



Research on the Innovation Chain and Implementation Path of Science and Technology Activities - Taking Shenzhen Power Supply Bureau as an Example

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Abstract. This article first analyzes the conceptual connotation, structural characteristics, and position and logical relationship of the innovation chain in social production. On this basis, relevant concepts of the industrial chain are identified, and the internal and external factors that affect the bidirectional integration of the innovation chain and the industrial chain are further explored. The bidirectional integration mechanism of the innovation chain and the industrial chain is thoroughly examined from the strategic, structural, and evolutionary development levels. Finally, the basic factual relationship of the innovation chain and the basic path of dual chain integration are proposed: fully leverage the government's guiding role to promote deep integration of the innovation chain and the industrial chain; Layout the industrial chain around the innovation chain and construct a new industrial division of labor system; Deploy innovation chains around the industrial chain to promote collaborative innovation between industry, academia, and research; Build a good social innovation ecosystem with multi chain integration, and achieve a virtuous cycle of technology, industry, and finance.

Keywords: innovation chain, industrial chain, social innovation ecosystem

1 Introduction

In the current context of international economic integration, competition among enterprises has gradually shifted from the previous competition over capabilities and resources to the degree of systematic collaboration among various aspects of the enterprise. Fully leveraging the role of technology as the primary productive force and innovation as the primary driving force, accelerating the deep integration of innovation and industrial chains, is an important measure for China to address the restructuring of global industrial and supply chains, and also a key measure for China to enhance industrial capabilities and achieve high-quality economic development. With the fundamental purpose of meeting the people's growing needs for a better life, we should adhere to the concept of system, strive to achieve "four leading positions in the whole network", achieve "China's first, the world's best".

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Y. Chen et al. (eds.), *Proceedings of the 2023 2nd International Conference on Public Culture and Social Services (PCSS 2023)*, Advances in Social Science, Education and Humanities Research 787,

https://doi.org/10.2991/978-2-38476-130-2_49

2 Innovation chain of scientific and technological activities

2.1 Definition of Innovation Chain in Science and Technology Activities

Innovation chain is a functional chain structure model that revolves around one or more core entities, using innovation as a link to connect complementary nodes. Through mutual cooperation and influence, it realizes the economization of knowledge and the optimization of innovation systems. The factors that affect the cultivation of innovation chains include regional resources, knowledge, technology, funds, personnel, innovation promotion policies, and other environmental factors, involving multiple organizational structures such as enterprises, research institutions, research intermediaries, financial institutions, and governments. [1]

The innovation chain exhibits significant characteristics such as market orientation, value creativity, diverse subjectivity, and resource integration. Firstly, the innovation chain has market orientation, and market demand has a strong guiding and driving effect on the basic research and technological development at the front end of the innovation chain. Innovative products or services ultimately need to meet the needs of consumers. Secondly, the innovation chain has value creativity, and the process of innovation leads to the creation and increase of value. The generated value will transfer between different innovation entities along with the innovation process, thus making the innovation chain and the value chain complementary and integrated. Thirdly, the innovation chain has multiple subjectivity, with different innovation entities playing a leading role in different links of the innovation chain. Universities and research institutes are the main suppliers of basic research, enterprises are the main drivers of technology industrialization, the government is the maker and regulator of innovation policies, and technology service intermediaries such as financial institutions are the integrators of innovation resources. Finally, the innovation chain has resource integration. By coordinating and arranging various types of innovation resources, the innovation chain realizes the full flow of innovation resources in the innovation chain. including funds and raw materials, knowledge, talent, and information. Through resource integration, the value of innovation resources is maximized.

2.2 Definition of Innovation Chain in Science and Technology Activities

Firstly, the innovation chain is composed of several functional nodes. The innovation chain divides innovation activities into several functional nodes, and the nodes ultimately generate innovation through interaction [2] There is a certain degree of complementarity between nodes. This complementarity leads to a clear division of labor relationship between nodes, where nodes obtain different types or fragments of knowledge through division of labor. At the same time, the result of division of labor is an increasing degree of dependency between nodes.

Secondly, there is a collaborative relationship between nodes that is linked by innovation. According to the theory of resource allocation, independent economic organizations can form symbiotic entities by sharing similar or complementary resources. The formation of this symbiotic entity leads to the improvement of the direct or indirect resource allocation efficiency within or outside the economic organization, which is called a symbiotic economy. The symbiotic economy can bring about both an increase in organizational benefits and an increase in social welfare.

Furthermore, there is at least one core entity on the innovation chain. Generally speaking, "leading" enterprises with core technologies and well-known brands belong to the core entities of the innovation chain. The core subject is the organizer, leader, and controller of the innovation chain. If the core is lost, the innovation chain loses direction and it is difficult to achieve system optimization.

Furthermore, technological resources are the material foundation on which innovation activities rely. Technological resources include four aspects: technological human resources, technological financial resources, technological material resources, and technological information resources. These four elements are essential for innovation activities, and effective control of them can shorten innovation time and reduce innovation costs.

