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# Research on the Evaluation Index System for Scientific and Technological Innovation Ability of Tobacco Commercial Enterprises

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## Abstract

**The scientific & technological innovation ability of tobacco commercial enterprises plays an important leading and supporting role in realizing the high-quality development of tobacco industry. According to the characteristics of the tobacco industry, the design principles of evaluation index on scientific & technological innovation ability of tobacco commercial enterprises are put forward. Based on the innovation ecosystem, the evaluation of scientific & technological innovation ability of tobacco commercial enterprises can construct the evaluation index system of scientific & technological innovation ability of tobacco commercial enterprises from the three dimensions, which are scientific & technological innovation input ability, output ability and basic ability, so as to effectively promote scientific & technological innovation ability of tobacco commercial enterprises.**

## Keywords

**Tobacco Commercial Enterprises; Scientific & Technological Innovation Ability; Evaluation Index system; Innovation Ecosystem.**

## 1. Introduction

In recent years, China's tobacco industry attaches great importance to scientific & technological innovation. The national symposium on tobacco science and technology work in 2022 stressed that it is necessary to systematically grasp the requirements of industry scientific & technological innovation in the new era, so that the key variable of scientific & technological innovation can become the maximum increment of industry development, accelerate the realization of high-level science & technology self-reliance and self-improvement, and comprehensively shape the new advantages of innovation and development. The national tobacco work teleconference in 2023 pointed out that scientific & technological innovation should be actively promoted to make more outstanding achievements serve the development of the tobacco industry. The scientific & technological innovation of tobacco commercial enterprises is an important basis for realizing the high-quality development of the tobacco industry. In order to improve the scientific & technological innovation strength of tobacco commercial enterprises, it is necessary to scientifically design the evaluation index system for scientific & technological innovation ability.

At present, the research on the evaluation of scientific & technological innovation ability is mainly reflected in the following aspects. One is the evaluation of scientific & technological innovation ability. Gao evaluated the innovation capability of strategic emerging industries

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from the perspective of innovation community and innovation environment [1]. Pan et al. evaluated China 's regional innovation capability based on the composite system collaborative system [2]. Zhang and Zhang constructed an evaluation model of scientific & technological innovation and sustainable development ability based on cloud model and evidence theory [3]. Yan and He systematically analyzed the composition and relationship of innovation elements by using the theory of industrial cluster innovation, and evaluated the industrial innovation ability by combining the analytic hierarchy process and the analysis factors [4]. The other one is the evaluation index system of scientific & technological innovation ability. Based on the literature research method, Ravari et al. selected six main criteria which are collective learning, resources, marketing, innovation organization, strategic planning and performance to evaluate the scientific & technological innovation ability of scientific research institutions [5]. Ma et al. constructed the evaluation index system of Hubei grass-roots enterprises' scientific & technological innovation ability from the aspects of scientific & technological innovation inputs and outputs [6]. Bao and Chen took manufacturing SMEs as the research object, and measured the scientific & technological innovation ability from implementing capability, integrated management capability, investment capability and performance capability [7]. Based on bibliometrics and grounded theory, Zhang and Lin established a first-class manufacturing enterprise innovation ability evaluation system composed of three first-level indexes and subdivision indexes of source innovation, nuclear innovation and chain innovation [8]. Sun et al. constructed an evaluation index system from innovation input ability, output ability and innovation environment to analyze the theoretical framework of scientific & technological innovation ability on agriculture-related enterprises [9]. Yu and Shi combined the characteristics of agricultural machinery and equipment enterprises to construct an evaluation system of enterprise innovation ability from research and development foundation, innovation investment ability, scientific & technological innovation benefit and marketing ability [10]. Based on the domestic and international experience of innovation evaluation, Jia et al. constructed the evaluation index system of innovation ability of forestry and grass research institutes from evaluation orientation, platform construction and talent training [11].

