneurial competence and entrepreneurial knowledge. The relationship between entrepreneurial performance and these three parts was then empirically studied. It was found that the influence of entrepreneurial knowledge was the most significant and entrepreneurial competence took the second place. Moreover, the direct impact of entrepreneurial personality on entrepreneurial performance was not significant, which was completely mediated by entrepreneurial knowledge and entrepreneurial competence. These three variables of entrepreneurial personality, entrepreneurial competence, and entrepreneurial knowledge explained 60.1% variation of entrepreneurial performance, which indicated that the empirical results verified the theoretical model well. These findings not only make a breakthrough in the theoretical research of entrepreneurial attribute, but also have practical applications on cultivation and education strategy of young entrepreneurs.

Key words: young entrepreneurs; entrepreneurial attribute; entrepreneurial performance; statistical analysis; personality

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1. Introduction

Young entrepreneurs, with the age ranging from 18 to 35 (the State Council, 2017), become the backbone of innovation and entrepreneurship. They are energetic and smart, and often use existed information, resources, opportunities or technologies to start businesses on an appropriate platform or carrier. However, although the proportion of young entrepreneurs in China has reached to 6.3% in recent years, the average rate of their

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successful entrepreneurship is only 2% (Wang et al., 2021), which might be attributed to their limitation of entrepreneurial attribute.

Entrepreneurial attribute is a key factor that affects the success of entrepreneurship. Entrepreneurial attribute includes not only the basic personality that is accumulated and internalized on individual growth by social achievements, but also the potential ability that need to be developed in the future. The formation of entrepreneurial attribute is more easily affected by acquired factors instead of congenital factors, so learning experience and social practice play important roles on its development. Therefore, it is both urgent and feasible to clarify the constitution and inherent interrelationships of entrepreneurial attribute, as well as to investigate its relationship with entrepreneurial performance. This can not only promote the development of entrepreneurial theory, but also improve the successful rate and performance of entrepreneurship, which will cultivate a large number of entrepreneurial talents, expand employment and promote economy.

2. Literature review and hypotheses

2.1 Entrepreneurial attribute

Entrepreneurial attribute refers to the individual characteristics of entrepreneurs that were reflected during entrepreneurial activities such as setting up new jobs, expanding new businesses and commences. Many researchers tried to understand it by identifying the traits and characteristics of entrepreneurs, which have been reported by a lot of literatures.

Shahin et al. (2021) and Liu et al. (2025) studied young entrepreneurs at different stages of the learning journey and evaluated the awareness of entrepreneurship, relevant knowledge, entrepreneurial self-efficacy (ESE), and entrepreneurial intentions. They were influenced by the experience, training, education, family background and other demographic variables of entrepreneurs. Ho et al. (2024) reviewed a lot of the literature and identified seven adolescent attributes that were linked to entrepreneurial attribute, including innovativeness, opportunity recognition, risk-taking propensity, proactiveness, foresighted thinking, ethical and sustainable thinking, and interpersonal communication. Kong (2018) explored the abilities and characteristics of college-student entrepreneurs. He established the theory model and evaluation indicators of entrepreneurial attribute, which included consciousness, ability, thinking, spirit, professional knowledge, and personality characteristics. Bird (2019) proposed that entrepreneurial attribute were underlying characteristics such as specific knowledge, motives, traits, self-images, social roles and skills that resulted in venture birth, survival and growth. Zhang et al. (2021) found that the key factors of entrepreneurial attribute included spirit, consciousness and ability. Entrepreneurial consciousness included entrepreneurial need, motivation and passion. Entrepreneurial competence included 16 indicators, such as opportunity recognition, innovation ability and market development etc. Li et al. (2022) set up a composite evaluation system to quantify the influence of entrepreneurial education on college students' entrepreneurial attribute. They thought that this education could train entrepreneurial skills and management/marketing abilities, and improve intrinsic quality and knowledge literacy.

According to the literature above, it can be found that entrepreneurial attribute shows the typical characteristics of multi-dimensional structure, which includes the following three aspects of personality, competence, and knowledge.