Finally, the innovation chain is influenced by the external environment. The innovation chain is not isolated and closed. Under the guidance of market demand and innovation promotion policies, core entities are prone to generating innovation demand and are committed to organizing and leading the innovation chain, as shown in Fig. 1.

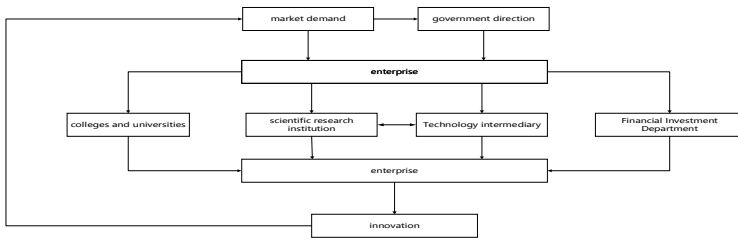


Fig. 1. Innovation chain structure diagram from the perspective of the same industry

2.3 Innovation Chain Development Model

There are three modes of innovation chain: linear innovation chain, nonlinear innovation chain, and circular innovation chain. The linear innovation chain starts with basic research and ends with product industrialization. For example, in the early stages of industrialization, industrial products flow unidirectionally from research and development, testing, production, and market. Ultimately, consumers fail to evaluate the performance of the products, which is not conducive to product improvement and the next step of innovation. The innovation process presents a single direction of flow. The innovation of nonlinear innovation chain refers to the simultaneous interaction and influence between technology and market, transforming linear models into nonlinear models. Entering the consumer era, ultimate consumers and even intermediate product users can evaluate and provide feedback on the front-end design and production of products

through commodity circulation, social media, and other channels, participating in the future innovation process. At this time, the innovation chain presents a two-way interactive state. The organizational boundaries become more open, and each innovation link is dispersed and integrated with market demand. The entire innovation process is fully integrated, with multiple entities guiding and driving the development of the innovation chain.

2.4 Organizational Structure of the Innovation Chain

Overall, the innovation chain emphasizes value creation and value appreciation, with multiple innovation entities. The core value lies in the industrialization of innovation achievements, thereby achieving continuous iteration and upgrading from a linear innovation chain to a circular innovation chain, as shown in Fig 2.

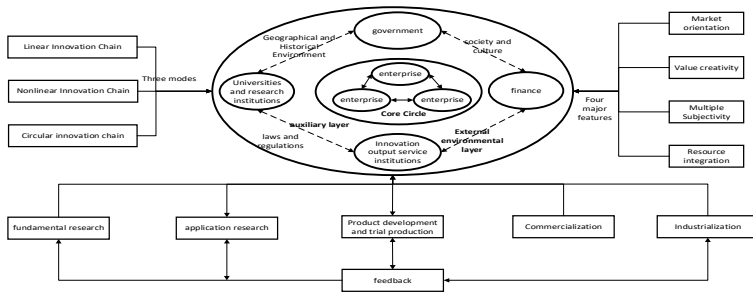


Fig. 2. Organizational Structure of the Innovation Chain

3 Implementation Path of Innovation Chain in Science and Technology Activities

3.1 Innovation Chain from an Industrial Perspective

Within the same industry, enterprises, universities, research institutions, and governments collaborate with each other to fully leverage their respective advantages and form an innovation chain that combines industry, government, academia, and research. In Figure 2, enterprises propose human resources and knowledge innovation requirements to higher education institutions based on market demand and government guidance, obtain research and development results or patented technologies from scientific research institutions, search for technical information or seek intermediary services from technology intermediaries, obtain financial support from financial investment departments, and participate in one or more innovation links such as product development, design, and marketing, ultimately forming market-oriented innovation.

The innovation chain is composed of central nodes, branch nodes, and terminal nodes. Central node A is the source of the innovation chain, providing technology and resource foundation for other industries on the chain. Branch nodes (A ... An) are nodes with parallel relationships that are extended from the central node, generally

manifested as the application and deepening of technology and knowledge in various industries. Terminal nodes refer to the re division of labor among industries in different fields.

3.2 Innovation Chain from a Functional Perspective

In Figure 3, if divided according to the process of value creation, the innovation chain can be refined into multiple steps such as basic research, applied research, and technological development, forming a structure called the innovation value chain. At first, the innovation value chain mainly occurred within individual enterprises. With the rise of Open innovation, more and more enterprises choose to outsource non core links, which makes innovation value chain appear more in cross enterprise cooperation.

Based on comparative advantages, different division of labor has been formed among enterprises, resulting in the emergence of professional technology developers, manufacturers, etc. Technology developers impart innovative knowledge to production manufacturers. Then, marketing service providers push innovative products to consumers. In Figure 4, the front of innovation chain is the innovation supplier. The rear is not only innovation demand side, but also provides feedback on innovation, allowing the front to continuously improve based on feedback and form re-innovation. A one-way arrow indicates the direction of innovation; the bidirectional arrow indicates participating entity not only focuses on themselves, but also provides feedback to each other.