To sum up, the existing achievements have carried out a lot of theoretical and empirical research on the evaluation of scientific & technological innovation ability, and put forward some useful theoretical systems. However, there are still some shortcomings. First, scholars focus more on the evaluation of innovation ability of manufacturing enterprises and agriculture-related enterprises, and less scholars study the evaluation of scientific & technological innovation ability of tobacco commercial enterprises, failing to form a scientific evaluation index system. Second, the existing researches rarely designs the evaluation index of scientific & technological innovation ability of tobacco commercial enterprises from the perspective of innovation ecosystem, ignoring the influence of other innovation subjects and innovation environment on tobacco commercial enterprises. Therefore, combined with the design principles of evaluation index, this paper establishes the evaluation index system of scientific & technological innovation ability of tobacco commercial enterprises based on the innovation ecosystem, from scientific & technological innovation input ability, output ability and innovation basic ability in order to promote the continuous improvement of the overall technological innovation capability of the tobacco industry.

## 2. Design Principles of Evaluation Index for Scientific & Technological Innovation Ability of Tobacco Commercial Enterprises

### 2.1. Systemic Principle

In order to make the evaluation results more accurate and ensure that there is a certain logical relationship between the indexes. In the selection of indicators for evaluating the scientific &

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technological innovation ability of tobacco commercial enterprises, we should follow the systemic principle, so that there is both relevance and their respective independence among the indexes. In addition, the evaluation index should also have a certain hierarchical relationship from the first-level index to a number of second-level indexes.

### 2.2. Representative Principle

The construction of the evaluation system of scientific & technological innovation ability of tobacco commercial enterprises should follow the principle of objective and independence, try to avoid subjective indexes, and build independently according to the related theory, so as to avoid interference from external stakeholders. The selected indexes should be highly general and typical representative, which can comprehensively and objectively reflect the scientific & technological innovation ability of tobacco commercial enterprises, in order to improve the evaluation accuracy.

### 2.3. Available Principle

In the construction of the evaluation system of scientific & technological innovation ability of tobacco commercial enterprises, we should pay attention to the availability of the evaluation indexes. The required data can be obtained from the existing databases or through investigation and interviews, so that the evaluation index system can be applied in the evaluation of scientific & technological innovation ability.

### 2.4. Dynamic Principle

The construction of the evaluation system should not be static and one-sided, but should make each index dynamic and interrelated. When designing the evaluation indexes of scientific & technological innovation ability of tobacco commercial enterprises, the evaluation indexes should be dynamically adjusted in combination with the development situation of the nation and the tobacco industry.

## 3. Design Basis of Evaluation Indexes for Scientific & Technological Innovation Ability of Tobacco Commercial Enterprises

### 3.1. Innovation Ecosystem

The innovation ecosystem was first proposed by Moore in 1993, who brought ecological theory into the field of economic innovation [12]. The innovation ecosystem explains how enterprises use resources and strategic positioning, and form ecological alliances from an ecological perspective. The concept of innovation ecosystem was formally proposed in 2004. The United States President's Council of Advisers on Science and Technology(abbreviated as PCAST) first proposed the leadership of national technology and innovation depends on a dynamic innovation ecosystem in the research report, which is Sustaining the Nation's innovation Ecosystems: Reporton Information Technology Manufacturing and Competitiveness that [13]. The theory of innovation ecosystem introduces the concept of ecosystem into the development of innovation, and gives new characteristics to the overall diversity, openness and synergy, and stability and regulation of innovation [13]. It enriches and refines the theory of innovation, and allows the innovation process to be optimized and transformed.

In an innovation ecosystem, a large number of complementary and interconnected innovation elements gradually evolve into a structured and loose network organization [15]. With the changes of internal and external environmental triggers, innovation subjects dynamically change the structure and interaction of the innovation ecosystem to achieve the sustainable development of innovation activities, while optimizing the innovation efficiency of each innovation subject and the system itself. Therefore, focusing on the innovation ecosystem can enable relevant enterprises to better carry out scientific & technological innovation.

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## 3.2. Design Ideas of Evaluation Indexes for Scientific & Technological Innovation Ability of Tobacco Business Enterprises

Scientific & technological innovation is a long-term activity with the characteristics of high risk, high cost, difficult to guarantee the benefits and so on. It requires a large and sustained investment of resources, which makes it difficult for tobacco commercial enterprises to complete their scientific & technological innovation activities independently, and needs to use other innovation subjects to realize collaborative innovation. Tobacco commercial enterprises collaborate with all subjects during the process of innovation to form an innovation ecosystem. To evaluate the scientific & technological innovation ability of enterprises, it is necessary to analyze the innovation ecosystem of tobacco commercial enterprises and the support of other subjects to the scientific & technological innovation work of enterprises.

