Research and Construction of Science and Technology Innovation System of Aviation Manufacturing Enterprises

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Abstract: The paper uses the structural equation model to study the environmental factors and action paths of China's aviation manufacturing industry's technological innovation capabilities. The research results show that the economic environment, market environment, talent environment and policy environment of China's aviation manufacturing industry have significant but different degrees of positive impact on its technological innovation capabilities. Among them, the market environment and economic environment have a strong influence on technological innovation capabilities, and the policy environment and talent environment have relatively weak influence on technological innovation capabilities. It is believed that by optimizing the market environment, increasing funding, giving play to the government's role in regulating services, and strengthening the construction of a human resource system, China's aviation manufacturing industry should improve its technological innovation capabilities.

1. Introduction

The aviation manufacturing industry is a country's strategic industry, which affects the competition of comprehensive strength among countries. At the same time, the aviation manufacturing industry is also the embodiment of national defense forces and an important driving force for the overall economic progress. The aviation manufacturing industry is characterized by a long industrial chain and a large degree of industrial relevance. It is a high-tech industry with great development potential. Its development mainly depends on the application and extension of cutting-edge industrial manufacturing technology in the aviation industry. Although my country’s aviation manufacturing industry has made rapid progress and has independent research and development capabilities, and has cooperated with McDonnell Douglas in research and development, and has a better R&D and manufacturing platform, it still has a large gap with the world's aviation manufacturing countries. The main reason is my country still lacks independent intellectual property rights in the core technology of aviation manufacturing, and usually only obtains the low value-added part of the aviation manufacturing industry chain [1]. The lack of innovation makes the technological breakthrough of my country's aviation manufacturing industry very difficult. However, if my country wants to obtain the high value-added part of aviation products, it must strengthen independent innovation and establish a sustainable scientific and technological collaborative innovation system, so that my country can become a major and powerful country in aviation manufacturing. Therefore, this article attempts to use the structural equation model to analyze the technological innovation capability of my country's aviation manufacturing industry from the perspective of environmental factors.

2. Introduction to Structural Equations

Structural equation model can be divided into two parts: measurement model and structural model. The measurement model is used to describe the relationship between the latent variable ξ, η and the

measured variables X and Y, expressed as

$$Y = \lambda_Y \eta + \varepsilon$$
$$X = \lambda_X \xi + \sigma \quad (1)$$

In the formula, Y is the vector composed of endogenous observation variables; X is the vector composed of exogenous observation variables; η is the endogenous latent variable; ξ is the exogenous latent variable; λ_Y is the endogenous observation variable on the endogenous latent variable Factor loading matrix, which represents the relationship between the endogenous latent variable η and its observed variable Y; λ_X is the factor loading matrix of the exogenous observed variable on the exogenous latent variable, which represents the relationship between the exogenous latent variable ξ and X ; ε and σ are the residual matrix of the measurement equation [2]. The structural model is used to illustrate the relationship between exogenous latent variables and endogenous latent variables, which can be expressed as

$$\eta = B\eta + \gamma\xi + \zeta \quad (2)$$

In the formula, B is the structural coefficient matrix, which represents the mutual influence between the constituent factors of the endogenous latent variable η in the structural model; γ is the structural coefficient matrix, which represents the influence of the exogenous latent variable ξ on the endogenous latent variable η in the structural model The influence of; ζ is the residual matrix of the structural model.

3. The construction of indicators affecting the technological innovation capabilities of aviation manufacturing enterprises

This paper analyzes the environmental factors affecting the technological innovation capability of the aviation manufacturing industry from four aspects: economic environment, talent environment, market environment, and policy environment. The observed variable indicators selected for each latent variable are mainly selected through reliability and validity evaluation. At the same time, in order to perform structural equation model analysis in the empirical analysis part, the index data selected for each variable quantitative index has been standardized, and the sample data basically conforms to the normal distribution [3]. Table 1 shows the variable quantitative indicators and variable identification.

Table 1 Variable quantitative indicators and variable identification

Latent variable	Quantitative indicators	Variable identification
Technological innovation	Number of R&D centers	X1
	Number of patent applications	X2
	Number of patents granted	X5
	Number of new product development projects	X4
Economic environment	Per capita sales income of employees	X5
	Value added per employee	X6
	Industrial value added rate	X7
	Investment amount	X8
Human resources environment	Proportion of employees in science and technology activities	X9
	Scientists and engineers account for the proportion of employees	X10
	R&D personnel input ratio	X11
Market environment	Main business income	X12
	Export delivery value	X13
Policy Environment	Ratio of government funds to R&D expenditure	X14
	R&D expenditure as a percentage of regional fiscal expenditure	X15

4. Model verification

4.1 Model construction

Firstly, a theoretical model of environmental factors affecting the technological innovation capability of China's aviation manufacturing industry is constructed, that is, the economic environment, talent environment, market environment, and policy environment of the aviation manufacturing industry have a positive impact on its technological innovation capability.

