

A Review of the Research on the Influencing Factors of Enterprise Key Core Technology Breakthrough

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Abstract: The breakthrough of key core technology is a theoretical and practical strategic issue to realize the rise of the country. This paper analyzes the concept of key core technology and its breakthrough and analyzes its characteristics. Based on the perspective of participants, this paper summarizes the influencing factors of key core technology breakthroughs in enterprises: internal and external enterprises, universities and scientific research institutions, and government. This paper expands the relevant research on key core technology breakthroughs and provides inspiration for enterprises to carry out key core technology research and breakthrough practices.

Keywords: Key core technology breakthrough; Concept discrimination; Technical features; Influencing factors

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1. Introduction

At present, with the rapid development of science and technology, the competition among big countries is increasing. In 2018, to enhance the global competition for national key technologies, the Chinese government put forward the concept of “key core technology” for the first time. The breakthrough of key core technology is complex system engineering, which has attracted wide attention in academia. Currently, the theoretical research on key core technology breakthroughs is in its infancy, and the concept is confusing. The research on key core technology mainly focuses on the connotation, influencing factors, modes, paths, and mechanisms of key core technology breakthroughs, and the relevant theoretical research needs to be further deepened^[1,2].

2. Key core technologies and their breakthroughs

The connotation definition of key core technology is the premise of its theoretical research and practical exploration. The concept of key core technology comes from innovation and policy practice. Its connotation refers to the technology population that plays a subversive role in a certain industry or technology field in the international competitive environment, is in the core position of the field, can realize industry remodeling, and has substantial help for technological breakthroughs.

For the key core technology, the current academic circles generally agree that it has the dual attributes of “key” and “core” and is a technology that is at the core of and plays a key role in a specific historical period, a specific industry, or field. The research holds that the key core technology is the technology that can control the technological commanding point in the industrial chain. It is critical, highly invested, difficult to transcend, and irreplaceable, and needs to be obtained through continuous high-intensity research and Development (R&D) investment^[3]. Scholars define key core technologies from four perspectives and believe that their characteristics include high investment, high complexity, monopoly, and commerciality^[4].

The breakthrough of key core technologies of enterprises refers to the non-linear and transitional changes realized by enterprises in the field of key core technologies to break the monopoly and blockade of technologies, including the initial breakthrough demand based on strategic needs, to the functional breakthrough, performance breakthrough, reliability breakthrough and frontier breakthrough of key core technologies in turn, and finally to the overall performance of key core technologies from scratch and from existence to excellence^[5]. The innovation chain and the industrial chain are interdependent, integrated, and coordinated, which is the key to promoting the key core technology to achieve breakthrough innovation.

3. Internal factors

Enterprise is a collection of knowledge^[6]. Knowledge is the core of innovation and development. The essence of technology is knowledge. Therefore, the enterprise is an important subject of key core technology breakthroughs. To break through the key core technology, enterprises need to constantly update and iterate the existing knowledge and finally form new knowledge, which will help enterprises tackle the key core technology.

3.1. The individual

At the moment, interdisciplinary research in scientific and technological innovation activities has become the main theme. The cross-integration of multi-disciplinary knowledge is the general trend. The knowledge of any single discipline is often difficult to sustain in the face of complex problems. Enterprises have a certain degree of knowledge in multiple disciplines, which not only helps to carry out technological innovation but also better identify technological opportunities and lead technological changes.

Technical knowledge exists among individuals. Individuals accumulate and update their technical knowledge through continuous learning and accumulation of experience^[7]. Enterprise employees usually work according to the set goals, and the common goals will promote the exchange and sharing of internal knowledge, thus promoting the innovation of knowledge. With newer knowledge created within the enterprise, the more knowledge stock, and the higher the ability for knowledge transformation. Enterprises should maintain the autonomy and continuity of interdisciplinary talent introduction, accelerate interdisciplinary basic research planning, optimize basic research and development structure, strengthen the quality of key core technological innovation, and pay attention to the two-way cultivation of the quantity and quality of key core technological talents.

3.2. The organization

The organization is composed of two or more individuals, which gathers the technical knowledge of all individuals and is a collection of technical knowledge. Organizations can learn technical knowledge from each other by manifesting technical knowledge in individuals into knowledge at the organizational level^[8]. In the process of internal R&D, enterprises will continue to absorb R&D personnel, broaden the breadth of the knowledge base, realize knowledge sharing and transfer through the benign interaction between differentiated teams, and constantly create new knowledge.

4. External factors

With the rise of R&D risks and costs, a single entity often cannot have all the resources for key core technology breakthroughs, and cooperation between different innovation entities has become an important form of technological innovation activities^[9]. Knowledge exchange and sharing among employees within the enterprise can strengthen the absorption of new external knowledge. Additionally, the absorption of new external knowledge by enterprises can increase the stock of knowledge and provide the basis for the innovation of internal knowledge.

