

## Research on Operation Mechanism of Chinese Ocean Energy Industry Technology Innovation System

DING Yingying, SONG Xiaohong

Harbin University of Commerce, Harbin, 150001, China

qingtian629@163.com

**Keywords:** technology innovation, innovation system, operation mechanism, ocean energy industry

**Abstract.** The energy crisis is a worldwide hot topic under the knowledge economy era. Increasing depletion of traditional energy continually challenges renewable energy. Exploring and developing new energy is a very urgent task. The paper aims to construct Chinese ocean energy industry technology innovation system, made of innovation subject subsystem study and innovation support subsystem study, and deeply analyzes operation mechanism study. It has important theoretical and practical significance to ocean economic development.

### Introduction

Technology innovation system is a subsystem of entire economic system of the ocean energy industry which is around the new knowledge application, communication, organization, management and new technology research and development. Due to technical innovation system has characteristic features of knowledge and technology, thus it is different from the traditional sectors of the economy in the operating mechanism and organizational management. Through the integration of wave energy, tidal energy, tidal energy, offshore wind and other ocean energy aspects of explicit knowledge, combined with tacit knowledge of experts and scholars, utilized product attributes of knowledge, the innovation system of ocean system will create a new round of knowledge and wealth and form a closed recycling economy. The production of ocean energy technology innovation not only serves the entire ocean energy industry, but also supports the value system of the entire national economy. To cater to the develop trend of world ocean energy technology innovation which has benefit for development of national economy, it plays an important directive role to research, improve, enrich our ocean energy industry technology innovation system for future sustainable development of the national economic and strategic emerging industries and built a scientific and effective industrial innovation cycle value chain for energy technology and ocean energy industry. On one hand, the production of technology innovation activities of ocean energy industry offers a variety of energy products and services to those who need innovation. On the other hand, Through the influence and infiltration, traditional industries make all public become its indirect consumers. Since the ocean energy develop to various types of emerging strategic industries, the whole constitutes a huge innovation economy system of ocean energy technology.

### Operation Process of Technology Innovation System

As shown in Figure 1. At the early stage of technological innovation activities, The ocean energy industry is affected by internal and external environmental factors and the pursuit of high profits. Whether it is universities, research institutions or technical companies, they are starting with initiation of technical innovation power and a variety of innovation factor, The company which has financial strength or skill initiated technological innovation activities firstly. On the basis of innovation achievement and knowledge spillover, they tap the market, find the most valuable opportunities. The papers, patents, business investment, new results of products, technologies are ultimate goal. Then they will carry out technical innovation behavior. This period mainly based on dynamic mechanism, dynamic elements and interactive elements play a vital role on the process of technology innovation<sup>[1]</sup>.

