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on topic:
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List of questions, that subject to research:

1. THEORETICAL ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES
2. ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES
3. CASE ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES

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ABSTRACT

In the era of deep dependence of the global economy on innovation-driven, technology R&D activities are of great value to export-oriented enterprises. At present. the international and domestic macroeconomic environment is undergoing systemic changes. Teak external demand has weakened the driving role of exports in national economies, and export-oriented enterprises need to shift to non-price competition with quality as the core. Under such circumstances. it is urgent to accelerate the innovation- driven transformation of enterprises, achieve scientific and technological self-reliance. and promote high-quality development of export trade. In the highly competitive international market. enterprises with innovative technology and potential are more flexible and adaptable, and can better adapt to changes in the market and fluctuations in demand. Improving the technological innovation ability of enterprises i8 also forced by the situation of reshaping the new advantages of international cooperation and competition, and promoting the new development pattern of double cycles at home and abroad.

KEYWORDS

MANAGEMENT, TECHNOLOGICAL, DEVELOPMENT, EXPORT, ENTERPRISE

CONTENTS

INTRODUCTION

Against the backdrop of still sluggish consumer demand and intensifying trade protectionism and geopolitical conflicts, the openness of the world has generally shown a downward trend. The war in Ukraine, the interdependent decoupling of Sino-US trade and the aftermath of Brexit have shaped important bilateral trade trends. Countries' trading partners have become less diverse, global trade has become more concentrated in major trade relationships, and global trade patterns are increasingly influenced by geopolitics[1]. However, in this context, there is still great potential for new products and new forms of business in the field of foreign trade, and the dividends of opening up will continue to be released. For example, in 2022, China's net export of goods and services will contribute 17.1% to GDP growth, boosting GDP growth by 0.5 percentage points. Expanding export business will not only help realize a broader development space and better economic returns, but also contribute to China's economic growth. It will also accelerate the construction of a modern industrial system and promote high-quality economic development.

New formats and models such as cross-border e-commerce, overseas warehouses, digital trade, and cloud outsourcing are vital forces in the development of import and export trade, and they are also important trends in the development of international trade. Accelerating the development of new forms and models of trade will help promote high-quality trade growth and foster new advantages in international economic cooperation and competition. In the early

days, due to climate, consumption habits, infrastructure and other factors, the Some countries' market is not sensitive to online consumption, but the outbreak of the epidemic has forced the rapid development of Some countries e-commerce companies, and constantly improve their Logistics, payment and other service channels, but also for foreign companies 1ooking for new international markets to provide a good opportunity. By expanding export business, enterprises can disperse market risks to different countries and regions, reduce the dependence on a single market, and enhance the stability and anti-risk ability of enterprises.

With the acceleration of global digitization, cross-border e-commerce and digital trade have become important engines driving the development of international trade. The outbreak of the COVID-19 pandemic has led to a significant increase in consumer demand for online shopping and digital services, providing enormous development opportunities for cross-border e-commerce platforms. By establishing cross-border e-commerce platforms, businesses can more easily reach global markets, achieve cross-border sales of goods, and streamline logistics and delivery. The construction of overseas warehouses further optimizes the logistics process of cross-border e-commerce, shortens delivery times, and enhances the shopping experience for consumers. Digital trade, through digital technology, breaks the temporal and spatial constraints of traditional trade, enabling transactions and cooperation on a global scale. Cloud outsourcing provides businesses with a more flexible way of managing human resources, reducing production costs, and improving production efficiency.

Against the backdrop of global economic integration, the Belt and Road Initiative provides enterprises in countries and regions along the route with broader markets and deeper cooperation opportunities. By participating in the construction of the Belt and Road, enterprises can leverage intergovernmental cooperation frameworks to explore new international markets, expand business reach, and achieve diversified trade layouts. Meanwhile, the infrastructure construction and industrial upgrading needs of countries and regions along the route also provide abundant business opportunities for enterprises. Enterprises can participate in local economic development through technology transfer, project investment, and achieve win-win development. At the same time, the consumption potential of countries and regions along the route also brings tremendous business opportunities for enterprises. By expanding export business, enterprises can achieve economies of scale and enhance competitiveness.

The world today is undergoing profound changes unseen in a in century, with rising protectionism, a sluggish world economy and a shrinking global market. At present, most developing Countries are stil1 subject to the yoke of others in some key and core technologies. The reserves of science and technology to create new industries and guide future development are far from sufficient. Many industries are stil1 in the middle and low end of the global industrial chain and value chain. Only by vigorously promoting technological innovation among enterprises, accelerating research in key and core technologies, and upgrading the modernization of industrial chains and suppl chains can win the battle of initiative

and keep the initiative of competition and development firmly in our own hands.

Export-oriented enterprises are faced with challenges in research and development. activities, but there are also opportunities for development. New energy, high and new technology and digital economy have become global hotspots. Export-oriented enterprises pay more attention to digital transformation and improve their production efficiency and product quality through smart manufacturing, Internet of Things and other technologies. Nearly 90 WTO members, including China, the European Union and the United States, are currently negotiating basic rules for digital trade. Agreed trade rules would improve trade predictability, reduce duplication of effort and reduce costs. Cooperation with domestic and foreign universities, research institutions and other partnerships to overcome technical difficulties, creating opportunities to break through related technical barriers. The promotion of green ecological concepts encourages export-oriented enterprises to implement green sustainable development plans, introduce environmentally friendly products, reduce energy consumption and emissions, and receive favorable feedback from international consumers.

With the increasingly prominent position of technology R&D activities in shaping the core competitiveness of export-oriented enterprises, technology R&D management has gradually attracted the attention of enterprises, and technology R&D management determines the future status of export-oriented enterprises in the international market. Technology R&D management helps export-oriented

enterprises to maintain normal operation in the face of uncertainty and risks, improve the efficiency of enterprise operation, and improve the core competitiveness of enterprises.

Technology R&D management is crucial for the international competitiveness and long-term development of export-oriented enterprises. Technological innovation is the core competitiveness for the survival and development of enterprises. Pursuing substantial development is inseparable from innovation and technological transformation, especially in today's wave of economic globalization. Export-oriented small and medium-sized enterprises (SMEs) face significant survival pressure due to intense international competition, escalating international trade disputes, relatively limited funding, weak market development capabilities, and insufficient innovation capabilities. The average lifespan of "Fortune Global 500" companies is about 40-50 years, while that of general multinational corporations is about 13-15 years, highlighting the vital significance of technology R&D management for the survival and development of export-oriented enterprises.

Research goal and objectives. Based on the new trend of technology research and development practices of export-oriented enterprises, combined with existing relevant research on enterprise technology research and development management, this paper conducts in-depth theoretical analysis on the "element management" and "process management" of technology research and development of export-oriented enterprises. Furthermore, based on the research

framework of "element-process" technology R&D management, taking DJI Innovation, a model of export-oriented enterprises, as a specific case, empirical analysis is conducted on the "element management" and "process management" of technology R&D in export-oriented enterprises. This further reveals the characteristics of the technology R&D management system formed by export-oriented enterprises in the process of acquiring dynamic innovation capabilities and maintaining core competitive advantages, providing ideas and references for optimizing the technology R&D management process of export-oriented enterprises and improving R&D management efficiency.

SECTION 1. THEORETICAL ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES

1.1 The Connotation and Characteristics of Export-Oriented Enterprises

From the perspective of organizational form, export-oriented enterprises refer to those enterprises that focus on exports in the domestic market and engage in the export of products or services. According to differences in export operation models, export-oriented enterprises mainly include export processing-oriented, self-export-oriented, joint venture export-oriented, and domestically controlled export-oriented types. These enterprises sell products or services in the international market, thereby earning foreign exchange income and promoting the development of the domestic economy. By gradually strengthening themselves through the utilization of comparative advantages, technology transfer, and exploring international markets, they gain competitiveness in the global market.

Export-oriented enterprises drive the development of related industrial chains, promote technological progress, and upgrade industries. Export earnings help improve trade surpluses, increase foreign exchange reserves, and enhance the comprehensive strength of the country. The development of export-oriented businesses also provides important opportunities for Chinese enterprises to enter the international market and improve international competitiveness. Export-oriented enterprises play an important role in the Chinese economy. Their development is not only conducive to their own growth but also has a positive

effect on promoting stable economic growth and enhancing international competitiveness.

The sales of products or services of export-oriented enterprises in the domestic market are uncertain and involve significant risks, which mainly manifest in two aspects: First, the sales revenue of products or services may be affected by factors such as changes in international market supply and demand and exchange rates, leading to considerable uncertainty. Second, the sales revenue of products or services in the domestic market may be influenced by factors such as domestic market competition, consumer preferences, and domestic industrial policies, also posing considerable uncertainty. These uncertainties in both aspects bring risks to enterprises, exposing them to significant risk losses.

When export-oriented enterprises export products or services, they need to consider the sales capabilities and operational levels of other relevant enterprises in the international market, thus making appropriate choices. This choice may lead to significant operational risks for export-oriented enterprises in the short term. However, in the long run, these risks can be avoided or mitigated.