Entrepreneurial personality. Entrepreneurial personality represents the psychological characteristics of young entrepreneurs that are relatively stable, such as personality characteristics, morality, consciousness, etc. Among of them, personality characteristics play a moderating role to the entrepreneur behaviour. Morality is the reflection of entrepreneur spirit. Consciousness includes demand, motivation, ideals and beliefs, among which the demand and motivation are the internal driving force and precondition of entrepreneurship.

Entrepreneurial competence. Entrepreneurial competence refers to various abilities that appear during entrepreneurship, mainly including abilities of innovation and change, identify and grasp opportunity, risk assessment, operate and manage enterprise. Thereof, innovation ability is the core competence of entrepreneurial attribute.

Entrepreneurial knowledge. Entrepreneurial knowledge, the primary necessity during entrepreneurship, includes theoretical knowledge and practical experience such as business management, law, market operation, and policy. It is the basic constituent of entrepreneurial attribute.

2.2 Entrepreneurial performance

Entrepreneurial performance is mostly used to evaluate the operation and management performance of start-up enterprises at the organizational level. In early studies, entrepreneurial performance was often generalized to survival indicators and growth indicators. Survival indicators represent the guarantee and possibility of the enterprises' existence, which are regarded as basic conditions for the success of entrepreneurship. Growth indicators represent the operation and development of enterprises, which are main indicators to measure entrepreneurial performance. However, it is often difficult to compare financial indicators or data between different types of enterprises, so some subjective indicators were added to characterize entrepreneurial performance in later literatures (Vij et al., 2016; Gao et al., 2024). On this basis, a lot of researchers reported how to measure or evaluate entrepreneurial performance. Wach et al. (2020) thought that the conceptualisation of entrepreneurial success should account for various, holistic, and integrated elements, especially in the context of comparative entrepreneurship. Gerschewski et al. (2025) suggested that the concepts of entrepreneurial success consisted of multiple dimensions that combine together to define the direction of entrepreneurs when developing their businesses. They found that entrepreneurs revealed success configurations in terms of sustainability, profit, growth, or some combination of these, along with a purpose defined at the individual, business, and societal levels, or any combination of these. Wach et al. (2016) proposed the criteria of entrepreneurial success ranging from minimal success (survival) to maximal success (growth) and considered it as four types of main indicators, namely, growth indicators, firm stability indicators, position in the market, and firm survival capture. Rahman et al. (2015) measured entrepreneurs' business success by 9 indicators. Among of them, sales, profits, overall growth, debt level and satisfactory on financial condition belonged to financial performance, and the number of jobs, customer trust and confidence, contribution to the community development, and satisfied customers belonged to non-financial performance.

2.3 Hypotheses

As for the relationship between entrepreneurial attribute and entrepreneurial performance, most researchers investigated from one aspect of entrepreneurial attribute, namely, entrepreneurial personality or entrepreneurial competence or entrepreneurial knowledge. There was nearly no literature that covered all the aspects of entrepreneurial attributes to show its whole influence on entrepreneurial performance. This is precisely the start of our research that makes three hypotheses as follows.

2.3.1 Relationship between entrepreneurial personality, entrepreneurial competence, and entrepreneurial performance

Staniewski et al. (2016) assessed the relationships between the personality of entrepreneurs and economic success of SME in Poland. According to 294 samples, they found that personality disposition was relevant to the maintenance of liquidity, the competitiveness of companies, the developing chances of companies, and the innovativeness of companies. Self-efficacy also affects entrepreneurial performance. On the one hand, self-efficacy determined the choice of individuals and the persistence to achieve goals, so as to impact the motivation and behavior of entrepreneurs. On the other hand, entrepreneurs with high self-efficacy believed that they had more business knowledge and professional skills, and managed enterprises more effectively, all of which could promote entrepreneurial performance (Chadha et al., 2025). Wang et al. (2024) examined the influence of digital capabilities in sculpting entrepreneurial orientation and enhancing metaverse entrepreneurial performance. The empirical findings showed that the positive impact of digital capabilities on entrepreneurial orientation and metaverse entrepreneurial performance, with entrepreneurial orientation mediating this relationship. Neneh (2019) examined the effect of personality traits on the orientation from recognizing opportunity to practicing business. He found that alertness greatly influenced entrepreneurial intention, and then affected innovation behavior and successful entrepreneurship. Thus, we believe that personality traits of entrepreneurs, such as self-efficacy, consciousness of risk, sense of innovation, and risk-taking play important roles during the successful entrepreneurship. Therefore, we propose the following hypothesis:

Hypothesis 1: Entrepreneurial personality is positively related to entrepreneurial performance.

Laouiti et al. (2022) used fsQCA to shed new light in the relationships between the Big Five personality traits and students' entrepreneurship. By capturing the interdependencies of openness, conscientiousness, extraversion, agreeableness, and emotional stability, they found that the combination of emotional stability and high openness to experience was core for entrepreneurship among the students. Obschonka et al. (2017) found that an entrepreneurial Big Five personality was associated with early entrepreneurial competence and could predict entrepreneurial social capital. Personality characteristics, such as self-esteem, innovation consciousness, and proactivity motivation, influenced entrepreneurial competence greatly.

Rahman et al. (2015) explored the influence of support from large private organizations on entrepreneurship at the base of economic pyramid. They found that entrepreneurial competencies contribute to business success and play a mediate role between the technical/training supports and business success. Xia et al. (2020) investigated the relationship among entrepreneurial perseverance, entrepreneurial competence and entrepreneurial performance. It was found that entrepreneurial competence had a positive mediate effect between entrepreneurial perseverance and entrepreneurial performance. Furthermore, the stronger the entrepreneur's competence was, the stronger the mediate effect was. Thus, two key issues have risen from the above literatures. Firstly, entrepreneurial competence was greatly influenced by the personality traits of entrepreneurs such as conscientiousness, leadership, self-esteem, innovation and consciousness. Secondly, some entrepreneurial competence mediated the relationship between entrepreneurial personality and entrepreneurial performance. Therefore, we propose the following hypothesis:

Hypothesis 2: Entrepreneurial competence mediates the relationship between entrepreneurial personality and entrepreneurial performance.

2.3.2 Relationship between entrepreneurial personality, entrepreneurial knowledge, and entrepreneurial performance

Sadiq et al. (2025) adopted a dimensional view of the knowledge-management model to investigate the effect of entrepreneurial knowledge on sustainable entrepreneurship. The results revealed that knowledge creation and transfer had a significant and positive relationship with sustainable entrepreneurship. Moreover, information acceptance of entrepreneurs significantly moderated the relationship between knowledge creation, knowledge transfer and storage, and sustainable entrepreneurship. Degeest et al. (2018) examined the relationship between the general mental ability (GMA) of entrepreneurs and the multiple indicators of entrepreneurial performance with meta-analysis. They found that the effect of GMA on entrepreneurial performance was partially mediated through entrepreneurial knowledge and skill. Dai et al. (2019) studied the influence of personality traits of top management team members (TMT) on the performance of venture. They draw the conclusion that knowledge integration played a partial mediate effect on the relationship between TMT's extraversion, agreeableness, conscientiousness, openness to experience and the performance of the venture. Farooq et al. (2018) explored the effect of entrepreneurial orientation on business performance. The result showed that knowledge management mediated the relationship between entrepreneurial orientation and business performance.

Thus, the knowledge and experience of entrepreneurs, as well as knowledge management and knowledge fusion, would mediate the relationship between personality traits and business performance. Therefore, we propose the following hypothesis:

Hypothesis 3: Entrepreneurial knowledge mediates the relationship between entrepreneurial personality and entrepreneurial performance.

The proposed model was shown in Figure 1 below.