The innovation ecosystem of tobacco commercial enterprises consists of innovation elements and innovation environment, and the innovation elements include innovation input elements and innovation output elements [16]. Innovation input elements refer to the human resources, financial resources and material resources invested in carrying out scientific & technological innovation work, while innovation output elements including the output of patents, products, other innovation achievements, low-tar cigarettes, the establishment of standard projects and so on. Innovation environment refers to the strategic, institutional, material and cultural foundations required for tobacco commercial enterprises to perform scientific & technological innovation work. Therefore, the evaluation of the scientific & technological innovation ability of tobacco commercial enterprises is corresponding to the design of scientific & technological innovation input ability indexes, innovation output ability indexes and scientific & technological innovation basic ability indexes as shown in Figure 1.

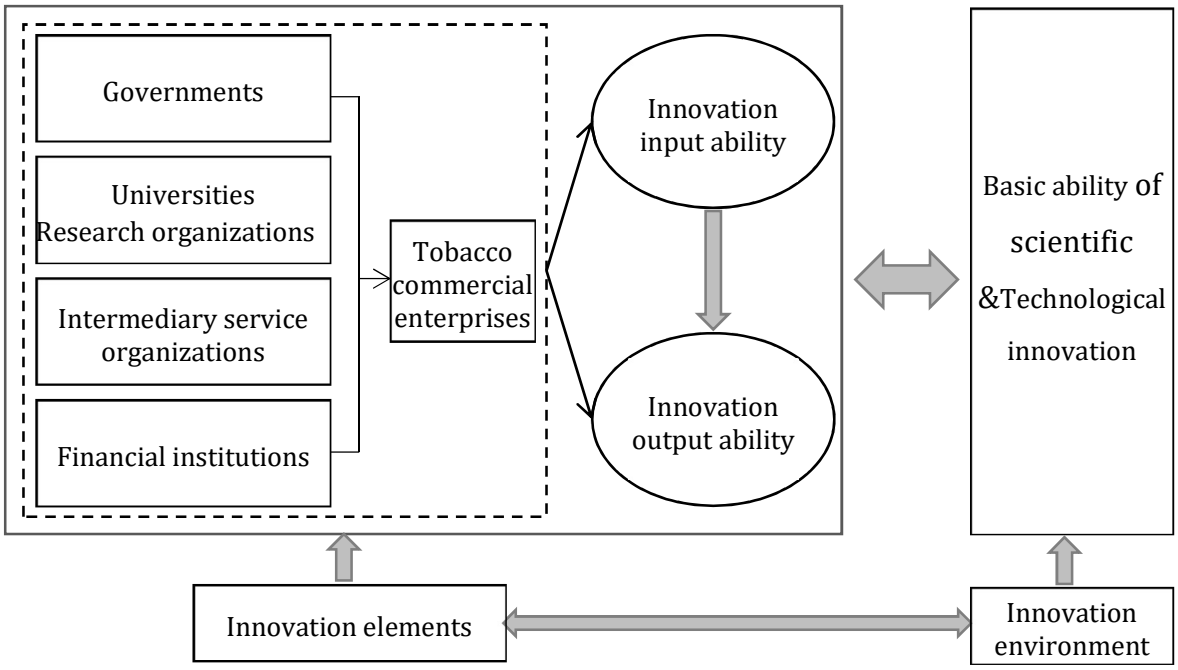


**Figure 1.** Design ideas for evaluation indexes of scientific & technological innovation ability of tobacco business enterprises

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## 4. Design of Evaluation Index System for Scientific & Technological Innovation Ability of Tobacco Commercial Enterprises

Based on the theory of innovation ecosystem, combined with the existing research results on the evaluation index system of scientific & technological innovation capability, and 2022 assessment form on Shaanxi Provincial Tobacco Company, the evaluation index system of scientific & technological innovation ability of tobacco commercial enterprises is designed. It contains 3 first-level indexes and 20 second-level indexes from the perspectiveof scientific & technological innovation input ability, innovation output ability and innovation basic ability as shown in Table 1.