In recent years, the development trends of export-oriented enterprises have shown three major features. On one hand, there is digital transformation and cross-border e-commerce. Export-oriented enterprises accelerate digital transformation, expand overseas markets using the internet and information technology, and cross-border e-commerce becomes an important channel, enhancing trade efficiency and marketing effectiveness. On the other hand, there

is supply chain optimization and global layout. Enterprises optimize supply chain management, strengthen cooperation with global suppliers, and achieve global layout through overseas investment and the establishment of overseas production bases to reduce costs and risks. Finally, there is brand building and sustainable development. Enterprises focus on brand building and product innovation to enhance competitiveness while facing pressures for environmental protection and sustainable development, strengthening environmental management, and promoting green trade.

Digital transformation and cross-border e-commerce have become significant development trends for export-oriented enterprises. With the rapid development of the internet and information technology, companies are increasingly prioritizing digital transformation, integrating traditional sales models with the internet, and expanding overseas markets through e-commerce platforms. Cross-border e-commerce, as an important sales channel, not only enhances trade efficiency and marketing effectiveness for enterprises but also reduces operational costs and promotes the development of global trade.

Supply chain optimization and global deployment have become strategic choices for export-oriented enterprises. By optimizing supply chain management and strengthening cooperation with global suppliers, companies have achieved optimized allocation of global resources and efficient utilization of production factors. Meanwhile, through overseas investment and the establishment of overseas production bases, enterprises can better respond to changes in the

international market, reduce production costs and operational risks, and enhance their competitiveness in the global market.

Brand building and sustainable development are important strategic objectives for export-oriented enterprises. Companies recognize the importance of branding in market competition, focus on brand building and product innovation, thereby enhancing product value and competitiveness. At the same time, companies face pressure for environmental protection and sustainable development, which has led to strengthened environmental management and promotion of green trade, achieving a virtuous cycle of economic growth and environmental protection.

In recent years, the development of export-oriented enterprises not only reflects the strategic adjustments and innovative development of the enterprises themselves but also reflects the influence of trends such as globalization, digitalization, and sustainable development. In the future, with the changes in the global economy and the continuous evolution of the market environment, export-oriented enterprises will continue to actively respond to challenges, continuously enhance their competitiveness, and achieve sustainable development and win-win situations.

The demand elasticity of products or services of export-oriented enterprises is relatively low, and consumers' demand for a certain type of product or service is less affected by price changes. Market capacity is limited, and the demand for a commodity or service in the market often reaches a certain level of saturation.

This determines that export-oriented enterprises need to continuously adjust the cost structure of their products or services to adapt to this demand. This feature makes the cost structure of products or services of export-oriented enterprises relatively unstable, resulting in a lack of flexibility for export-oriented enterprises to cope with various market changes, which has a certain impact on their survival and development.

From the perspective of the global value chain, export-oriented enterprises can integrate research and development, design, procurement, production, and sales under the participation of the domestic market, fully utilize the country's factor endowments and technological progress conditions, leverage their comparative advantages, raise the level of participation in international division of labor, and enhance the international competitiveness of enterprises.

1.2 The Theoretical Implications of Enterprise R&D management

Research and development (R&D) is the abbreviation for research and development, which is an organizational activity to achieve product improvement and service enhancement through innovation and to achieve specific business goals. Research is a process of conducting extensive, systematic, and repeated exploration on a specific topic in order to reveal the essence of things, while development is an activity that utilizes existing science and technology to recreate or make substantial improvements to products, technologies, and services. Thus, research and development is a comprehensive innovative activity that possesses the attributes and characteristics of both research and development activities[2].

R&D includes different types such as improved research and development, innovative research and development, and basic research and development.

R&D management refers to a series of activities conducted under the guidance of the overall corporate strategy, based on various management theories, and utilizing information platforms to organize and manage research and development work, including team building, process design, plan management, performance management, achievement management, risk management, cost management, and other related aspects. These activities aim to ensure that corporate research and development can more effectively achieve the expected goals[3]. R&D management can be viewed as the management of R&D-related matters such as enterprise R&D institutions, R&D personnel, R&D activities, and R&D projects. It can also be understood as the management of the entire process of developing new products and new processes for enterprises, encompassing the generation and formation of product concepts, market research, design, research and development, testing, trial production, mass production, and finally, product launch[4]. As an important form of modern management activities in enterprises, R&D management exhibits highly integrated characteristics. It requires the utilization of informationalized technological means and tools to conduct team building, process design, performance management, and other activities based on the design of the organizational structure[5].

The ultimate goal of R&D management is to successfully transform market opportunities and technological achievements into products that can meet customer needs[6]. In the actual management of technological research and development, greater attention should be paid to performance management, communication management between departments, coordination management, innovation capability management, and cost management[7]. The establishment of

an R&D team is the first crucial step in R&D management. The success of R&D is directly related to the construction of the team. Building an organizational structure and fostering a harmonious and proactive team culture are essential means for the team to maintain its competitiveness over the long term. The scientific design of the R&D process is directly related to the efficiency of enterprise R&D. The R&D management process is not fixed but a dynamic and continuously iterative process. Design thinking is an effective approach to product R&D management[8]. R&D management first emerged in the United States and Europe and has now developed into a relatively mature management discipline system. It has gone through five stages of development in total.

① The intuitive stage. From the late 1950s to the early 1960s, R&D personnel freely chose topics, with papers and patents as the main outputs, and the R&D results had no direct impact on corporate performance. ② The market-oriented stage. From the early 1960s to the 1970s, many companies began to establish dedicated R&D departments and proposed clear R&D objectives to R&D personnel based on external market demand. ③ The strategic introduction stage. From the early 1970s to the 1980s, the economic crisis triggered by the oil crisis prompted companies to pursue efficient and low-cost new products based on research and development. Technology research and development rose to the strategic level of the enterprise, emphasizing the overall operation of research and development and other departments of the enterprise. ④ The extension stage of the R&D chain. From the late 1980s to the early 1990s, technological research and

development were regarded as the core competitiveness of enterprises. The collaborative R&D departments had transcended the boundaries of enterprises, with external suppliers and consumers integrated into the enterprise's R&D chain. ⑤ The innovative system stage. Since the 1990s, the rapid development of the internet and information technology has broken the constraints of geographical distance, and corporate research and development has gradually entered the stage of innovation networks and systems.

1.3 The Main Types of Enterprise Technology R&D

Enterprise research and development can be divided into different types from different perspectives. For example, the trichotomy includes basic research, applied research, and development research; the pentad includes research, exploratory development, extended development, engineering development, and operational system development. Based on the content of research and development, the technological research and development of export-oriented enterprises can be classified into four types: product innovation, process innovation, service innovation, and business model innovation.

Product innovation. Product innovation refers to the introduction of a new product that can meet customer needs or solve customer problems. Traditionally, a product refers to a tangible, physical item or raw material. However, in recent years, companies in the service industry have also begun to refer to their service offerings as "products," although they differ significantly from traditional products. From the perspective of the degree of impact on the morphological

changes of enterprise products, product innovation can be further divided into three categories: component innovation, architecture innovation, and complex products and systems (CoPS) innovation. Component innovation primarily refers to research and development activities that focus on individual or multiple components within a product's numerous constituent parts. Architecture innovation refers to research and development activities that involve the product system architecture or the way in which the various components of a product are combined. Architectural innovation has profound and complex impacts on competitors and technology users within an industry. The transition from feature phones to smartphones is an example of architectural innovation. Complex products and systems refer to large-scale products, systems, or infrastructure that require significant investment in research and development, have high technological content, and are produced in single-piece or small-batch customized production. Due to the diverse and highly technological nature of the components involved in complex products and systems, their successful development can directly lead to the application of various modular technologies embedded within them to other fields, thereby triggering technological upgrades across the entire relevant industrial chain and enhancing national competitiveness.

Process innovation. Craftsmanship refers to the methods and processes used to produce specific products or provide specific services. Process innovation involves a series of research and development activities aimed at improving the methods, procedures, routes, and equipment used to produce products or provide

services. Process innovation is an important aspect of technology research and development for export-oriented enterprises. Its main objectives include reducing the cost of product and service inputs, increasing the efficiency of production and service delivery, reducing energy consumption, optimizing the production environment, and improving employee job satisfaction. Process innovation typically does not involve changes in product performance, architecture, or other such characteristics. The uniqueness of process innovation lies in the fact that customers often cannot see such changes as they occur in the "backstage" of the enterprise. Through process innovation, the value delivery of products and services becomes more stable and reliable, thus enabling customers to also benefit from process innovation. Product innovation and process innovation often alternate and complement each other. New processes may enable the production of new products, and new products may also necessitate the development of new processes. Additionally, a product innovation for one enterprise may constitute a process innovation for another. For instance, a new digital machine tool developed by a machinery factory would significantly improve the production quality and efficiency for other enterprises using it to process products, which would qualify as a process innovation for those enterprises.

Service innovation. Service innovation refers to purposeful and organized research and development activities conducted by export-oriented enterprises aimed at improving service quality, optimizing service delivery methods, promoting service value-added, or exploring new service markets. Depending on

the specific content of service innovation, it can be further divided into five types of research and development activities: service product innovation, service process innovation, service management innovation, service technology innovation, and service model innovation. The theoretical research of service innovation originates from technological innovation, and there is a close connection between the two. Service innovation differs significantly from technological innovation in traditional manufacturing industries and exhibits a unique innovation strategy. Service innovation may involve technological advancements, but it often involves non-technical or social innovations as well. Therefore, service innovation should not be narrowly understood from the perspective of technology as the sole determinant of innovation. The essential characteristics of service innovation include: intangibility, inseparability, heterogeneity, perishability, and absence of ownership. Service innovation often involves small changes in processes and is more often incremental in nature. Innovation in service products is typically difficult to separate from innovation in service processes. Service innovation is customer-centered, and the lower the degree of standardization in services, the higher the degree of customer determination in service innovation. Since service enterprises do not have or have very few R&D departments, service innovation does not require scientific research or data collection. Therefore, the time required for service innovation is relatively shorter, and the innovation organization is more flexible.