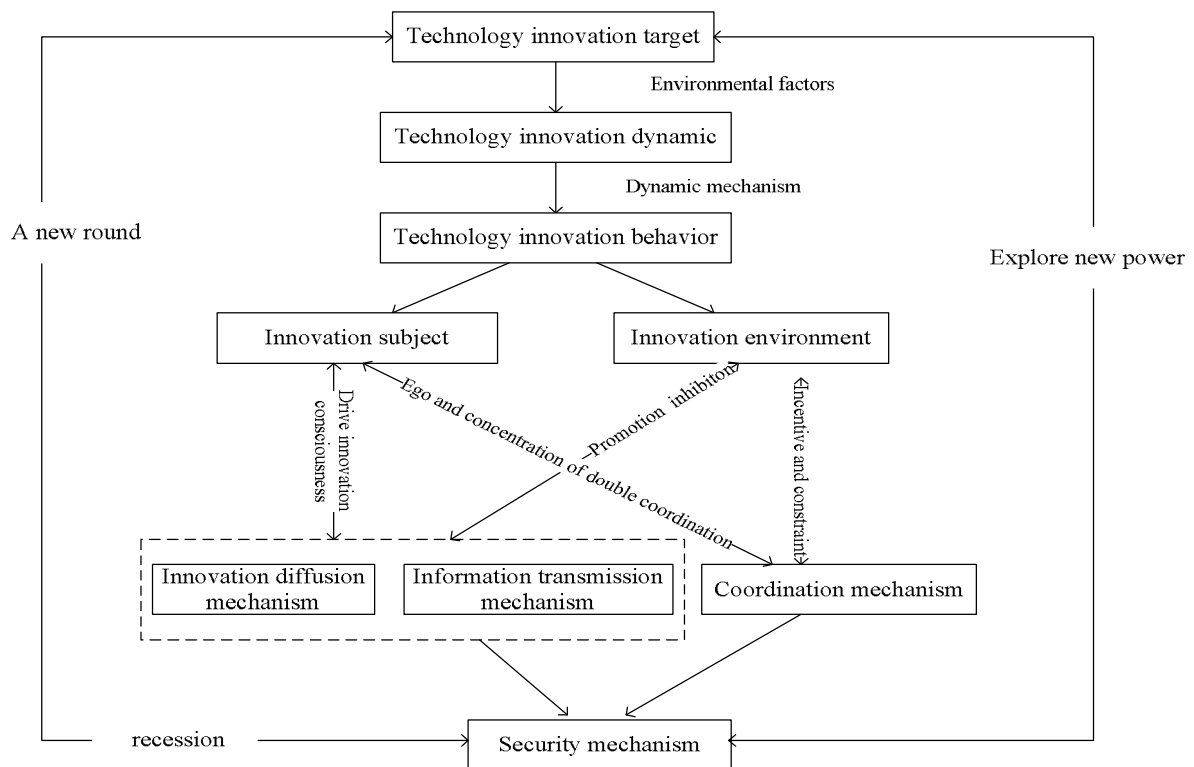


Figure 1. the Operation Process of Ocean Energy Industry Technology Innovation System

With the propose of technology innovation behavior, technological innovation activities carried out into the implementation phase. Innovation activities can not be automated with staffs and funding. It should rely on certain social organizations, research institutions, universities and technology-based enterprises to achieve innovative activities, Innovation activities need materials and technical condition. Innovation subsystem provides the policy environment, laws and regulations, This provides protection from the national level to provide guidance on innovation, support and management. Service environment and financial support and other resources can satisfy the need of markets of innovation activities and ensure the source of funding. The infrastructure is the prerequisite and basis for all activities<sup>[2]</sup>. If these resources can combine with innovation subject effectively, it can emphasis the importance of coordination mechanisms. Innovation system can coordinate the relationship between innovation subject and internal resources. Support system mainly performs constraint and incentive. By controlling resources and environment, constraint or stimulate innovation subject, the whole process includes materials, funds, policy and other aspects. In the stage of implementation of innovation activities, the coordination mechanism plays an important role, innovation diffusion mechanism and information transmission mechanism also plays an important role<sup>[3]</sup>. As shown in Figure 2, through exchange of innovative idea and concept, innovation subject can transfer and learn knowledge and experience to dig more valuable, more ideal and more breakthrough technology innovation concept. The process controls by promoting or inhibiting the innovation system. Of course, the process should occur before coordination mechanism, it can also occur with coordination mechanism. It indicates that technology innovation is not limited by time and space. Comparing with the start period, the effect of dynamic mechanism has declined in this stage. The development mechanism and coordination mechanism becomes more important.

When innovation achievement arise in the laboratory or other research institutions, the industry has entered a stage which achievements will transfer to other things. The task of this period achieve commercial value of technology innovation through technology market, third-party intermediary service organizations or business service organizations<sup>[4]</sup>. Through expanding sale channels, innovation environment and innovation resource affects innovation subject, then it can form entity of technology innovation achievement and display to social and domestic and foreign markets. This process requires safeguard mechanism to ensure translation of achievement, policy environment, it can also ensure

innovation process which can couple back information to government, industry, market and social, it can ensure entire innovation activities which can be abundant of human, material and financial resources. During this period, a important task is to summarize the present stage of innovative experiences and tap new innovations in addition to the transformation of achievement. It can help to launch a new round of innovation activities as soon as possible and take innovation behavior. Virtuous cycle can enhance technology innovation abilities of our ocean industry in a new round technological innovation cycle<sup>[5]</sup>. It can also enhance international competitiveness our ocean energy industry. In the stage of operation, security mechanism is the most critical, the effect of driving mechanism, developing mechanism or coordination mechanisms is relatively lower.

### Operation relations of technology innovation system

This paper constructs structure model of technology innovation system of ocean energy industry. It attempts to reveal the internal operation mechanism and regular of technology innovation system of ocean energy industry. It is shown in Figure 2.