4.2 Empirical analysis

4.2.1 Reliability and validity analysis.

Reliability refers to the stability between data, and validity refers to the ability of data to express the object of measurement. These two analyses are a measure of data reliability. Before testing the reliability and validity of the data in this article, first the missing values in individual samples are processed by the linear interpolation method in SPSS21.0, then the data is transformed by logarithm (ln), and finally the data indicators are standardized deal with. The standardized formula is

$$Y_i = \frac{Y_i - 1/n\Sigma_{i=1}^{n} X_i}{\sqrt{1/n\left(\Sigma_{i=1}^{n}\left(X_i - 1/n\Sigma_{i=1}^{n} X_i\right)^2\right)}} \tag{3}$$

First, use Cronbach's α coefficient to test the reliability of the internal consistency of the measurement indicators. The test results are shown in Table 2.

Table 2 Cronbach's coefficient reliability calculation results table

Research variables	Number of items included	alpha coefficient	Overall alpha coefficient
Technological innovation ability	4	0.81	0.806
Economic environment	4	0.747	
Talent environment	3	0.783	
Market environment	2	0.707	
Policy Environment	2	0.857	

4.2.2 Analysis of estimation results.

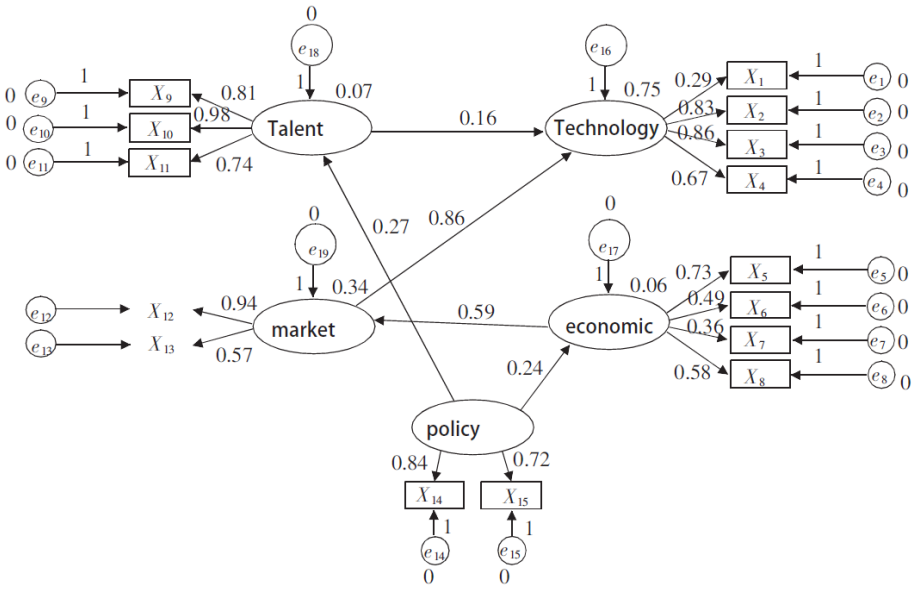

Fig. 1 The structural equation model of the technological innovation capability of China's aviation manufacturing industry and its parameter values

A structural path analysis diagram can be drawn through AMOS17.0 software, as shown in Figure

1. Among them, the ellipse represents the latent variable, the small circle represents the residual term, and the rectangle represents the observed variable. Figure 1 clearly reflects the relationship between the endogenous latent variable aviation manufacturing technology innovation capability and the four latent variables. It can be seen from Figure 1 that the talent environment, market environment, policy environment, and economic environment all affect the technological innovation capabilities of China's aviation manufacturing industry through direct or indirect effects, and all have a positive role in promoting [4]. Table 3 shows the direct effect, indirect effect and total effect among the variables after standardization. It not only reflects the direct effect, indirect effect and total effect of the four latent variables on technological innovation capability, but also reflects the mutual relationship between the latent variables.

Table 3 Standardized direct effects, indirect effects and total effects

Action path			Direct effect	Indirect effect	Total effect
Economic environment	←	Policy Environment	0.239	0	0.239
Market environment	←	Policy Environment	0	0.14	0.14
Talent environment	←	Policy Environment	0.269	0	0.269
Technological innovation	←	Policy Environment	0	0.165	0.165
Market environment	←	Economic environment	0.587	0	0.587
Talent environment	←	Economic environment	0	0	0
Technological innovation	←	Economic environment	0	0.507	0.507
Economic environment	←	Market environment	0	0	0
Talent environment	←	Market environment	0	0	0
Technological innovation	←	Market environment	0.863	0	0.863
Economic environment	←	Talent environment	0	0	0
Market environment	←	Talent environment	0	0	0
Technological innovation	←	Talent environment	4.1	0	0.164

5. Related Suggestions

5.1 From the perspective of high-end equipment manufacturing industry

5.1.1 Strengthen cooperation, competition and innovation awareness.

Enterprises should keep close contact with each other to jointly respond to social needs and changes, especially in product production and innovation. Innovation is an important factor in the reform of industrial structure, economic growth and the improvement of the quality of economic development. The optimal allocation of innovation resources has been promoted to a new height under the impetus of cooperation. To realize industrial collaborative innovation, we must take thought as the forerunner of action and establish correct consciousness and concepts [5]. It can be seen that strengthening the awareness of collaborative innovation and establishing new concepts of collaborative competition are of great significance to China's high-end equipment manufacturing industry.