Business model innovation. Scholars at home and abroad have conducted diverse discussions on the connotation of business model innovation. Business model innovation aims to remove product attributes that customers do not need and provide them with the most suitable products[9]. It involves adjusting and innovating the enterprise's value chain or its elements[10], which may impact or disrupt existing market rules and create a unique operating system[11]. It is a process of transforming the core elements and business logic of an enterprise[12].Business model innovation arises from changes in external factors such as the emergence of new technologies, changes in the market environment, or adjustments in institutional frameworks, which subsequently lead to changes in certain components of a company's business model[13]. The innovation of business models has diversified paths of implementation, mainly including the path of factor optimization, the path of value added and the path of strategic upgrading. A business model consists of three systems: value proposition, value support, and value retention. Business model innovation can be achieved through these three aspects respectively. The source of business model innovation comes from changes in the external environment and internal organization of the enterprise. Therefore, it can be achieved through strategic planning methods similar to those based on strategic upgrading[14]. The driving forces of business model innovation mainly include changes in the market environment, the development of new technologies, the pull of new opportunities, and the pressure of fierce competition.

As an indispensable and important activity for modern innovative enterprises, technology research and development is essentially a complex process of continuously exploring unknown areas and promoting product value-added. This process includes various steps such as generating new ideas, researching, developing, trial-manufacturing, producing, and commercializing new products. Each step is interconnected and advanced step by step, forming a complete research and development chain. The absence of any key step may lead to the failure of the research and development objectives, and make it difficult to achieve the ultimate market value of research and development activities. According to Rothwell's (1992) classification of industrial innovation models, the technology research and development process has undergone five generations of representative morphological changes since the 1950s[15].

The simple linear technology push model. From the 1950s to the mid-1960s, with the breakthroughs in technologies such as semiconductors and electronic information, as well as their rapid and widespread applications in related fields, they greatly promoted social progress and economic development. The status and role of science and technology were widely recognized, and a large number of enterprises achieved great success through the research and development of new products. Against this backdrop, the first-generation innovation process model emerged: "Basic Science → Design and Engineering → Manufacturing → Marketing → Sales." The simple linear driving model holds that technology research and development is a process that starts with basic science and ends with

market sales. It is a sequential process from basic research to the market, with the market serving as a passive recipient of research and development.

The linear market pull model. This took place in the 1960s and 1970s. At that time, social productivity had been significantly improved, and a basic balance between supply and demand for social products had been achieved. Many companies began to pay attention to the impact of the market on the research and development process, giving rise to the market-driven model: "Market demand pull → Development → Manufacturing → Sales." This model believes that enterprise research and development originate from market demand and are the result of market demand pull. The market is both the recipient and the source of research and development.

The interactive coupling model of technology and market. It emerged in the late 1970s and early 1980s. At this stage, a large number of studies on "innovation" activities emerged, revealing the process and essence of "innovation" and providing theoretical support for enterprise research and development activities. This model believes that technological progress can drive enterprise research and development, and market demand can also pull enterprise research and development. Therefore, the research and development process is the result of the organic integration, interaction, and joint promotion of technological progress and market demand.

The Integrated (Parallel) Model. From the mid-1980s to the early 1990s, Japanese companies demonstrated advantages in many product areas compared to

Western developed countries, triggering widespread research. The research found that in addition to factors such as proficiency in imitation, Just In Time production, and quality orientation, integration and parallel development were important reasons for the competitive advantage of Japanese companies. The core feature of the integration model lies in the parallelism of various functional departments and the high degree of integration of related functions during the research and development process.

The system integration network model. Since the 1990s, global corporate research and development practices have shown that corporate research and development is not only influenced by economic factors, but also by various factors such as institutions, organizations, society, politics, and the environment. The system integration network model believes that the main body of research and development includes not only enterprises, but also universities, scientific research institutions, governments, financial institutions, intermediary organizations, etc. Different entities possess differentiated innovative resources and have various interactive relationships of exclusion and integration, competition and cooperation, promotion and constraint. The interaction of multiple entities and various elements forms an organic innovation network, driving continuous progress in research and development activities.

The main task of research and development is the creation and application of knowledge. From the perspective of research and development subjects and technology sources, there are usually three models for technology research and

development in export-oriented enterprises: the first is to conduct independent research and development using the enterprise's own resources; the second is to integrate external resources and cooperate with other enterprises in research and development; the third is to fully utilize external resources and entrust other units to complete research and development, that is, outsourcing of research and development.

Independent research and development model. Independent research and development refer to the research and development activities carried out by export-oriented enterprises that tap and utilize their own resources, achieve technological progress or breakthroughs through their own efforts, and successfully commercialize them. Independent research and development can be further divided into core technology research and development and non-core technology research and development. Core technology research and development refers to the activities where enterprises obtain the key components, parts, or manufacturing processes of products through their own research and development, and continue to promote the subsequent stages of core technology research and development, ultimately completing the commercialization of technologies and products. Non-core technology research and development refers to the research and development activities that are not related to the key components, parts, and manufacturing processes of products.

The independent research and development model has certain advantages, mainly including: the research and development results are concentrated within

the enterprise to the maximum extent, making it difficult for competitors to exploit them, which is conducive to protecting the exclusivity of intellectual assets; the research and development results have specific practicality, allowing for rapid and smooth transformation of results; it helps improve the technical learning and technological development capabilities of enterprise personnel; it is conducive to establishing core competitiveness and cultivating core competitive advantages for the enterprise. At the same time, the independent research and development model also has some disadvantages that are difficult to overcome, including: high investment costs and significant uncertainty in research and development; relying entirely on internal forces within the enterprise, leading to a long investment recovery period, high sunk costs, and a very high risk of failure; the research results have externalities; high requirements for the quality and management level of enterprise personnel. Therefore, there are significant limitations for small and medium-sized enterprises to adopt the independent research and development model.

Collaborative research and development model. Collaborative research and development refers to the cooperation between export-oriented enterprises and other research and development entities, such as other enterprises, scientific research institutions, and universities, to jointly develop new products and processes. In collaborative research and development, relevant members fully leverage their respective technological advantages to jointly complete the

established research and development tasks, share investment risks, and enjoy the fruits of research and development.

Depending on the different collaborating parties, collaborative research and development can be divided into inter-enterprise collaborative research and industry-university-research collaborative research. Inter-enterprise collaborative research can be further classified as horizontal and vertical collaboration based on the sharing of knowledge elements. Industry-university-research collaborative research refers to the formation of collaborative research and development organizations through cooperation between enterprises and institutions such as universities, research and development institutions, scientific research institutions, and industry foundations, based on complementary advantages. The selection of partners should follow the principles of goal consistency, technological complementarity, capability balance, and mutual integrity. Collaborative research and development can take various organizational forms such as joint development, technology licensing, establishment of alliances, joint institutions, and project cooperation.

Contract research and development model. Contract research and development, also known as research and development outsourcing, refers to a technical research and development model in which export-oriented enterprises propose corresponding research and development tasks and requirements based on their international market demand, product and process innovation needs, and entrust other enterprises, universities, or scientific research institutions to conduct

the research. This model mainly targets non-core technological fields and is typically implemented under conditions such as limited research and development capabilities, insufficient research and development resources, urgent need for certain research and development outcomes, or a desire to rapidly improve product innovation efficiency within export-oriented enterprises.

Contract research and development has certain advantages that help export-oriented enterprises fully utilize external research and development forces to solve the challenges they face, while facilitating enterprises to concentrate limited internal resources on advantageous technological research and development, and rapidly enhance the international competitiveness of their products. As an important mode of research and development activities for export-oriented enterprises, contract research and development differs significantly from collaborative research and development. Collaborative research and development typically involves joint investment, shared risks, and shared outcomes. In contract research and development, the entrusting party bears the research and development costs and enjoys the research and development outcomes according to the contract, but does not participate in the specific research and development process and does not bear the risk of research and development failure. From the perspective of social division of labor, contract research and development is the infiltration and expansion of the social division of labor and collaboration relationships that have already formed in the industrial economy era into the field of contemporary enterprise research and development activities.

SECTION 2. ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES

2.1 Advance in Technology R&D Management of Export-oriented Enterprises

Export-oriented enterprises can promote industrial upgrading, expand markets, introduce foreign capital and technology, and improve labor quality, but they may also affect industrial structure, requiring government guidance and regulation in policy formulation. Fan Wenjing started from the perspective of demand, deeply discussing the impact of export-oriented economy on China's productive service industry, dividing it into direct effects and indirect effects, and compared with the central and western regions, the impact of export-oriented economy on the eastern region is more significant[16]; Ma Jianhui proposed optimization paths from six aspects: improving the industrial chain system, supporting the entrepreneur team, building a technology innovation support system, modern logistics support system, marketing support system, and integrating support system for urban agglomerations within the region[17].

There is still ample room for improvement in export-oriented enterprises. In order to compare the characteristics of two production modes, Lai Xinfeng and Wang Xin established system dynamics models of partially vertical integration and completely vertical integration production modes under random market demand and supplier output conditions, and found that labor costs also significantly influence manufacturers' decisions[18]; Tian Yumei and Ma Tao

analyzed the main subjective and objective factors affecting the development of small and medium-sized export enterprises in China, summarized the reasons for the difficulties in the development of small and medium-sized export enterprises in China, and proposed strategies for achieving long-term development[19].