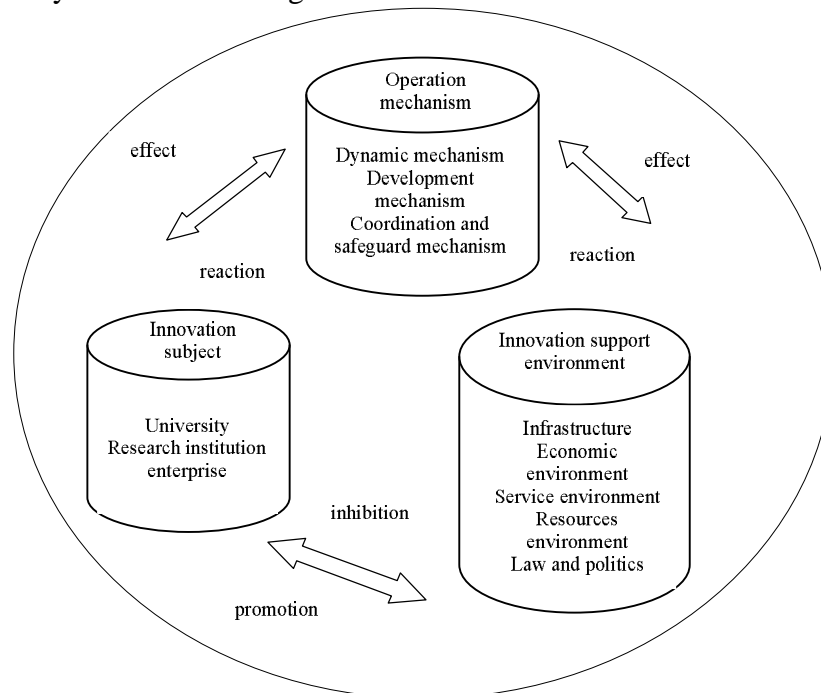


Figure 2. the Structure Model of Technology Innovation System of Ocean Energy Industry

#### (1)The main subject of Innovative includes the following aspects :

##### 1)Relationship between enterprise and colleges and universities

In our ocean energy industry technology innovation system, When the external development of environment in urgent need of new products and new technologies, Enterprise is the fastest actors which accept feedback when market demands change, by the promotion of dynamic mechanism, push the innovation layer in the enterprise to develop new technology<sup>[6]</sup>. Colleges and universities are the main channel in the transportation of professionals to the enterprise, with the R&D cooperation, achieving the flow of technical personnel in the enterprise and colleges and universities, on the one hand, Enterprises provide internships, research funding and other facilities to the university through sponsorship and other measures, strengthen awareness of corporate recruiters talents; on the other hand, college students take part in the daily operation and management in the enterprise through working and learning in internal of corporation, enhance their social practical experience.

##### 2)The relationship between enterprise and research institutions

If the technological innovations likened commodity words, enterprise is the main place to achieve its commercial value, the research institutions is the laboratory who make it happened. To pursue the maximum profit brought by commodity, enterprise don't pay close attention in the innovation research and development work, they often put more attention on the share of market and profit margins which

the technology innovation bring about. Research institutions embark on the R&D of scientific technology, it provide feasible technology research to enterprise through repeatedly experiments in the laboratory, each with its own advantages, the enterprise and research institutions carry out their duties, stabilize and improve technological innovation market. In our ocean energy industry technology innovation system, the enterprise and research institution forge an technology alliance through cooperation, on the one hand it can save cost bring from repeat work, on the other hand it can also decrease market fluctuate risks, jointly safeguard the coordinated development of technology market<sup>[7]</sup>.

### 3)The relationship between colleges and universities and research institutions

For our country's R&D project in ocean energy technology, the State Oceanic Administration would extract part of it to cooperate with the colleges and universities, for example, the State Oceanic Administration and the Harbin Engineering University collaborated with the 2012 Ocean special fund for renewable energy projects, "ocean energy development and utilization of the results of the integration of technical standards and specifications and integration."<sup>[8]</sup> Both sides use advantages to complete their own tasks, with a wealth of theoretical advantages the university published an excellent article related to the project, the State Oceanic Administration, with advanced R&D equipment to expand technological innovation experiments. Through transfer of periodic achievements, Both the communication of technical and information together to complete the technical innovations.

### **(2)The main subject of innovation support environment includes the following aspects:**

#### 1)the relationship between government and industry sectors with innovative subjects

Government policies and industrial sectors have a certain degree of tilt to the institutions of higher learning and scientific research institutions. Government and industry department believe that universities and research institutions is the birthplace of technological innovation activities. They both have different strengths. The government departments and industry increase the intensity of investment for the key disciplines and specialties through financial investment. In this way, it will not only provide convenient conditions for school expansion and construction of key discipline, but also provide the basis for cultivating excellent technical talents and building a good scientific research environment. Scientific research institution has an important advantage in the aspect of project application<sup>[9][10]</sup>. It can cooperate with industry sector or the government to solve the key issues which have been faced in the national economic development and provide theoretical basis for the development of the national industrial policy and external guarantee. Government and industry departments will give the corresponding preferential policies to the industry which need to be supported in the process of national economic development<sup>[11]</sup>. There is also a certain skewed for the company with creative potential or strong innovation ability on the tax policy, subsidies and corporate risk management. It will create convenient innovation through public policy services for its environment.