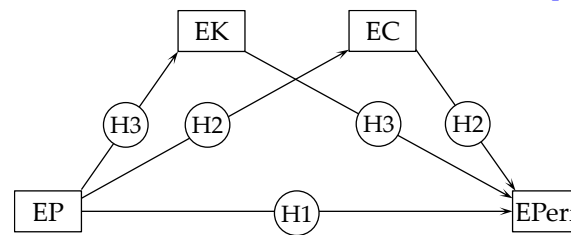


Figure 1. The proposed model

3. Data and methodology

3.1. Sample and data collection

In order to test the above hypotheses, we collected data from young entrepreneurs under the age of 35 in Mainland China. With the help of business accelerators, government agents and MBA students, the questionnaire was sent to respondents in year 2024. We guaranteed that all the responses would be kept confidential and anonymous, and only used for research purpose. Research findings would be used to guide policy-making and entrepreneurs' education, which would be beneficial for their entrepreneurship in the future. On the base of the above commitment and encouragement, we received 312 responses, and the number of valid questionnaires was 222. Among the valid questionnaires, the percentage of male respondents is 53.3% and the percentage of female respondents is 46.7%. In fact, the actual number of male respondents is much larger, but too many invalid responses lower their percentage. As for the age of respondents, the questionnaire covers people in the range of 18 to 35, which meets the demand of this research. For the educational background, the proportion of undergraduates is as high as 58% and the proportion of masters and doctors is only 6%. As far as the entrepreneurial motivation is concerned, entrepreneurship is a type of spiritual pursuit to get a better life instead of avoiding the pressure on employment. Before starting a business, the top three original occupations of respondents are college students, urban workers, and farmers and off-farm workers.

In this survey, 52% enterprises supply less than 10 jobs and 36% enterprises have the start-up capital of less than ¥100000 (\$15000), which indicates that most of the enterprises started by young entrepreneurs are small and micro enterprises. The samples are widely distributed from the view of employee numbers, start-up capital and working area, which meets the demand of research.

3.2 Measure

According to the popular back-translation procedure (Brislin, 1980), the scales were translated from English to Chinese, and then to English by two independent bilingual individuals to ensure equivalency of meaning.

Entrepreneurial personality (EP). Entrepreneurial personality was measured with 10-items scale based on Laouiti et al. (2022) and Chadha et al. (2025). Participants make a choice among a five-point response scale ranging from 1 (strongly disagree) to 5 (strongly agree). Sample items were "I have strong perseverance to face all kinds of difficulties and setbacks" and "I have a strong desire to start a business". Cronbach's alpha in this study was 0.960.

Entrepreneurial competence (EC). Entrepreneurial competence was measured with 10-item scale based on Zhang et al. (2022) and Rahman et al. (2015). Participants make a choice among a 5-point scale to show whether they agreed with statements as "I have strong ability to explore new things and situations" and "I have strong ability to learn with various tools". Cronbach's alpha in this study was 0.970.

Entrepreneurial knowledge (EK). Entrepreneurial knowledge was measured with 4-item scale developed by Sadiq et al. (2025). Sample items include "I have a deep understanding of entrepreneurship policy" and "I have rich knowledge of business management". Cronbach's alpha in this study was 0.922.

Entrepreneurial performance (EPerf). Entrepreneurial performance was measured with 6-item scale developed by Wach et al. (2020) and Wang et al. (2024). Sample items include "the market share of your

company is growing rapidly” and “the number of employees in your company is growing rapidly”. Cronbach’s alpha in this study was 0.941.

3.3 Data Analyses

Both entrepreneurial personality and entrepreneurial competence were not measured by one mature scale, so exploratory factor analysis was conducted with SPSS 22.0 by the 72 valid questionnaires firstly. LISREL8.70 was then used for confirmatory factor analysis by the 150 valid questionnaires. Correlation analysis was done with SPSS 22.0. SPSS PROCESS macro was utilized to test hypotheses of indirect effects, in which Model 6 was chosen to examine the model with two mediate variables. As for the data, we put entrepreneurial personality into X, entrepreneurial knowledge into M1, entrepreneurial competence into M2, and entrepreneurial performance into Y. Some control variables including gender, age, education, and scale of organization, were inputted as covariates.