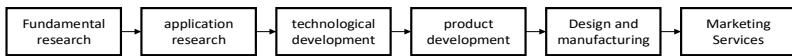


Fig. 3. Innovation Value Chain Structure Diagram

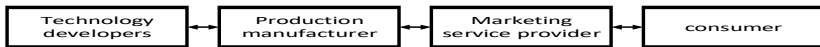


Fig. 4. Innovative Supply Chain Structure Diagram

4 Multidimensional Benefits of Innovation Chain in Science and Technology Activities - Based on Shenzhen Power Supply Bureau

4.1 Case analysis

Shenzhen Power Supply Bureau has always attached great importance to technology innovation. Since 2012, the bureau has carried out a series of smart grid related research, including the research on the overall technical architecture of smart grid, the research and development of key technologies and key equipment, etc.

In recent years, Shenzhen Power Supply Bureau has adhered to the special zone genes of leading and testing, actively exploring and piloting the new technology innovation organizational model of Southern Power Grid Company, constructing the "7 1" new technology innovation system, and promoting the creation of multiple heavy-weight innovation achievements. Among them, the first two-way interaction

demonstration project of vehicle network in the Guangdong–Hong Kong–Macao Greater Bay Area will be built to provide new charging modes and service experiences for new energy vehicles; Build the first national demonstration of "5G+full stack localization+digital power grid" application, providing demonstration templates for various regions of the country to carry out "5G+" and "localization" applications.

4.2 Exploring the Path of Building an Innovation Chain

4.2.1 Focus on promoting the "four chain synergy" of industrial chain, innovation chain, talent chain, and education chain.

Improve the collaborative development ability of innovation chain, industry chain, talent chain, capital chain, and other multiple chains. Accurately deploy innovation chains to address key and difficult issues in the development of the industrial chain, enhance the technological originality and practical application transformation capabilities of scientific and technological innovation achievements; Guide innovation resources to gather in various links of the industrial chain and improve the connection and coordination between science and technology and industrial development. Focusing on the bottlenecks and bottlenecks in the development of the innovation chain, we will carry out talent introduction and education. Develop a funding chain layout around the innovation chain, increase research funding to provide strong support for innovation process, and strengthen the accuracy, effectiveness, and sustainability of the support.

4.2.2 Enhance the original innovation ability and innovation driven development ability of technological innovation.

Enhance the original innovation ability and innovation driven development ability of technological innovation. Strengthen the construction of high-level scientific research institutions and other strategic scientific and technological forces, continuously improve the level of basic research and original innovation capabilities, and expand the supply channels and capabilities of cutting-edge technologies. Enhance the transfer and diffusion capabilities of technological innovation achievements, enhance the closeness and matching between supply and demand sides of technological achievements through technology service intermediaries, achievement trading platforms, and achievement display conferences, improve the industrialization efficiency of technological innovation achievements[3].

4.2.3 Deploy innovation chains around the industrial chain to promote collaborative innovation between industry, academia, and research.

Starting from the chain structure of innovation chain and industrial chain, strengthen the extension and integration of innovation chain towards industrial chain direction. We should try to focus on the development needs of the industrial chain or choose the weak or weak links of technological support in the industrial value chain, set up scientific and technological innovation projects, and deploy innovation chains. For example, key core technologies that constrain the smooth flow and development of the industrial

chain can be jointly addressed through joint efforts with multiple innovative entities and multiple innovative elements, continuously promoting the construction of an industrial technology joint innovation chain through technological innovation; It can also build a docking platform between enterprises and innovation carriers[4].

4.2.4 Building a multi chain integrated ecosystem to achieve a virtuous cycle of technology industry finance.

The bidirectional integration mechanism of innovation chain and industrial chain is not only influenced by the inherent factors of scientific research innovation and industrial development itself, but also by the social innovation ecological environment and innovation conditions. Therefore, it is necessary to highlight market orientation and fully leverage positive role of the market as a driver of innovation demand. In addition, due to the different roles played by scientific research institutions and enterprises in different links and stages of the innovation chain and industrial chain, promoting the two-way integration of the industrial chain and innovation chain must fully coordinate the interests of various innovation entities, reduce interest disputes and conflicts, and improve the innovation distribution mechanism; Thirdly, in terms of talent environment. To truly form a good scientific and technological innovation atmosphere that respects knowledge and values talents, and to effectively support various innovative entities to actively carry out and participate in scientific research and technological development activities, we need to optimize the investment and financing environment, expand diversified investment and financing channels, establish and gradually improve a diversified investment and financing system, play the role of the market, and provide sufficient and diversified financial support for the innovation chain and industrial chain. [5]

5 Conclusion

The innovation chain has the characteristics of competitiveness and sustainability, which meets the objective needs of technological development. It has the functions of enhancing independent innovation capabilities, achieving economies of scale, and consolidating cooperative relationships. This article suggests that it is necessary to optimize the innovation environment of Shenzhen Power Grid, highlight the focus of innovation cooperation, build a multi chain integration ecosystem, strengthen the original innovation ability and innovation driven development ability of technological innovation, and focus on promoting the "four chain synergy" of industrial chain, innovation chain, talent chain, and education chain.

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