**Table 1.** Evaluation index system of scientific & technological innovation ability of tobacco commercial enterprises

| Evaluation objective | First-level indexes | Second-level indexes |
|---|---|---|
| Scientific & technological innovation capacity of tobacco commercial enterprises | Scientific & technological innovation input ability | Number of personnel in scientific & technological activities |
| | | Percentage of staff with middle and senior titles |
| | | Selection program of innovative talent |
| | | Innovation team construction |
| | | Formation of innovation teams in core business areas |
| | | Total expenditure on science and technology |
| | | Implementation of scientific & technological activities |
| | | Formation of innovation studios in core business areas |
| | | Establishment of joint laboratories and other joint innovation platforms with universities, research institutes, enterprises, etc. |
| | Scientific & technological innovation output ability | Scientific & technological impact of innovation achievements |
| | | Sales proportion of low-tar cigarettes |
| | | Weighted value of scientific & technological achievements |
| | | Weighted value of scientific & technological innovation achievement rewards |
| | | Project establishment China National Tobacco Corporation |
| | | Transformation ability of scientific & technological innovation achievements |
| | Scientific & technological innovation basic ability | Strategic planning for scientific & technological innovation |
| | | Institutional construction for scientific & technological innovation |
| | | Construction of common technology platform |
| | | Institutions establishment of scientific & technological innovation |
| | | Culture construction of scientific & technological innovation |

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## 4.1. Design of Specific Indexes for Scientific & Technological Innovation Input Ability

Innovation input is an important functional element of the innovation ecosystem of tobacco commercial enterprises, mainly providing resources for innovation activities. The evaluation of the scientific & technological innovation input ability mainly focus on the measurement of the ability of investing various types of resources, such as human, financial and material resources, in the process of carrying out scientific & technological innovation activities for tobacco commercial enterprises.

### 4.1.1. The Indexes of Scientific & Technological Innovation Human Input

The human input of tobacco commercial enterprises in scientific & technological innovation activities not only needs to consider the impact of the number of innovative personnel on the ability of scientific & technological innovation, but also needs to measure the construction of innovative teams. First, combining the indicators proposed by Ou et al. [17], Hou et al. [18], Zhong [19] and other scholars, the two indexes of "number of personnel in scientific & technological activities" and "percentage of staff with middle and senior titles" are selected , to measure the human input in scientific & technological innovation. The index of "number of personnel in scientific & technological activities" is measured by the number of scientific & technological personnel in tobacco commercial enterprises. The index of "percentage of staff with middle and senior titles" is measured by the percentage of senior and middle-level personnel to total employees in tobacco commercial enterprises.

At the same time, according to 2022 assessment form of Shaanxi Provincial Tobacco Company, "Selection program of innovative talent" is used as another index for the input of scientific & technological innovation talents, to measure whether the enterprise has selected innovative talents by Shaanxi Provincial Tobacco Company, and the status of establishment and implementation on innovative talent programs in local companies. The creation of scientific & technological achievements of enterprises requires not only the labor of innovative talents, but also the organization and cooperation of teams. According to the research results of Bao and Chen [7], the two indexes of "innovation team construction" and "formation of innovation teams in core business areas" is selected to measure the construction status of innovation teams in tobacco commercial enterprises.

### 4.1.2. The Indexes of Scientific & Technological Innovation Financial Input

The financial input of scientific & technological innovation in Tobacco commercial enterprises mainly includes two aspects. The first aspect is the investment in R&D, which refers to the direct input for R&D activities in Tobacco commercial enterprises. Combined with the research results of Yan and He [4], Chen [20] and other scholars, the index of "total expenditure on science and technology" is designed, reflecting the internal input of R&D funds, government financial support and other financial inputs of scientific & technological innovation in tobacco commercial enterprises. The second aspect is the management and service funds to carry out QC projects, competitions, the communication papers from the Academy and other scientific & technological activities. According to the research results of Ma et al. [6], the index of "implementation of scientific & technological activities" is designed to measure the financial input in scientific & technological activities in Tobacco commercial enterprises.