4. Results

4.1 Reliability and Validity Tests

According to the results of exploratory factor analysis (See the Electronic Supplementary Material 1 for more information), the reliability of entrepreneurial knowledge was improved after the item “I am familiar with the knowledge about industry and product” was deleted, so this item was deleted. After that, the items of all variables were proved to meet the expectation by the reliability test, Kaiser–Meyer–Olkin test and factor loading analysis.

The reliability in this study was evaluated by Cronbach’s alpha, which was 0.960, 0.970, 0.922, and 0.941 for entrepreneurial personality, entrepreneurial competence, entrepreneurial knowledge, and entrepreneurial knowledge, respectively (Table 1). All these values of Cronbach’s alpha were higher than the threshold value of 0.7 (Nunnally et al., 1994), indicating that the measurement of all constructs was reliable.

The validity of the measurement was tested as follows. Firstly, all the indicators were measured on the base of previous literatures, which supported the content validity. Secondly, a series of confirmative factor analysis (CFA) were run to test the convergent validity with LISREL8.70. The results of factor loading, CR, and AVE were shown in Table 1. The factor loading, composite reliability, and convergence validity of all indicators largely exceeded 0.5, 0.7, and 0.5, respectively. These results proved the convergent validity of the measurement. Finally, the square root value of AVE of each construct was larger than its correlation coefficients to other constructs, so the discriminant validity was proved (Fornell et al., 1981).

The results of confirmatory fitting analysis for the single factor model of all indicators did not fit well ($\chi^2/df = 10.882$, RMSEA = 0.258, SRMR = 0.12, NFI = 0.88, NNFI = 0.89, CFI = 0.90), indicating that there was no significant common method bias in the measurement.

Table 1. Reliability and validity of the construct

Constructs	Cronbach’s α	Factor loading	Composite reliability (CR)	Convergence validity (AVE)	Discriminant validity			
					EP	EK	EC	EPerf
EP	0.960	0.77-0.89	0.9601	0.7067	(0.841)			
EK	0.970	0.85-0.93	0.9253	0.8052	0.431	(0.897)		
EC	0.922	0.79-0.92	0.970	0.7646	0.695	0.722	(0.874)	
EPerf	0.941	0.79-0.92	0.9412	0.728	0.446	0.743	0.678	(0.853)

Notes: n = 150; EP = entrepreneurial personality; EK = entrepreneurial knowledge; EC = entrepreneurial competence; EPerf = entrepreneurial performance. The values in round brackets are the square root of the AVE. Other values in the columns of Discriminant validity are correlations.

4.2 Descriptive statistics analysis

Table 2 shows the mean value, the standard deviation, and the correlation of all variables. As shown in Table 2, entrepreneurial personality was positively related to entrepreneurial performance ($r = 0.446$, $p < 0.001$), entrepreneurial competence was positively related to entrepreneurial performance ($r = 0.678$, $p < 0.001$), entrepreneurial knowledge was positively related to entrepreneurial performance ($r = 0.743$, $p < 0.001$), entrepreneurial personality was positively related to entrepreneurial knowledge ($r = 0.431$, $p < 0.001$), entrepreneurial knowledge was positively related to entrepreneurial competence ($r = 0.722$, $p < 0.001$), and entrepreneurial personality was positively related to entrepreneurial competence ($r = 0.695$, $p < 0.001$). These results were fully consistent with the tendency of our supposition, which gave primary evidence for all the hypotheses. It was noteworthy that there was also a significant correlation between scale of organization and entrepreneurial performance ($r = 0.327$, $p < 0.001$).