#### 2)The relationship between innovative secondary institutions and actors of institutional innovation

The innovative secondary institutions refers to financial institutions and intermediaries. Financial institutions and intermediaries provide protection to the technological innovation activities of enterprises, scientific research institutions by the resource circulation of enterprises, research institutions and universities. Financial institutions compensate in enterprises, research institutions and universities in the form of funds to solve the problem of funding shortage problems during the process of technological innovation<sup>[12]</sup>. This measure will provide funding channels for the smooth development of innovative activities. Intermediary agencies primarily responsible for commercial operation of innovative product to ensure that innovation and technological achievements can successfully achieve its commercial value. Financial institutions and intermediary agencies throughout the course of the technological innovation activities. It will give assistance to the main innovation complete the innovation activities, at the same time provide new business activity to the main innovation.

#### 3)The relationship between innovation subject and other supporting environment

Innovation subject provides the manpower and material resources to technology innovation system of the ocean energy industry. Innovation auxiliary institutions provide capital and commercial supporting to technology innovation system of the ocean energy industry. And these activities emerge and develop in the external environment, such as macroeconomic environment, legal and political environment<sup>[13][14]</sup>. Our ocean energy industry will changes with the change of external environment, their need of manpower, material resources and capital will changes. On the contrast, innovation consciousness of enterprises, institutions and scientific research institution affects the external environment. Innovation activities of innovation subject is closely related to political environment, financial institution, intermediary and the macro economic environment. In a timely manner to understand new development of domestic and international market of ocean energy industry can realize the commercial value of technology achievement of ocean energy industry.

## Conclusions

Operation mechanism is the key to technology innovation system of our ocean energy industry. Similar to any industries, operating mechanism is the blood of industry development. It can link innovation subject with innovation environment, the relationship of the three parts is inseparable. Operation of technology innovation system of our ocean energy industry depends on collaboration of the various subsystems and function of internal subsystem. Operation of technology innovation system of ocean energy industry depends on collaboration of the various subsystems and function of internal subsystem. Each subsystem needs mutual cooperation to ensure their operation which can cross the limitation of system, it plays a role of bridge. Through their unique advantages in resources, they can cooperate to push the system orderly. The entire operating mechanism of technological innovation system has effective or ineffective impact to subsystem and supporting subsystem of innovation system. In the innovation period of industry, innovation subject subsystem and supporting subsystem form chain innovation cycle. Their mechanisms dispersed in all aspects of the innovation process. It has become an important part of technology innovation system of ocean energy industry. It plays an decisive role of innovation activities of innovation system.

## Acknowledgements

The paper is funded by Harbin University of Commerce Doctoral Research Start-up Project(14rw25), Heilongjiang Province Natural Science Fund Project(G201320), Heilongjiang Province Philosophy Social Sciences Research Plan Project(12B071), the Ministry of Education Humanities and Social Science Research Projects(14YJC630142), Heilongjiang Social Science Research Projects(14D007).

## References

- [1]Yu Chen. The economic explanation of innovation system: Innovation Economy[J].China Technology Forum,2010,(6):17-24.(in Chinese)
- [2]Yuping Chai. Ocean renewable energy technology development status and countermeasure[J].Renewable Energy,2011,29(2):152-156.(in Chinese)
- [3] Qiubiao Jiang. The review of Ocean energy research and development[J].Ocean Development and Management,2008,(12):22-25. (in Chinese)
- [4]Gang Zhao.The analysis of investment prospects and the trend of new energy technology[J].Technology Innovation and Productivity,2010,(197):9-15. (in Chinese)
- [5]Ying Li. Research on the construction of high-tech enterprise intellectual property management system[J] . East China Economic Management,2008,(9):98-101. (in Chinese)

- [6]Jianxin Guan. Research on the intellectual property management of China high-tech enterprise [D].Harbin Engineering University,2008.(in Chinese)
- [7]Xielin Liu. China regional innovation ability research report[M].Beijing: Intellectual Property Press,2007. (in Chinese)
- [8]Edwin Mansfield.Academic research underlying industrial innovations: sources, characteristics and financing[J].The Review of Economics and Statistics,1995,1:60-63.
- [9]Feldman M.P.The geography of innovation[M].The Netherlands:Kluwer Academic Publishers,Dordrecht,1996.
- [10]Freeman,Soete.The economics of industrial innovation.The MIT Press.Cambridge.MA,1996.
- [11]Lee Branstetter. Exploring the link between academic science and industrial innovation[R]. Discussion paper series APEC study center,2004.
- [12]Dongqi Yang. Empirical research on the construction of independent innovation environment of high-tech enterprises in China[J].China Technology Forum,2008,(2): 83-86. (in Chinese)
- [13]Qing Song. Empirical research on the hatching factors of promoting the growth of high-tech enterprise[J]. Science of Science and Management of S.&T.,2011,(5):108-114. (in Chinese)
- [14]Li Liu.The function of innovation system[J].Studies in Science of Science,2011,29(8):1121-1123. (in Chinese)