### 4.1.3. The Indexes of Scientific & Technological Innovation Material Input

The Indexes of material input focus on the non-monetary assets invested by tobacco commercial enterprises for scientific & technological innovation activities, including research platforms and innovation studios. Combined with the research results of Jia et al. [11], the two indexes of "formation of innovation studios in core business areas" and "establishment of joint laboratories and other joint innovation platforms with universities, research institutes,

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enterprises, etc." are designed to measure the material inputs to scientific & technological innovation activities of tobacco commercial enterprises.

## 4.2. Design of Specific Indexes for Scientific & Technological Innovation Output Ability

Scientific & technological innovation output refers to the effectiveness of the use of enterprise resources in the process of carrying out scientific & technological activities, which can directly reflect the scientific & technological innovation capacity of tobacco commercial enterprises. The output ability of scientific & technological innovation can be evaluated from output ability and transformation ability of scientific & technological innovation achievements.

### 4.2.1. The Indexes of Output Ability of Scientific & Technological Innovation Achievements

According to the evaluation indexes of Du and Zeng [21] and Tang et al. [22], the index of "scientific & technological impact of innovation achievements" is designed to indicate the patent research and development ability of tobacco commercial enterprises, including the number of effective invention patents and the number of patents with independent intellectual property rights in the tobacco commercial enterprises.

Reducing tar and harm is one of the key directions of scientific & technological innovation in the tobacco commercial enterprises. The index of "sales proportion of low-tar cigarettes" reflects the innovation output ability of tobacco commercial enterprises to a certain extent, so this index is designed to measure the effect of scientific & technological innovation output.

According to 2022 assessment form of Shaanxi Provincial Tobacco Company and the evaluation indexes of Ma [6], the indexes of "weighted value of scientific & technological achievements" and "weighted value of scientific & technological innovation achievement rewards" are designed as scientific & technological innovation output ability. Among them, the index of "weighted value of scientific & technological achievements" is calculated by multiplying the number of scientific & technological achievements acceptance by the corresponding weights; the index of "weighted value of scientific & technological innovation achievement rewards" is calculated by weighting the number of scientific & technological awards from provincial and local companies. Taking into account the characteristics of scientific & technological innovation output in the tobacco industry, the index of "project establishment China National Tobacco Corporation" is designed to measure the status of tobacco commercial enterprises in obtaining industry projects.

### 4.2.2. The Indexes of Transformation Ability of Scientific & Technological Innovation Achievements

The transformation ability of innovation achievements is the ability to transform scientific & technological achievements or patented technologies into products while realizing commercialization and scaling based on market and social demand [23]. According to the research results of Jia et al. [11], Ou [17], Chen [20] and other scholars, the index of "transformation ability of scientific & technological innovation achievements" is designed to reflect the transformation of technology and patents, mainly measuring the number of technology transformation contracts, the turnover of technology transformation, the number of contracts for the sale of patents, patent sales et al. This index is used to evaluate the transformation ability of innovation achievements.

## 4.3. Design of Specific Indexes for Scientific & Technological Innovation Basic Ability

The science and technology innovation foundation is an important component of the innovation environment of the ecosystem in tobacco business enterprises supporting the flow of resources, and plays an important role in the development of tobacco business enterprises. Thus, the

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indexes of innovation basic ability should be included in the evaluation of the scientific & technological innovation ability of tobacco business enterprises. According to the evaluation principles and characteristics of the tobacco industry, the evaluation indexes of scientific & technological innovation basic ability should be designed from strategic basic ability, institutional basic ability, material basic ability and cultural basic ability.

#### 4.3.1. The Indexes of Strategic Basic Ability

Innovation strategic planning can promote the technological innovation, product innovation and service innovation of tobacco commercial enterprises, and improve the management innovation of enterprises, which is an important basis for adapting to market changes, guaranteeing the sustainable development and increase the innovation ability of enterprises. Combining the research results of Ravari et al. [5], the index of "strategic planning for scientific & technological innovation" is designed to measure the strategic basic ability of innovation of tobacco commercial enterprises, which indicates the science and foresight of innovation strategic planning.