Table 2. Mean value, standard deviation, and correlation of descriptive statistics analysis

Variables	Gender	Age	Education	Scale of organization	EP	EC	EK	EPerf
Gender	1							
Age	-0.407**	1						
Education	0.100	-0.448***	1					
Scale of organization	-0.078	0.003	0.151	1				
EP	-0.149	0.045	-0.003	0.289***	1			
EC	-0.116	-0.084	0.219**	0.364***	0.695***	1		
EK	-0.023	-0.107	0.194*	0.315***	0.431***	0.722***	1	
EPerf	-0.031	-0.033	0.132	0.327***	0.446***	0.678***	0.743***	1
Mean	1.47	26.9	2.51	2.15	4.011	3.79	3.37	3.35
Standard deviation	0.501	5.61	0.873	1.496	0.882	0.816	0.857	0.758

Notes: $n=150$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. EP = entrepreneurial personality; EK = entrepreneurial knowledge; EC = entrepreneurial competence; EPerf = entrepreneurial performance.

4.3 Hypothesis Testing

The results of hypothesis testing are summarized in Table 3. The relationship between entrepreneurial personality and entrepreneurial performance was significant ($\beta=0.338$, $p < 0.01$), so Hypothesis 1 was verified. According to a bootstrapped 95% confidence interval of [0.130, 0.584], the total effect of entrepreneurial personality to entrepreneurial performance in this model was significant ($\beta =0.338$, $p < 0.01$). However, after entrepreneurial knowledge and entrepreneurial competence were added as mediate variables, the direct effect of entrepreneurial personality to entrepreneurial performance became insignificant and the total indirect effect of entrepreneurial personality on entrepreneurial performance was significant ($\beta = 0.332$, $p < 0.001$). Thus, the indirect effect of entrepreneurial personality on entrepreneurial performance through entrepreneurial knowledge was positive (0.172), and Hypothesis 3 was verified. Moreover, the indirect effect of entrepreneurial personality on entrepreneurial performance through entrepreneurial competence was checked to be positive (0.115) by the same method, so Hypothesis 2 was proved. Unexpectedly, we found that these two mediators were not completely juxtaposed, but showed positive indirect effect of entrepreneurial personality on entrepreneurial performance through entrepreneurial knowledge and entrepreneurial competence in serial (0.045). In addition, these three variables of entrepreneurial personality, entrepreneurial knowledge, and entrepreneurial competence explained the 60.1% variation of entrepreneurial performance ($R^2=0.601$), which indicated that the empirical results verified the theoretical model well.

Table 3. The results of PROCESS macro for mediate analysis

Regression analysis	Coeff	SE	t	p	LLCI	ULCI	R ²	F
Dependent variable = EPerf ^a							0.253	5.797***
Predictor variables								
EP	0.338	0.117	2.898	0.004	0.108	0.569		
Dependent variable = EK ^a							0.256	6.746***
Predictor variables								
EP	0.372	0.112	3.323	0.001	0.151	0.593		
Dependent variable =EC ^a							0.723	52.373***
Predictor variables								
EP	0.431	0.092	4.674	0.000	0.2494	0.614		

EK	0.455	0.062	7.394	0.000	0.334	0.577		
Dependent variable =EPerf ^a							0.601	22.608***
Predictor variables								
EP	0.006	0.091	0.069	0.945	-0.174	0.187		
EC	0.266	0.115	2.318	0.022	0.039	0.492		
EK	0.464	0.075	6.227	0.000	0.317	0.611		
Total effect of EP on EPerf	Effect	SE	<i>t</i>	<i>p</i>	LLCI	ULCI		
	0.338	0.117	2.898	0.004	0.108	0.569		
Direct effect of EP on EPerf	Effect	SE	<i>t</i>	<i>p</i>	LLCI	ULCI		
	0.006	0.091	0.069	0.945	-0.174	0.187		
Total indirect effect of EP on EPerf	Effect	Boot ^b SE	Boot ^b LLCI		Boot ^b ULCI			
	0.332	0.081	0.182		0.500			
Indirect effect of EP on EPerf through EK	Effect	Boot ^b SE	Boot ^b LLCI		Boot ^b ULCI			
	0.172	0.050	0.084		0.284			
Indirect effect of EP on EPerf through EC	Effect	Boot ^b SE	Boot ^b LLCI		Boot ^b ULCI			
	0.115	0.054	0.016		0.238			
Indirect effect of EP on EPerf through EK and EC in serial	Effect	Boot ^b SE	Boot ^b LLCI		Boot ^b ULCI			
	0.045	0.022	0.010		0.101			