Meanwhile, Hu Wei, Zhang Xueru, and others focused on export-oriented listed companies as their research subjects, concluding that in order to prevent and alleviate the adverse effects of trade wars, the government needs to increase its policy support for export-oriented enterprises[20]. Tianlan Fu and Chun Yang explored the industrial upgrading paths of export-oriented manufacturing enterprises in the process of shifting from export to domestic sales. They demonstrated diverse paths of industrial upgrading and downgrading by embedding domestic market-oriented production networks through network-based, intra-enterprise coordination-based, and market-based approaches[21].

Some studies investigated the factors influencing the development of export-oriented enterprises. Guisheng Wang conducted a detailed analysis of the impact factors of exchange rate risk on export-oriented listed companies[22]. Xiaoling Zhou analyzed the risks faced by export-oriented enterprises due to trade barriers and exchange rate fluctuations, and proposed relevant suggestions[23]. Jianting Fan and Li Wang investigated the impact of export orientation to different target markets on technology transfer by Japanese companies in China, providing insights into how China can enhance the technology spillover effects of foreign direct investment[24].

Ming Liu and Jie Zhu proposed that inadequate internal management of Chinese export-oriented enterprises, especially in dealing with internal and external "credit" issues, leading to "credit crises," is the main problem of the enterprises themselves[25]. Hui Cheng and Chenggang Xu constructed a new "six-dimensional" social responsibility competitive model based on the core content of ISO 26000 guidelines[26]. Xinming Xia and Canfei He's research analyzed the geographical evolution of China's export-oriented foreign-funded enterprises and discussed the industrial linkages between foreign-funded enterprises and local enterprises, as well as the interaction between international trade protection measures[27].

Relevant studies summarized and refined the theories of enterprise technology R&D management, established evaluation indicator systems, and deeply explored the evolutionary process and development trends of enterprise technology R&D management. Bruno Cassiman used empirical methods to analyze enterprise technology R&D activities and concluded that the complementarity between internal R&D and external knowledge acquisition is more sensitive to other factors in the strategic environment of enterprises[28]. Lixin Guo reviewed the concept of enterprise technology management and analyzed its core content, providing suggestions for future enterprise technology management[29].

Romel Mostafa discussed how industry pioneers established through the dissemination of foreign industry knowledge unconsciously spread knowledge to

subsequent entrants to catalyze the growth of industries in developing countries. Based on empirical research on two historical events in Bangladesh's garment industry, he concluded that industry knowledge dissemination is crucial for the initial establishment and subsequent expansion of the industry, emphasizing the role of experienced worker mobility in building new enterprise capabilities[30]. Yuhong Zhang, Xianxian Mao, and others discussed the content of enterprise technology management systems, aiming to help enterprises establish effective technology management systems, standardize management processes, and promote sustainable and healthy development of companies[31].

Ling Xiong analyzed the current situation of modern enterprise technology management and proposed corresponding solutions to support the enhancement of enterprise technological innovation capabilities[32]. Hongmei Hu identified relevant capabilities in the technology management operation system based on the theory of technology life cycle, which became an important basis for establishing an evaluation indicator system for technology management capabilities[33]. Linjia Tang, and Renyong Chi analyzed the structural connotations and dynamic evolution process from the perspective of dynamic resource view[34]. Weiwei Wu, and Bo Yu analyzed the paths of technology management capability enhancement in different technology lifecycle stages and throughout the entire lifecycle based on fitness landscape theory, and proposed the necessity for enterprises to adopt appropriate capability enhancement strategies in different contexts[35].

Wu Weiwei and Liang Dapeng et al. constructed the operational process

model of "Search-Select-Execute-Feedback" for enterprise technology management, using the technology management practice of Haraid Group as a case study, pointing out that this model is an effective operational mode for technology management, helping enterprises improve their adaptability to complex changing environments[36]; Xu Xiaoqin and Yang Min used the Analytic Hierarchy Process (AHP) to determine the weights of the evaluation index system for modern enterprise technology management, providing new ideas for establishing a sound technology management system for modern enterprises[37]; Qu Jun explored the core technology management model of Japanese enterprises[38].

Xie Jun and Xu Qing's research found that practical new utility patents and design patents formed a competitive advantage for manufacturing export enterprises in China’s Guangdong Province in the international market, while invention patents mostly assisted in gaining a competitive advantage in the domestic market[39]; Heather Berry discussed the degree to which multinational companies prioritize knowledge networks in their home country, host country, and third countries during the technology R&D process and its impact on incremental and radical innovation[40].

In empirical research, studies by Helpman et al[41], Wignaraja[42] and Antonietti[43], etc., supported the role of technological innovation in promoting enterprise exports, indicating that when enterprises invest more and at a higher level in technological innovation, their export competitiveness is stronger, while Hassan et al. found that the impact of technological innovation on Indian export

enterprises is limited, which was confirmed in data analysis of specific countries[44]; Shou-Min Tsao and Guang-Zheng Chen, through panel data model studies, found that the higher the degree of enterprise openness, the greater the patent density[45].

Li Zhengwei et al. explored the impact of different technology introductions and product exports on enterprises' independent research and development investment[46]; Liu Xiuling conducted empirical research on the characteristics of technological innovation of Chinese export enterprises and its influencing factors[47]; Dai Mi and Yu Miaojie concluded that the enhancement effect of exports on enterprise productivity is related to the length of the previous research and development investment time, with longer time resulting in a more significant enhancement effect[48].

Jayaratne et al. demonstrated the importance of small banks to small business loans through surveys of small enterprises[49]; I.R. Gordon and P. Mccann[50], Enright Michael and J. Regional, etc., conducted research on industrial clusters and regional enterprise clusters[51]; Pengfei Han discussed the degree of technological decoupling and dependence measurement between the United States and China based on the combined number of patents, showing that downstream businesses in industries covered by China's strategic emerging industry policies affected by sanctions have been affected, while upstream companies in sanctioned industries have increased productivity and generated more high-quality entrepreneurship[52].

2.2 R&D Element Management of Export-oriented Enterprises

From the perspective of managing technical research and development elements, the management of export-oriented enterprise technology research and development primarily involves research and development strategic management, research and development organizational management, intellectual property management, innovation information management, research and development funding management, and research and development personnel management.

(1) Implications of Research and Development Strategy

The Research and Development strategy is established by export-oriented enterprises to obtain long-term international competitive advantage, based on the correct analysis of their internal conditions and external environment, encompassing the overall objectives of technology development and significant arrangements related to Research and Development, usually involving the acquisition, enhancement, and utilization of technology. Research and Development strategy features characteristics such as comprehensiveness, long-term orientation, dynamism, hierarchy, multiple objectives, risk, and compliance. The fundamental goal of Research and Development strategy is to change the competitive position of the enterprise, establish core competitive advantages, and increase profitability. Enterprises must attach importance to Research and Development strategy, especially export-oriented ones. From the perspective of corporate development history, many enterprises, although important innovators in technology, have failed strategically due to insufficient consideration of the

overall issues of Research and Development from a strategic perspective, resulting in failure to derive more benefits from Research and Development, and even losing their competitive advantages. For example, the British company EM created the scanner but failed to establish a defensive competitive advantage, resulting in competitors seizing market share. Xerox, an American company, was an innovator in photocopiers, yet in the 1980s, Canon of Japan occupied a larger market share. Therefore, while technology development is important, Research and Development strategy is even more critical.

(2) The categories of Research and Development strategy

From different perspectives, the Research and Development strategies of export-oriented enterprises can be categorized into different types. Based on the desired technological competitive position of the enterprise, they can be divided into technology leadership strategy and technology follower strategy. ① The technology leadership strategy entails the enterprise's commitment to establishing a leading position in relevant technological fields. This involves being the first among all competitors to adopt new technologies and introducing new products to the market earliest to secure a larger market share and profits. This strategy places high demands on the enterprise, requiring not only the ability to pioneer the development and adoption of new technologies but also to continuously innovate and develop new leading-edge technologies. ② The technology follower strategy refers to enterprises not aiming to lead but rather learning from leaders' research and development of new technologies, and imitating them afterward. The

advantage of this strategy is that enterprises can improve upon the leader's technology and push it to the market, avoiding significant research and development investments themselves.

According to the market position and behavior pursued by export-oriented enterprises, technology research and development strategies can be divided into offensive strategies, defensive strategies, and penetration strategies. ① The offensive strategy aims to continuously launch new products and production processes ahead of competitors, to enter new technological or market domains. Characteristics of this strategy include strong pioneering efforts, high risk, and potentially high returns. ② Defensive strategy. Enterprises implementing a defensive strategy often possess advanced technology but are not leading in technology research and development or market share. To avoid the uncertainty, high risk, and substantial research and development costs associated with leading, they aim to capture the market with low-cost, high-performance, and high-quality products. ③ Penetration strategy. This involves closely following the leader in a particular aspect, continuously seeking opportunities to strike in the market, and innovating in the 'entry point.' This strategy requires enterprises to closely monitor competitors' weaknesses and their own strengths, timely introducing new technologies to replace existing dominant technologies, and disrupting the existing technological and market competition landscape.