#### 4.3.2. The Indexes of Institutional Basic Ability

The institutional innovation can improve the effectiveness of enterprise governance, promoting the operation of tobacco commercial enterprises more efficient by regulating and restricting innovation activities in order to realize the efficiency and quality of innovation work. Therefore, the index of "institutional construction for scientific & technological Innovation" is used to reflect the innovation institutional construction of tobacco commercial enterprises, which mainly includes whether the enterprise standard institutional is complete and operates in practice, so as to measure the basic ability of tobacco commercial enterprises in scientific & technological innovation system.

#### 4.3.3. The Indexes of Material Basic Ability

Based on the research results of Tang et al. [22] and 2022 assessment form of Shaanxi Provincial Tobacco Company, the indexes of "construction of common technology platform" and "Institutions establishment for scientific & technological innovation" is designed to measure the basic ability of scientific & technological innovation of tobacco commercial enterprises. The index of"construction of common technology platform" focus on basic technologies that have been or may be widely applied in many industries or fields in the future, and strengthening the construction of common technology platforms is an important method to enhance the ability of scientific & technological innovation. The index of "Institutions establishment for scientific & technological innovation" should be used to measure whether the standardization organization is sound and complete.

#### 4.3.4. The Indexes of Cultural Basic Ability

As a branch of enterprise culture, innovation culture has the common characteristics of culture. Because the innovation practice has the characteristics of advancement and novelty, the tobacco commercial enterprises through the construction of innovation culture can guide and unite the staff innovation power to the development of enterprise innovation strategy, attracting and motivating the innovation talents to participate in the innovation work, so as to promote the improvement of the enterprise's innovation ability. Therefore, the index of "culture construction of scientific & technological innovation" is designed with the characteristics of the tobacco industry and evaluation principles, which reflects the basic capacity of scientific & technological innovation of the enterprise, and can be used to measure the construction of the innovation culture of tobacco commercial enterprises.

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## 5. Conclusion

Combined with characteristics of the tobacco commercial enterprises and the existing research results, some evaluation principles should be proposed including systematic principle, representative principle, available principle and dynamic principle for the scientific & technological innovation ability of tobacco commercial enterprises. Combining the innovation ecosystem, the evaluation index system of scientific & technological innovation ability of tobacco commercial enterprises is designed from the three dimensions, including input ability, output ability and basic capability of scientific & technological innovation. The evaluation index system is made of three first-level evaluation indexes and 20 second-level evaluation indexes. The system effectively combines quantitative and qualitative indexes, while more clearly, intuitively and comprehensively measuring the scientific & technological innovation ability of tobacco commercial enterprises.

In order to make the subsequent evaluation process simple and operational, qualitative indicators can be quantified using the grid acquisition method. Some methods including expert evaluation method, hierarchical analysis method, factor analysis method, entropy value method, set value statistics method and other methods are used to determine the weights of evaluation indexes and calculate the evaluation results, so as to provide scientific support for the evaluation of science & technology innovation ability of tobacco commercial enterprises, and then enhancing the innovation ability of the tobacco industry.

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## References

[1] H.Y. Gao: Construction of Strategic Emerging Industry Innovation Ability Evaluation Index System Based on the Innovation Ecosystem, Science Technology and Industry, vol. 20 (2020) No. 9, p. 41-44.

[2] T. Pan, L.H. Wang and F.C. Guo: Evaluation of China's Regional Innovation Ability Under the Background of Digital Economy-From the Collaborative Perspective of Science & Technology Service Industry and Advanced Manufacturing Industry, Journal of Industrial Technological Economics, vol. 41 (2022) No. 11, p. 42-47.

[3] K. Zhang, M.H. Zhang: Evaluation of Technological Innovation and Sustainable Development Capability Based on Cloud Model and Evidence Theory, Operations Research and Management Science, vol. 31 (2022) No. 4, p. 109-115.

[4] Y. Yan, M. He, L. Song: Evaluation of regional industrial cluster innovation capability based on particle swarm clustering algorithm and multi-objective optimization, Complex & Intelligent Systems, (2023) No. 9, p. 3547-3558.

[5] M.S.S. Ravari, E. Mehrabanfar, A. Banaitis, et al. Framework for assessing technological innovation capability in research and technology organizations, Journal of Business Economics and Management, vol. 17 (2016) No. 6, p. 825-847.