Notes: n = 150; EP = entrepreneurial personality; EK = entrepreneurial knowledge; EC = entrepreneurial competence; EPerf = entrepreneurial performance. Control variables = gender, age, education, and scale of organization; LLCI = lower limit of 95% confidence interval; ULCI = upper limit of 95% confidence interval. ^aDirect effect; ^b 5000 bootstrap samples used. ***p < 0.001.

The validated model was shown in Figure 2 below.

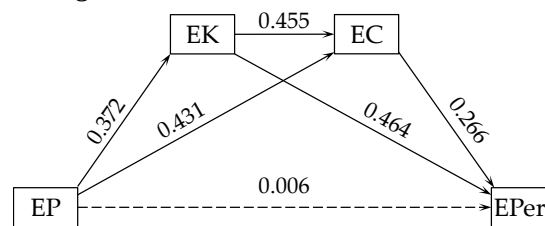


Figure 2. The validated model

5. Discussion

On the base of literatures and interview surveys, the components of entrepreneurial attribute were obtained and a model that entrepreneurial attribute impacted entrepreneurial performance was supposed. SPSS22.0, LISREL8.70 and SPSS PROCESS macro were then used for statistical analysis, so that the relationship between entrepreneurial attribute and entrepreneurial performance was explored to obtain the final model.

5.1 Theoretical Implications

The influence of entrepreneurial attribute on entrepreneurial performance has been comprehensively studied. This was very different from the previous literatures that only a few aspects of entrepreneurial attribute were chosen to find their relationship with entrepreneurial performance. Thus, the theoretical implications of this paper can be summarized as the following three points.

(1) The constitution of entrepreneurial attribute of young entrepreneurs was established. Entrepreneurial attribute was composed of three variables, namely, entrepreneurial personality, entrepreneurial competence and entrepreneurial knowledge. Entrepreneurial personality represented the psychological characteristics of individuals during the entrepreneurial process, which was composed of 10 indicators. Entrepreneurial competence was various abilities that entrepreneurs should have, which was composed of 10 indicators. Entrepreneurial knowledge referred to the knowledge system that entrepreneurs should have, including 3 indicators. The items of entrepreneurial personality and entrepreneurial competence were in accordance with the original design. By contrast, the items of entrepreneurial knowledge were changed from 4 to 3 by deleting

the item “I am familiar with the knowledge about industry and product”, since the respondent’s score in this item was much higher than that in other items, namely, the internal consistency was poor. Therefore, it would fail the test of Cronbach’s alpha if this item was retained. This item represented theoretical knowledge of entrepreneurship and it was relatively abundant, so it would be important to strengthen the practical knowledge of young entrepreneurs.

(2) The relationship between entrepreneurial personality, entrepreneurial competence, entrepreneurial knowledge and entrepreneurial performance was investigated by empirical testing. The results showed that entrepreneurial attribute certainly impact entrepreneurial performance. The direct impact was not significant and the indirect impact was significant. More importantly, the indirect impact was implemented through three paths by two mediate variables - entrepreneurial knowledge and entrepreneurial competence. Firstly, entrepreneurial personality affected entrepreneurial performance through entrepreneurial knowledge. Secondly, entrepreneurial personality affected entrepreneurial performance through entrepreneurial competence. Thirdly, entrepreneurial personality affected entrepreneurial performance by the serial relationship from entrepreneurial knowledge to entrepreneurial competence. The final results showed that three variables of entrepreneurial personality, entrepreneurial competence, and entrepreneurial knowledge explained the 60.1% variation of entrepreneurial performance ($R^2=0.601$), which indicated that the empirical results verified the theoretical model well.