According to the source of technology, the technology research and development strategies of export-oriented enterprises can be divided into

independent research and development strategy, imitation research and development strategy, and cooperative research and development strategy. ① Independent research and development strategy. This refers to enterprises achieving technological breakthroughs through their own exploration, overcoming technical challenges, completing the commercialization of technology, and achieving the intended research and development goals. This strategy requires enterprises to have strong research and development capabilities and a certain level of investment capacity to realize the transformation from basic research to applied research. ② Imitation research and development strategy. This refers to enterprises learning and imitating the innovative ideas and behaviors of pioneering innovators, introducing, purchasing, or deciphering the core technologies and technical secrets of these innovators, and making appropriate improvements and innovations. ③ Cooperative research and development strategy. This refers to two or more enterprises collaborating on research and development, sharing the outcomes of technological research and development, to save on research and development investment, shorten the research and development cycle, or enter new markets. This includes both vertical cooperation among enterprises in the industrial chain, as well as horizontal cooperation between enterprises or between enterprises and research institutes.

(3) Construction of Research and Development Strategy

The technology research and development strategy is an integral component of the operational strategy for export-oriented enterprises. It serves as a vital

means to achieve the operational strategy, involving processes such as setting strategic objectives, strategic diagnosis, strategic formulation, and strategic execution.① Setting strategic objectives involves establishing both long-term and phased goals. Long-term strategic objectives must align with the operational strategy, exhibiting characteristics of longevity, stability, and transcendence. Phased strategic objectives are the short to medium-term goals that the enterprise aims to achieve, possessing strong operability. ② Strategic diagnosis involves analyzing both the external environment and internal conditions of the enterprise. External environmental analysis focuses on the competitive landscape and technological trends in the export market, such as changes in consumer demands, the strength of competitors, and macroeconomic conditions. Internal analysis focuses on the current technological resources and capabilities of the enterprise.③ Strategic formulation involves soliciting opinions from professionals and various functional departments within the enterprise after initially determining the strategy, continuously refining and improving the strategy. Key activities include selecting core technologies, acquiring technology sources, and integrating technology into products and value chains.④ Strategic execution refers to the concrete implementation of strategic plans by mobilizing various departments and necessary resources within the enterprise after the formulation of the strategy. It involves addressing key issues such as the timing and method of introducing new technologies, resource allocation for technology applications, and effective management of technology research and development.

The efficiency of technological research and development is closely related to its organizational form. From the perspective of Research and Development practice, the Research and Development organizational forms of export-oriented enterprises mainly include linear organizational models, parallel and cross organizational models, group organizational models, and matrix organizational models.

2.3 R&D Process Management of Export-oriented Enterprises

From the dynamic level, the technology research and development activities of export-oriented enterprises is a continuous, multi-linked process, and enterprises need to do a good job of technology research and development process management according to the key aspects of research and development work. Technology research and development process management mainly includes technology market demand forecasting, research and development creative mining, research and development project initiation, research and development project implementation, research and development interface synergy, research and development risk control and other work.

(1) Concept of technology demand forecasting

Technology demand forecasting refers to the multi-angle research and analysis of the proposed research and development products and their technology demand based on the relevant investigation information, to grasp the inner law of demand and make correct estimation and judgment on its development trend, so

as to ensure that the proposed research and development products and their supporting technologies meet the market needs and have lasting market competitiveness. Technology demand forecasting is to analyze the process of technology change and make a comprehensive evaluation of the connotation, performance, promotion time, product development, market share and sales of the emerging new technologies, so as to provide reference for research and development decision-making.

Technology demand forecasting gives enterprises the expected level of research and development demand for their products in the coming period, and provides a basis for their research and development planning and control decisions. The purpose of forecasting is to make the most of present and past historical data, consider various influencing factors in the future, combine with the actual situation of the enterprise, adopt appropriate scientific analysis methods, and put forward realistic demand targets, so as to formulate the enterprise research and development plan and guide the enterprise research and development activities and product development.

Facing the international competitive environment full of uncertainties, scientific and reasonable technology demand forecast is an important link in the management of technology research and development of export-oriented enterprises, and at the same time, it is the prerequisite for enterprise technology research and development decision-making. Technology research and development decision-making includes the selection of technology content, access,

research and development programs, application timing, etc. The materialization of technology research and development decision-making is manifested in planning and scheduling. Technology research and development decision-making, planning, planning must be built on the basis of scientific forecasting. Significant technology demand forecasting and subsequent research and research and development decisions greatly affect the product development and international competitiveness of export-oriented enterprises.

(2) Elements of technology demand forecasting

When export-oriented enterprises make technology demand forecasts, they should focus on technology development trend, new product performance and new process characteristics, application field of new technology, and the scope of technology promotion and application. ① Technology development trend. Analyze and predict the direction and approximate time range of technological development in a certain field. For example, in view of the finiteness of petroleum resources and the requirement of environmental pollution control, the important trend of automobile technology development is energy saving, less pollution, and the use of new energy. ② New product performance structure, new process characteristics. Predictions are made on the performance and structure of new products to be developed, and the process methods and characteristics of new processes. ③ Application areas of new achievements. Make predictions on the possible application prospects and scope of new scientific discoveries and technological inventions. ④Technology popularization and application paradigm.

Forecast the popularization, demand, competitiveness and life cycle of the applied technology.

Factors involved in technology demand forecasting. Technological development does not take place in isolation, and the forecasting of technological needs of export-oriented enterprises should take into account a variety of factors. ① Science and technology development trend. The impact of scientific discoveries, scientific breakthroughs, new technological advances, etc. on the enterprise's technological field and related fields. ② Level and trend of economic development. For specific export-oriented enterprises, if the economic development level of the exporting country is low, the proportion and absolute amount of science and technology investment in GDP is low, it will restrict the speed of technological development. ③ Industry development and competitive situation. The technological development of industries in different states of emergence, rise and decline is very different. The degree of competition will also have an important impact on the technological development of the corresponding field. ④ Social Factors. Social values, consumption tendencies, etc. may have an impact on the demand for technology. For the same product, domestic and international sales may encounter significant differences in customer evaluation, which requires enterprises to make improvements to the product and its related technology based on analyzing the social values and consumption tendencies of the exporting countries. ⑤ Political and policy factors. Political and policy factors are an important part of the technology research and development environment

and a dimension to focus on when analyzing technology demand forecasts.

(3) Methods of technology demand forecasting

The selection of scientific methods is the key to achieving the expected results of technology demand forecasting. From the perspective of domestic and foreign forecasting time and the history of forecasting research, technology demand forecasting methods have gone through an evolutionary process from qualitative forecasting to quantitative forecasting, and then to a combination of qualitative and quantitative methods. Early methods of technology demand forecasting were dominated by qualitative analysis methods, and commonly used methods include expert forecasting method, market survey method, scenario analysis method, Delphi method and so on. Quantitative forecasting methods refer to forecasting based on quantitative characteristics and quantitative relationships, based on data analysis or on constructing models, and mainly include time series forecasting method, regression forecasting method, bibliometric method, patent analysis method, trend analysis method, hierarchical analysis method and so on.

From the perspective of the actual effect of forecasting, the traditional, single qualitative forecasting method or quantitative forecasting method has certain limitations, and it is difficult to comprehensively and systematically consider the complexity and variability of the factors affecting technology demand. Therefore, export-oriented enterprises rely more and more on the combination of technology forecasting methods in the process of technology demand forecasting. The combination of qualitative and quantitative methods is a

commonly used combination of technology demand forecasting methods, which can more comprehensively and accurately analyze the future technology development trend and market technology demand. Common combined forecasting methods include technology roadmap-Delphi method, Delphi method-bibliometric method, Delphi method-patent analysis method, etc.

(1) Connotation of research and development creativity

In general, the product development process in export-oriented firms is divided into three stages: the Fuzzy Front End (FFE) stage, the New Product Development (NPD) stage, and the Commercialization stage. Fuzzy Front End (FFE) is the activity in the product development process that precedes the formal, structured New Product Development (NPD) process. In the Fuzzy Front-End stage, a company forms a product concept and decides whether or not to invest resources in developing the concept. During this phase, product strategy is formed and communicated within the business unit, opportunities are identified and evaluated, and concept generation, product definition, project planning, and initial execution studies are performed.

(2) Value of creative management

Due to shorter product life cycles and rapid changes in technology, the competitive environment, and customer demand, export-oriented firms need to manage the innovation process optimally. In this product development process, idea generation is the initial impetus for new product development projects. Export-oriented firms must rely on continuous research and development for long

term survival and growth, and the occurrence of research and development relies on good ideas. Idea management can not only cause business organizations to change the status quo through a series of activities, but also create new opportunities for the organization.

Research on new product development in the pharmaceutical industry has shown that the fuzzy front-end product ideas can be up to thousands, but the ideas that can enter the research and development stage are extremely limited, and the ones that can eventually be commercialized and become successful are even more limited. From the initial generation of ideas to the real research and development success of the process, the generation of ideas to the product to achieve the probability of research and development is less than 1%, and once the product into the research and development, its research and development from research and development to research and development success until the probability of success of the commercialization of more than 7%. It can be seen that, on the one hand, the success rate of new product development at this stage is extremely low, on the other hand, the real key to the failure of product development still lies in the process from the generation of ideas to product development.