Industry-university-research cooperation is an important way to effectively connect scientific research and market demand and can promote regional innovation and economic development to form a benign relationship of interaction, linkage, coupling, and coordination^[10]. The enterprise has the resource advantages of capital, site, and achievement transformation and the sensitivity to the key core technology breakthrough direction, and the academic research institution is the main technical force of collaborative innovation. The two sides carry out technology research and development cooperation based on the principle of complementary advantages and revenue sharing. Government departments encourage enterprises to carry out strategic alliance cooperation, promote the deep integration of industry, university and research, and build a platform for knowledge sharing of key core technologies in various forms.

4.1. External enterprises

The technical knowledge that the enterprise itself does not have can learn the technology from the external enterprises through cooperation with the external enterprises, to finally obtain the technology. The research shows that network embeddedness indirectly promotes technological innovation through the intermediary role of knowledge creation^[11]. From the perspective of the evolution of inter-organizational relationships, the two companies will gradually develop and refine a stable model in the process of multiple cooperation, that is, inter-organizational routines^[12].

Tesla has established innovative alliances with competitors such as BMW and Nissan through open-source patents, which not only improves the company's own R&D capabilities but also obtains high profits in the electric vehicle industry. Philips has formed an innovative alliance with enterprises in the form of patent licensing and business outsourcing, absorbing the latest product ideas and R&D programs into its own technological innovation system, to maintain the leading position of core technology.

4.2. Colleges, universities, and scientific research institutions

Colleges and universities are the main fronts for training talent and a large platform for gathering talent. It is the path for colleges and universities to break through the key core technologies by giving full play to the advantages of talent training and scientific research in colleges and universities and injecting innovative talents at all levels into the local areas. Scientific research institutions should strengthen the construction of science and technology infrastructure^[13]. The construction of science and technology infrastructure is the material and technical basis for supporting key core technologies and enhancing regional innovation capabilities.

Universities and scientific research institutions are mainly engaged in basic research and can constantly output theoretical guidance for enterprises to guide enterprise practice. There is a wide range of heterogeneity in knowledge between industry-university-research institutions. When the heterogeneity is relatively high, it can ensure the knowledge demand for core technology breakthroughs and promote knowledge sharing in general. The higher the heterogeneity, the more inclined the innovation subjects to carry out learning and R&D activities. The more different knowledge is interactively combined, the more likely it is to create new knowledge and achieve knowledge innovation^[14]. Cooperation among universities, research institutions, and enterprises

provide a broader source of knowledge sharing, thus laying a solid foundation for knowledge creation.

4.3. Government departments

Government departments can invest funds to support enterprise R&D and can also build a knowledge-sharing platform to promote the flow of knowledge. To create a good regional innovation environment and build and improve the regional innovation system, the government gives indirect support to the control means, including improving the public service system of science and technology, the construction of science and technology infrastructure, etc., which affects the innovation strategy of enterprises in the region with the flow and allocation of innovation elements ^[15]. A higher level of government indirect support can break the barriers to the flow of innovation factors by building a sound scientific research infrastructure. Abundant resource acquisition channels can help enterprises obtain complete innovation resources, increase the confidence of enterprise managers in the return of R&D investment and future development prospects, and enhance the willingness of enterprises to undertake R&D projects with high-risk coefficients and long income cycles. The government's indirect support can create a variety of information-sharing channels such as scientific and technological achievements information-sharing platforms and industry technology exchange meetings, which is conducive to the search for knowledge needed by enterprises.

The innovation platform jointly built by the state and local governments to meet the needs of local industries is a long-term strong supporting project, such as national laboratories, national key laboratories, and national innovation center cities. The national laboratory is a strategic scientific and technological force, carrying out basic and cutting-edge high-tech research. To improve regional innovation ability and local research ability, the national key laboratory carries out regional characteristic research. The national innovation center city provides technical supply and support for regional industrial upgrading by promoting the transformation and industrialization of scientific and technological achievements for key core technology research and development and industry-university-research cooperation ^[16].

5. Conclusion

Based on the existing research and practice, this study clarifies the connotation and characteristics of key core technologies and analyzes the influencing factors of key core technology breakthroughs from the perspective of participants. The following conclusions are drawn:

- (1) Individuals and organizations within the enterprise play a decisive role in the breakthrough of key core technologies through the accumulation and updating of technical knowledge.
- (2) Through cooperation with external enterprises to obtain technical knowledge to help key core technology breakthroughs.
- (3) Universities and research institutions support the breakthrough of key core technology and core technology and provide theoretical guidance for enterprise practice.
- (4) Government departments provide basic resources for key core technology breakthroughs through financial support and building knowledge-sharing platforms.

This study expands the research on the influencing factors of key core technology breakthroughs of enterprises. Based on the perspective of participants, this paper expounds on the influence of key core technology breakthroughs from the perspective of technical knowledge and provides a reference for subsequent related research. Analyzing the influence of each subject on the breakthrough of key core technologies of enterprises provides a theoretical reference for the practice of key core technologies of enterprises.

Disclosure statement

The authors declare no conflict of interest.

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