[6] Y. Ma, Y.Y. Xie, J.J. Hu, et al. A research on evaluation of the science and technology innovation ability of grass-root enterprises in Hubei Province, Science Research Management, vol. 39 (2018) No. 4, p. 10-20.

ISSN: 2692-7608 DOI: 10.6981/FEM.202311_4(11).0035

[7] Z. Bao, L. Chen: Construction of evaluation index system of technological innovation capability of Smes in manufacturing industry based on AHP method, IOP Conference Series: Materials Science and Engineering, vol. 612 (2019) No. 3, p. 1-7.

[8] Z.G. Zhang, D. Lin: The construction of innovation ability evaluation system for first-class manufacturing enterprises, Statistics & Decision, vol. 37 (2021) No. 4, p. 181-184.

[9] L.X. Sun, X.J. Wang, Y. Jin, et al. Evolution and Promotion Path of Scientific and Technological Innovation Ability of Chinese Agricultural Enterprises: Empirical Evidence from Listed Agricultural Enterprises, Issues in Agricultural Economy, (2022) No. 12, p. 4-18.

[10] J.F. Yu, X.B. Shi: Research on the Evaluation of Innovation Ability of Agricultural Machinery Equipment Manufacturing Enterprises Based on AHP, Scientific Management Research, vol. 40 (2022) No. 6, p. 100-106.

[11] T.Y. Jia, R Zhao and S.C. Chen: Construction of Evaluation System for Scientific and Technological Innovation Ability of Forestry and Grass Research Institutes in China, Science and Technology Management Research, vol. 43 (2023) No. 6, p. 88-93.

[12] J.F. Moore: Predators and prey: a new ecology of competition, Harvard business review, vol. 71 (1993) No. 3, p. 75-86.

[13] X.M. Xie, S.H. Yu and Y.H. Wu: Research Hotspots and Evolution Path of Foreign Innovation Ecosystem: Based on the View of Mapping Knowledge Domains, Science of Science and Management of S.& T., vol. 41 (2020) No. 10, p. 20-42.

[14] Q.L. Liu, X.F. Xie: Study on Generation Mechanism of Mass-innovation Space under Theory of Innovation Ecosystem, Science and Technology Management Research, vol. 38 (2018) No. 12, p. 240-247.

[15] R. Adner, R.Kapoor: Value creation in innovation ecosystems: How the structure of technological interdependence affects firm performance in new technology generations, Strategic management journal, vol. 31 (2010) No. 3, p. 306-333.

[16] Y.Q. He: Research on the Evaluation and Promotion Strategy of W Automobile Company's Technological Innovation Ability (Ph.D., Guangxi University, China 2021), p.19-20.

[17] G.J. Ou, Q. Yang and L. Lei: A research on evaluation of innovation ecological ability of national high-tech industrial clusters, Science Research Management, vol. 39 (2018) No. 8, p. 63-71.

[18] L.Z. Hou, W. Gao, H.M. Zhao, et al. Research on Evaluation of Science and Technology Innovation Abilities of Top 100 High-tech Enterprises in Tianjin, Tianjin Science & Technology, vol. 47 (2020) No. 5, p. 8-11, 15.

[19] M.G. Zhong: On the construction of evaluation index system of high quality development of tobacco enterprises, Accounting Learning, (2020) No. 31, p. 153-154.

[20] S.Y. Chen: Construction and Measurement of Evaluation Indicator System for Green Innovation Capacity of High-Tech Industries, Statistics & Decision, vol. 39 (2023) No. 3, p. 174-178.

[21] D.L. Du, X.C. Zeng. A dynamic and comprehensive evaluation of the innovation capability of China's high-tech firms from the perspective of speed characteristics, Science Research Management, vol. 38 (2017) No. 7, p. 44-53.

[22] X.W. Tang, Y. Sun and X.B. Tang: An evaluation of technological innovation capability of the advanced equipment manufacturing industry in China, Science Research Management, vol. 42 (2021) No. 9, p. 1-9.

[23] C. Cao, H. Jiang, M. Ye, et al. Construction and Demonstration of the Evaluation System of Innovation Ability of China's Regional Industrial Chain: Taking the Laser Industry as an Example, Science and Technology Management Research, vol. 43 (2023) No. 5, p. 46-53.