Enterprise research and development practice has proved that many research and development projects do not fail in the research and development process, but are doomed to failure at the outset. That is to say that many projects even in the product development stage spend a lot of effort, due to the creative stage of the wrong judgment, will end up in failure. Therefore, the key to new

product development is to do a good job of fuzzy front-end idea management. The biggest difference between the success and failure lies in the implementation effect of the pre-research and development stage. The fuzzy front-end implementation effect is the watershed of product development success or failure. Effective idea management can not only improve the performance of new product development, but also save new product development time.

(3) Research and development creative mining

From the perspective of research and development practices, the most common way for companies to tap into the research and development creativity of their employees is to set up a suggestion box. As early as 1895, NCR (National Cash Register) founder John Patterson set up the first revolutionary “suggestion box” program, the initial proponent of the adopted proposal can get a reward of $ 1 to explore the first suggestion to be accepted was rewarded with a $1.00 prize to tap into the creativity of the hourly employees. By 1904, employees had submitted more than 7,000 ideas, one-third of which were adopted. Honda and others designed a clearer Employee-Driven Idea System to capture employee ideas and keep them informed of their implementation.

Similar to the “suggestion box” idea collection system is the initial form of tapping the creativity of employees, relatively easy to implement, and low cost, but this is only the first step to unleash the creativity of employees. With the value of creativity in the product development process highlights the deepening of creative management, new ways to tap the creativity continue to appear. For

example, Intel, 3M, Hewlett-Packard and other enterprises through the opening of a number of creativity training programs to stimulate staff research and development creativity; Siemens, electronic data systems companies and other companies through the establishment of a global creativity network, making full use of the intranet, inquiring into the corners of the various departments within the enterprise for the conception of new products and new services.

Although not all ideas have research and development value, more and more innovative firms recognize the importance of ideas and idea management for their research and development. Some export-oriented innovative enterprises have regarded creativity management as a central issue in enhancing their level of innovation and gaining international competitiveness. Idea system does not avoid traditional departments and new product development process, nor replace the existing opportunity search and idea development methods, but to stimulate the traditional departments and research and development work for the better. The Idea Management System helps organizations to establish a credo of innovation, encourages every department to look for new business opportunities, and promotes broad participation by managers and employees.

(1) Characterization of research and development projects

Project creation is an important link for export-oriented enterprises to put their research and development ideas into product innovation, which is based on the market demand of exporting countries, and the project demonstration, evaluation and selection made on the basis of many research and development

ideas screening. Research and development project is an important link in the management of export-oriented enterprise technology research and development, determines the direction of enterprise technology research and development, but also directly affects the enterprise international product market expansion areas. Enterprise research and development projects are usually centered on the research and development of new products and processes, which is a kind of project with high complexity and uncertainty, and also with greater risk. In the course of the project, the enterprise may constantly revise the decision according to the latest situation of the research and development to ensure the success of the new product and new technology research and development project. According to the intrinsic properties of new technologies, products and processes, technology research and development projects are characterized by innovation, process, learning, risk and openness.

① Innovativeness of research and development projects. Innovative here means that such a project must have independent innovative research and development activities and must be able to provide society with completely new products or processes with new functions and values. ② Process nature of research and development projects. Process means that such a project has its own unique process, which is a gradual unfolding and implementation of the process, this process is composed of a series of different stages. ③ Learning nature of research and development projects. Learning nature means that the process of such a project is actually a learning process. In this kind of project process, people

are constantly learning and changing, which leads to success step by step. ④ Riskiness of research and development projects. Riskiness means that this kind of project may succeed or fail, thus this kind of project may also bring gain or loss to the organization, so it has riskiness. ⑤ Openness of research and development projects. Openness means that such a project must be based on the understanding of customers and technology, and that business management, research and development, marketing and customers must all be infused into such a project.

(2) Guidelines for project selection

Based on the innovative, process, learning, risky and open characteristics of enterprise research and development projects, export-oriented enterprises need to follow certain guidelines when justifying, evaluating, selecting and determining research and development projects.

The basic principles of the enterprise research and development project itself. New product development projects should consider the following principles: firstly, the customer's preferences should be considered, the new product must meet the customer's requirements in all aspects; secondly, the impact on the environment should be considered, the production and use of the new product should be able to save resources; in addition, it should also take into account the enterprise's own production capacity, consider the production process and the assembly steps, cannot be divided between the design function and the production function, to produce high-quality new products at a lower cost. New products should be produced at a lower cost and with high quality.

Principles of consumer acceptance of new product concepts. New product research and development projects should first pay attention to understanding consumers' reactions and feelings towards new product concepts. For export-oriented enterprises, special consideration needs to be given to the impact of consumer demand preferences in exporting countries on product design, so how to incorporate user demand preferences into the research and development project program design process in order to improve the reliability of the evaluation results of the product concept design program is a problem that needs to be focused on.

Principles of dominant user analysis in new product concept development. Usually only a few users know exactly what kind of new product they need, and this kind of users is called “dominant users”. Dominant user analysis is a method to evaluate new product concepts according to the steps of identifying the dominant user, identifying the dominant user's needs, and testing whether the new product concept can be recognized by the dominant user in the target market of the exporting country.

Integrated decision-making principle based on comprehensive risk. The product concept design scheme contains a large amount of certainty and uncertainty information, how to integrate different evaluation scales, different forms of expression and different granularity of certainty and uncertainty information for integrated decision-making, to find out the comprehensive evaluation value of the project design scheme, and complete the prioritization.

(3) Procedures for project establishment

The process of setting up projects for technology research and development projects of export-oriented enterprises is similar to that of other project justification and evaluation, which requires a comprehensive analysis of all aspects of the exporting country's technology, economy, market, environment and society, and the use of a multi-indicator comprehensive evaluation model methodology to carry out project justification and evaluation. The research and development project establishment process for export-oriented enterprises mainly includes the following steps.

① Develops a system of indicators for evaluating technology research and development projects. The system of indicators for justifying and evaluating technology research and development projects includes four levels: the target level, the indicator level, the sub-indicator level and the program level. ② Determine the weight coefficients of the project justification and evaluation indicators. The Delphi method, hierarchical analysis method, entropy value method and other methods can be used to comprehensively determine the degree of importance of each indicator relative to the assessment of the target, and give the corresponding weight, but the entire indicator system must comply with the basic principle of mutual independence. ③ Formulate the expectation standard of research and development project demonstration and assessment indicators. Determine the expected standard value of the assessment indicators through sampling surveys, expert consultation and other methods. ④ Quantification and normalization of project justification and assessment indicators. The qualitative

indicators of research and development project justification and evaluation need to be quantified and normalized, so as to remove the overlapping information in each indicator. ⑤ Analyzes and calculates the feasibility of new product research and development projects. Use a combination of qualitative and quantitative analysis to make a judgment on the feasibility of the research and development project. ⑥ Give the conclusion of research and development project justification and evaluation. Based on the analysis of the feasibility of the research and development project, the conclusion of the research and development project justification and evaluation is clearly given.

SECTION 3. CASE ANALYSIS ON R&D ELEMENT-PROCESS MANAGEMENT OF EXPORT-ORIENTED ENTERPRISES

3.1 Current Situation and Development Stage of DJI

DJ-Innovation Technology Co., Ltd., referred to as DJI, has a similar entrepreneurial journey to the legendary stories of "dropout teenagers" and "garage startups" experienced by many high-tech companies in Silicon Valley in the United States. In 2006, DJI was founded in Shenzhen, a highland for innovation and entrepreneurship in China, originally emerging from a private house in Lianhua Village, Shenzhen. DJI's founder, Wang Tao, was born into a family of ordinary intellectuals in Hangzhou, Zhejiang Province, China. His father is an engineer, and his mother is a teacher. On the verge of graduating from university, Wang Tao made an incredible decision to drop out of the electronics major at East China Normal University. After several setbacks, he entered the Department of Electronic and Computer Engineering at the Hong Kong University of Science and Technology and embarked on the entrepreneurial journey of a "dropout teenager" who persistently pursued his dreams.

Wang Tao has an inherent affection and passion for airplanes, especially red helicopters. With insight into the international demand for drones and confidence in drone technology innovation, DJI focused on taking an international path from its inception, becoming a typical "born global enterprise"[53] and shaping the paradigm of an export-oriented high-tech company.

During its 18 years of growth, DJI has continuously developed new technologies, launched new products, and continuously explored new application scenarios and market areas. Its product applications have expanded from the initial drone aerial photography to various fields such as handheld photography equipment, intelligent driving, smart agriculture, remote sensing surveying and mapping, forest fire prevention, power line inspection, search and rescue, and AI education. By the end of 2023, DJI's airport series products have been tested and applied in more than 50 countries and regions worldwide, completing over 6.5 million flight tests and accumulating over 330,000 hours of testing operations.

DJI adopts an open innovation model, widely attracting innovative enthusiasts from all over the world. Currently, more than 110,000 developers have provided creative ideas or solutions for DJI. DJI attaches great importance to product after-sales service, with DJI official repair centers, DJI authorized service centers, and DJI airport authorized service providers covering multiple countries worldwide. There are over 40 official and authorized repair centers, more than 300 DJI airport authorized service providers, over 1,500 certified delivery engineers, and over 1,500 certified maintenance engineers providing continuous technology upgrades and product maintenance services to global consumers.

DJI has become a globally leading R&D and manufacturing enterprise for unmanned aerial vehicle (UAV) control systems and solutions. Its market and consumers span over 100 countries and regions worldwide, occupying more than 80% of the global drone market and over 70% of the Chinese domestic drone

market. It ranks first in the world in terms of total civilian drone sales. DJI attaches great importance to technological research and product innovation, with nearly 40% of its staff engaged in R&D.