5.1.2 Improve the internal information processing structure.

With the development of the data age, the market faced by high-end equipment manufacturing companies has been very different from before. The domestic and foreign markets are rapidly changing, which forces the companies in the depths to have sufficient information processing capabilities to deal with it. A rapidly changing information environment. Manufacturers should focus on establishing and improving a complete set of information collection and feedback mechanisms to meet the needs of the ability to process information in a modular collaborative innovation system, shorten the path from receiving information to feedback, and improve information processing efficiency. The information processing structure of the modular production method is obviously superior to the ordinary division of labor, because it is more efficient in processing the information,

knowledge and resources inside and outside the system, and can continuously innovate knowledge and technology. In the innovation process, the module is a unit, and its own innovation is easier and more convenient to implement than the overall innovation. Therefore, it is very necessary to implement modular integration for China's high-end equipment manufacturing industry [6]. The high-end equipment manufacturing industry is more complicated. It can be divided into several subsystems according to the modular design rules. The production levels, processes and capabilities of these subsystems are uneven, and then they are broken down according to functions and allocated according to the needs of downstream suppliers. This also enables suppliers to conduct "back-to-back competition" under implicit rules, rely on themselves to carry out innovation activities, and then deliver the innovation results to the dominant integrator, and then the module integrator will collect the information of each module. The products are organically integrated and brought to the market to meet the diverse needs of customers.

5.2 From the perspective of external government management

5.2.1 The government should increase investment in capital and technology and create a credit mechanism.

The two important factors that determine the overall output level and affect the innovation level of manufacturing enterprises are capital and technology. Therefore, the government that plays a leading role should increase investment in capital and technology to effectively and effectively increase the innovation output of enterprises and increase economic efficiency. Some enterprises themselves have great potential for innovation, but they have insufficient funds and insufficient technology. Such enterprises deserve government support. In addition, the exchange of information between enterprises should also be closer, which requires the government to take measures to facilitate such activities, such as holding exchange meetings with senior managers of enterprises to strengthen exchanges and cooperation between enterprises. To gain a foothold in the ever-changing market, an enterprise must pay attention to its own reputation. The establishment of a trust mechanism is by no means an overnight event. This requires the accumulation of long-term and honest transactions. The enterprise must establish a sound trust mechanism in order to be in the market. Make great progress. The local government must clearly recognize the importance of building an integrity mechanism, give full play to the role of leaders, and create a good environment for cooperation and innovation for enterprises.

5.2.2 The government should reduce market and corporate control and improve production efficiency.

The most direct means to improve production efficiency and promote the development of the industry is to introduce more participants and encourage competition. This is a consensus that has been formed in the micro and macro economic fields. This requires the government to strengthen leadership and give full play to the role of the leader: first, it must weaken barriers to facilitate the entry and exit of participating enterprises; second, it must minimize control methods and reduce procedures. If the government can effectively promote the subdivision of the system and the integration of modules, and play an active role in the process of industrial modularization, the modularization process of my country's high-end equipment manufacturing industry will surely be accelerated, and production efficiency will also be improved.

5.2.3 The government should speed up the introduction of corresponding policies and improve the innovation system.

For innovation activities involving multiple parties, innovation is a systematic project. It is not an individual behavior of a specific subject. It must take full advantage of the organic system that has an organizational structure. The government has a dominant position in the entire innovation activities. It is necessary to work hard to support the development of local innovation undertakings and establish an innovation system with high efficiency, high quality and strong practicality. Combined with the

introduction of the collaborative innovation model in the previous article, the following three specific measures have been summarized: First, a new industry-university research and innovation system must be established. This system must be built around enterprises and fully rely on scientific research institutions and intermediary institutions; second, separate preferential policies such as tax-saving subsidies to encourage enterprises to increase investment in innovative research and development, accelerate the transformation of innovation results, and encourage enterprises to establish their own research and development centers through various methods to improve their own strength , To strengthen contacts and cooperation with other companies; third: to promote the development of the business incubator industry through policy guidance, strengthen the construction of intermediary agencies for technology industry associations, strengthen publicity, and encourage competent people to join the industry to enrich this The power of such institutions promotes the development of private technology companies and shortens the time lag for innovative results from the laboratory to the market.

6. Conclusion

The technological innovation capability of the aviation manufacturing industry is a comprehensive index affected by many factors, which cannot be directly observed and measured. Structural equation models can treat it as a latent variable and use other observed variables to reflect it. This paper uses the structured equation model to study the environmental influence factors and path transmission of the technological innovation capability of China's aviation manufacturing industry.

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