(3) The approach that improves entrepreneurial performance through entrepreneurial attribute was developed. It was found that the influence of entrepreneurial knowledge was the most significant ($\beta = 0.464$), and entrepreneurial competence took the second place ($\beta = 0.266$). Moreover, the influence of entrepreneurial personality on entrepreneurial performance was completely mediated by entrepreneurial knowledge and entrepreneurial competence. Therefore, in order to improve entrepreneurial performance, the first thing is to improve entrepreneurial knowledge, followed by entrepreneurial competence, and some attentions should be partly paid to entrepreneurial personality. This would give theoretical guidance for entrepreneurial management.

5.2 Practical Implications

(1) Entrepreneurial training is the most effective way to improve entrepreneurial attribute, which mainly lead to the improvement of entrepreneurial knowledge and entrepreneurial competence. Firstly, various training programs, including general courses for fresh entrepreneurs and special training for different entrepreneurs, should be established according to their social experience, educational background and entrepreneurial field. Secondly, flexible training way should be provided including theoretical courses, entrepreneurship lectures and online learning, so that entrepreneurial training can cover the whole cultivation process of young entrepreneurs. Finally, the practical training should be strengthened as well, such as mature entrepreneurial projects and multidimensional practical exercises.

(2) The standardization, specialization and elaboration of start-up accelerators need to be enhanced, which could improve the entrepreneurial competence of young entrepreneurs. The start-up accelerator is a type of service organization for entrepreneurship that reduces their cost and improves success rate. Start-up accelerators build a platform for the communication of young entrepreneurs, and provide case sharing, practical guidance, project diagnosis, technology transfer, product exhibition, and financing guidance. In order to achieve these goals, diverse accelerators need to be built depending on various government platforms, and the management, evaluation, and development of these accelerators should be strengthened.

(3) Entrepreneurs must develop their special entrepreneurial personality to improve entrepreneurial performance. Firstly, young entrepreneurs should overcome their own shortcomings according to the industrial requirement for entrepreneurial attribute. Secondly, young entrepreneurs should complete their career planning, improve their understanding of entrepreneurship, and correct some wrong attitude or behaviour of doing business. Finally, some entrepreneurial personality and entrepreneurial competence, such as perseverance, self-efficacy, and entrepreneurial alertness, might be improved by mental training.

Limitations and expectations

The limitation of this study is reflected in the following aspects.

(1) The scope of sampling is not large enough. The survey target in this study involves many industries and enterprises with different scale, but convenient sampling was employed instead of random sampling. Thus, most of the samples come from Jinan, Qingdao and Dongying, which might limit the application of research findings. Therefore, the scope of investigation should be expanded and the method of random sampling should be adopted to improve this research in the future.

(2) The measurement of variables was subjective. Although the data had passed the reliability and validity test, it comes from the subjective judgment of the respondents, which leads to some limitation on inspecting causal relationship. More objective measurement should be considered in the future, such as typical case tracking over a long period of time.

(3) The model of the relationship between entrepreneurial attribute and entrepreneurial performance can be further explored. On one hand, are there other mediators or moderators to enhance their correlation? On the other hand, the weighting of different indicators in the constitution of entrepreneurial attribute can be introduced to evaluate their relationship. In the future, this model would be enhanced through more theoretical research and practical investigation, so that it might better guide the practice of young entrepreneurs.

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Ethics, Consent to Participate, and Consent to Publish declarations

Approval was obtained from the ethics committee. The procedures used in this study adhere to the tenets of the Declaration of Helsinki. Freely-given and informed consent to participate in the study was obtained from participants. All responses of participants are kept confidential and anonymous, and no potentially identifiable images or data are collected. All participants agreed to publish the collected data.

Data availability declaration. The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author Contribution declaration

Pengfei Yang: writing—original draft preparation, Conceptualization; *Yanhong Yu*: writing—review & editing, software, formal analysis, funding acquisition; *Junying Li*: writing—review & editing, investigation; *Feng Ma*: writing—review & editing, resources. All authors have read and agreed to the published version of the manuscript.

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