According to the PCT patent reports released by the World Intellectual Property Organization (WIPO) in 2021 and 2022, DJI filed 1,042 and 920 international patents in 2021 and 2022, ranking 20th among global enterprises in both years. By May 2023, DJI has cumulatively filed over 16,000 domestic and international patents, with PCT patent applications ranking among the top 10 in China for seven consecutive years. DJI holds the largest number of patents in the drone industry worldwide. It has registered over 1,500 trademarks in more than 60 countries and regions globally, and has won multiple intellectual property awards such as the "China Design Gold Award" and "China Trademark Gold Award."

DJI's products have been selected for international lists such as "Top 10 Technology Products of the Year" by Time magazine, "Ten Most Significant Technology Products of the Decade (2010-2019)" by The New York Times, "Outstanding High-Tech Products of the Year" by MIT Technology Review, and "Global 50 Smartest Companies." DJI ranks 313rd on the "2022 Top 500 Private Manufacturing Enterprises in China" list and 87th on the "2022 Hurun China 500" list. DJI's founder, Wang Tao, ranks 79th on the "2023 Hurun China Rich List" with personal assets of 50 billion yuan.

From the perspective of representative technological research and product innovation, DJI has mainly experienced four development stages since its

establishment: the initial exploratory stage focused on fixed-wing helicopters (2006-2009); the rapid growth stage centered on multi-rotor drones (2010-2014); the expansion and maturity stage with platform technology as the core (2015-2018); and the transformational development stage focusing on products in multiple fields (since 2019).

The initial exploratory stage focused primarily on fixed-wing helicopters (2006-2009). In the early stage of DJI's establishment, global drone technology was still in the conceptual stage, lacking a reference framework and related technologies for drones. With a deep passion for helicopters, Wang Tao focused DJI's initial R&D efforts primarily on fixed-wing unmanned helicopters. During this phase, DJI gradually made progress in single-rotor unmanned helicopters and flight control systems by pooling innovative ideas and talents from within and outside the company. In 2007, DJI successfully developed the XP2.0 helicopter drone flight control system. In 2008, DJI strengthened its research on flight control and image transmission, successfully developing the first fully automatic electric unmanned helicopter, EH-1. At the same time, DJI enhanced the technology of the helicopter flight control system, resulting in the development of the XP3.1 helicopter flight control system.

DJI's early years were mainly focused on market exploration, technological R&D, and the establishment of social networks. The customer target was mainly niche groups such as hobbyists in the European and American markets.[54] However, during this stage, DJI had not yet established any overseas branches or produced

mature products[55]. Due to high manufacturing costs, complex operation, and high product specialization, the promotion of single-rotor helicopters in the civilian sector was greatly limited, and DJI did not achieve ideal corporate profits.

The rapid growth stage focused primarily on multi-rotor drones (2010-2014). Given the inherent shortcomings of fixed single-rotor helicopters and based on feedback from international market sales, DJI adjusted its product R&D strategy in 2010, shifting from fixed-wing drones to multi-rotor drones. The company's R&D team focused on technological breakthroughs in the design and production of multi-rotor drones, flight control systems, cloud platforms, and application software, and quickly achieved significant progress. In 2010, DJI successfully developed its first consumer-grade product based on flight control technology, the Ace One, and achieved a significant advantage in manufacturing costs, thereby defeating major competitors in Europe and the United States and gaining market advantage.

In 2011, DJI accelerated its R&D efforts, with multi-rotor drones and ground station flight control systems as the core. It successively released high-end professional drone flight control systems such as Ace Waypoint, the first simulation/entertainment helicopter flight control system Woo Kong-H, the Woo Kong-M flight control system for commercial and industrial multi-rotor platforms, the multi-rotor flight platform Fenghuolun, and the new generation lightweight multi-rotor control platform Naza-M.

2012 was a milestone year for DJI. The world's first aerial photography all-

in-one "Phantom 1" was successfully developed, bringing an "out-of-the-box" flying experience to drone enthusiasts. In the same year, DJI also released the world's first professional integrated multi-rotor aircraft "Jingoudun S800" and new members of the Fenghuolun series such as F330 and F550. DJI's foreign sales revenue grew rapidly.

In 2013, DJI successfully developed the world's first flying camera, the "Phantom 2Vision". It was widely used in the production of popular TV shows in the United States, sparking a global aerial photography craze and becoming a star product. In 2014, DJI successively released products such as the world's first 4K camera-equipped transformable aerial photography drone Inspire 1, the full HD digital image transmission system Lightbridge, the professional aerial photography eight-rotor flight platform Jingoudun S1000 and S1000+, and the three-axis handheld gimbal system "Ronin". DJI sold a total of 400,000 drones in that year, with sales revenue exceeding 3-billion-yuan, accounting for 85% of the global civil drone market, making it the world's largest drone manufacturer.

The stage of expansion and maturity focused on platform technology (2015-2018). Under the demonstration effect of DJI's rapid growth in consumer-grade drones, more and more manufacturers have joined the research, development, and production of drones, leading to rapid intensification of competition in the international drone market, and DJI is facing a situation where the value-added space for consumer-grade drones is limited. Under such circumstances, DJI began to build a standardized technology platform composed of hardware, software, and

intelligent sensing devices, connecting cooperative manufacturers around the world for cooperation and expanding into industry-level drone applications. In 2015, DJI received a venture capital investment of 75million from the world′s top venture capital company Accel, coupled with the previous30 million investment from Sequoia Capital, providing strong financial support for consolidating the mature market for consumer-grade drones and exploring new areas for industry-level drones. DJI strengthened its R&D efforts, successively launching aerial photography drones such as the Phantom 3, Phantom 4, and Phantom 4 Pro, as well as new flight control products, further consolidating its international market position in consumer-grade drones. DJI also leveraged celebrity endorsements to increase the popularity of its drones in China and return to the domestic market.

In 2015, DJI established an industry application department to research and develop industrial-grade drones. At the same time, it set up overseas R&D centers in places such as California, USA, and introduced high-end foreign talent from Silicon Valley and other places to strengthen R&D cooperation in the field of industrial-grade drones. Responding to the special needs of industry-level drone R&D, DJI successively opened software development toolkits (SDK) and developer kits for drone flight control systems to allow professional users of industry drones to fully participate in the drone R&D process. Through technological R&D and platform construction, DJI quickly launched the MG-1 agricultural plant protection drone, officially entering the agricultural plant protection field, increasing agricultural spraying efficiency by more than 40 times.

DJI also held the RoboMaster robotics competition to actively promote the cultivation of new talent in universities. It released the first industrial-grade flight platform "Matrice M200" series, the programming education drone "Tello EDU," the plant protection drone T16, and built comprehensive online management platforms such as DJI Terra and DJI Agras Services. During this stage, DJI's products became more stable, its overseas branches continued to mature, and sales revenue rapidly increased, exceeding 20 billion yuan in 2018.

The stage of transformation with a focus on multi-field products (from 2019 to present).As international consumer-grade drone products become increasingly mature and market demand tends to saturate, DJI has taken the lead, further expanding its reform efforts based on the exploration of industry drones in the previous stage, pioneering a diversified product development model, and expanding its R&D focus to multiple fields such as intelligent driving, smart agriculture, remote sensing surveying and mapping, flood and drought prevention, forest fire prevention, power line inspection, reservoir inspection, oil and gas field inspection, earthquake and geological disaster rescue, and AI education, thus entering a stage of transformation and development.

In 2019, DJI launched its first educational robot, RoboMaster S1, and released China's first plant protection drone, T20, equipped with an omnidirectional radar. In 2020, DJI released the RoboMaster EP educational expansion kit and youth challenge, built the DJI education platform, established the DJI education subsidiary, and launched its first product, RoboMaster EP Core.

It also introduced new plant protection drones T30 and T10, as well as the all-new industry-grade drone "Mavic" 2. In 2021, DJI introduced agricultural drones T40 and T20P. In 2022, it released a one-stop drone mission management cloud platform - DJI Terra 2; introduced DJI Airport to address the pain points of unattended operations and achieve new breakthroughs in automation; released agricultural drones T50 and T25 equipped with dual radars; and launched aerial survey drone DJI Mavic 3M for precise agricultural production management. In 2023, DJI launched an even more intelligent and efficient unattended operation platform - DJI Airport 2, opening a new chapter in large-scale unattended operations. In the same year, it also released agricultural drones T60 and T25P.

During this stage, DJI has won numerous global and national honors. It has been selected for the 2019 "50 Smartest Companies" (TR50) list by MIT Technology Review, the 2020 Forbes China Most Innovative Companies List, and Fast Company's 2020 "China's Best Innovators 50" (MIC50) list. It has also been recognized as one of the top ten annual emerging brands at the 2019 China Brand Power Ceremony, the 2019 National Intellectual Property Advantage Demonstration Enterprise, the 21st China Patent Gold Award, and the 2020 China Excellent Industrial Design Gold Award. In 2022, DJI's sales revenue exceeded 30 billion yuan, ranking 313th on the "2022 Top 500 Private Manufacturing Enterprises in China" and 87th on the "2022 Hurun China 500".

3.2 Element Management of DJI Technology R&D

DJI has been committed to an international development model since its

inception and has become a model of an export-oriented enterprise. Over the past 20 years, DJI has regarded technology R&D, as well as product innovation, as the lifeline of its business development. It strives to gather high-quality innovative elements and continuously shape its international competitive advantage, following a distinctive path in technology R&D management. DJI management of key elements in technology R&D is primarily reflected in R&D strategic management, R&D organization management, intellectual property management, R&D funding management, and R&D personnel management.

The enterprise R&D strategy is a plan for the overall direction and development path of the enterprise's technological R&D and product innovation. It serves as the general outline and guiding principles of the enterprise's R&D management activities, determining the key areas and technological acquisition channels for future R&D endeavors. The product positioning of DJI and the personal aspirations of its founder, Wang Tao, at the time of the company's inception largely determined DJI' adoption of a leading R&D strategy in technology development. With a unique interest in unmanned aerial vehicles, Wang Tao positioned DJI' products in the drone market. At that time, from the perspective of drone technology, global drones were only in the early stages of development with no mature drone technology available for reference, and a lack of standardized drone architecture and component specifications. From his personal aspirations, Wang Tao believed that "China has always lacked a product that can impress the world. Chinese manufacturing also finds it difficult to escape

the awkward situation of relying on cost-effectiveness to gain market share." Therefore, he built a development vision of "limitless future" for DJI[56], aiming to produce world-class products through technological R&D and establish a globally leading drone brand[57]. This vision sought to transform the global perception of "Made in China" among consumers and redefine the essence of Chinese manufacturing.[58]The dual role of the external technological environment and internal entrepreneurial vision has prompted DJI to choose a leading technology R&D strategy from the very beginning. The 18 years of DJI' development has proved to be a process in which DJI' leading R&D strategy has continued to deepen and achieved remarkable performance. From the rapid upgrading of Phantom 1, Phantom 2, Phantom 3 to Phantom 4, and the upgrading of agricultural plant protection drones from T10, T20, T30, T40, T50 to T60, to the more compact and foldable Mavic Air series, DJI is a leader in the development of the Mavic Air series. The Mavic Air series is a concrete presentation of DJI' technology R&D leadership strategy. It can be said that from fixed-wing helicopter drones to multi-rotor drones, from the construction of the concept of consumer-grade drones to the rapid change of products, from the transformation of consumer-grade drones to professional-grade and industry-grade drones, and from commercial, agricultural, civil and industrial drones[59], DJI has been leading the dynamics and direction of the development of international drone-related fields.

The R&D organization is the department or institution that undertakes the

mission of technological R&D and product innovation in a specific enterprise, and it is an important carrier for promoting the enterprise's R&D activities. The structure, size, status and operation mode of R&D organizations have an important direct impact on the performance of enterprise R&D. For export-oriented enterprises, they are usually involved in a more complex international technological environment and more variable product innovation needs, and the activities and operation modes of the R&D organization are also more flexible and diversified. Since it chose a leading R&D strategy and decided to take the road of independent innovation development at the very beginning of its foundation, early DJI was essentially an R&D-oriented organization, consisting of a few early members such as Wang Tao, Lu Zhihui, Chen Jinying, and Chen Chuqiang. After nearly 20 years of development, DJI has explored a technology R&D organizational model that meets the needs of corporate positioning and international development, and has built a technology R&D organizational system that is mainly characterized by flatness, openness and flexibility. First of all, DJI's R&D organization adopts a flat organizational structure, which allows direct and full communication between R&D personnel, between R&D personnel and team leaders, and between R&D personnel and corporate executives on specific technology R&D and product innovation issues, effectively eliminating the stagnation of innovation information that may be brought about by the traditional hierarchical organizational structure, reinforcing the R&D personnel's sense of belonging[60], and unleashing the R&D personnel's innovation potential to the

fullest extent possible[61].Meanwhile, DJI's R&D organization is characterized by openness and cooperation. DJI has established DJI Innovation Laboratory and DJI Overseas Technology R&D Centers in cooperation with Microsoft, Hong Kong University of Science and Technology and other domestic and foreign universities and enterprises, absorbing the cutting-edge knowledge and leading technologies of international advanced R&D institutions, and building DJI's global R&D cooperation network. Establishment of “DJI Community”, “Young Engineers Community”, “Sky City”, “Flyers Training Camp” and other open communities. Open communities have been established, and software development kits for UAV flight control systems (including Mobile SDK, Onboard SDK, Payload SDK, UX SDK, etc.) have been liberalized to enhance communication and trust between DJI and global aerial photography enthusiasts, university students, product users and the general public, and to promote DJI's R&D practices, R&D developments, and latest products to the public. While promoting DJI's R&D practices, developments and latest products to the public, DJI has also gathered a steady stream of new ideas, knowledge and information for DJI.

Intellectual property rights are the ownership rights of innovation subjects to the results of innovation activities, which are both the protection of R&D activities of specific innovation subjects and the defense against possible infringement by competitors in related fields. Intellectual property management is an enterprise management activity that needs to be focused on in the internationalization process of export-oriented enterprises. DJI attaches great

importance to intellectual property rights represented by patents in the process of creation, development and transformation, and takes intellectual property management as a pioneer in exploring the field of unmanned aircraft products, an effective path for shaping the competitive advantage in the international unmanned aircraft market, and an important pusher in deepening the implementation of R&D-led strategy. From the perspective of time, DJI started to apply for patents in the field of drones soon after its establishment. Through patent database data retrieval, DJI first applied for international patents in 2008, and the number of international patents applied for that year was 1. The number of applications in 2009, 2010 and 2011 was 2. The number of patent applications in 2012 increased to 8, and the number of patent applications in 2013 was 9. Overall, from the first international patent application in 2008 to 2013, the number of patents applied for each year was relatively limited. 2014, the number of DJI's international patent applications showed explosive growth, rapidly growing to 216, an increase of more than 20 times compared with 2013. Since then, DJI's patent applications have maintained rapid growth for many years in a row, exceeding 500 pieces in 2016, reaching 573 pieces. 2019 even exceeded 1,000 pieces, up to 1,074 pieces. In recent years, DJI's annual international patent applications have been relatively stable, remaining at around 1,000. According to the global PCT patent report issued by the World Intellectual Property Organization (WIPO) for each year, DJI made its way into the global TOP50 of patent applications in 2018, ranking 29th. 2021 and 2022 both made their way into the global TOP50 of PCT

patents, both ranking 20th.

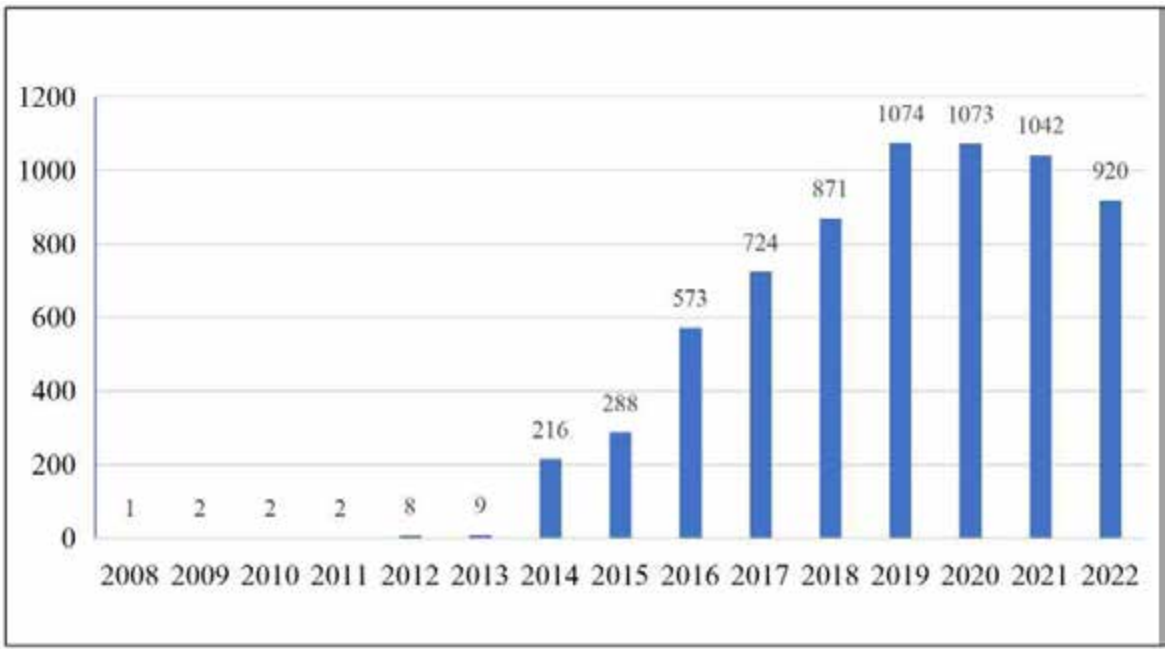

Figure 3.1 DJI's PCT Patent Applications over the Years (Unit: Pieces)

From the perspective of the technical fields involved in the patents, DJI has formed a relatively complete drone patent system[62].DJI's patents involve the structural design, circuit systems, flight documentation, wireless communication, and control systems of various parts of unmanned aerial vehicles. The multi-disciplinary and forward-looking layout of DJI International patents has demonstrated through practical actions the true essence of enterprise survival in the knowledge economy era, where "products remain unchanged and patents take the lead"[63].The patent management of DJI has gone through the evolution of core patent strategy in the early stage, offensive patent strategy in the development stage, and hybrid patent strategy in the mature stage[64].The international patents covering various fields largely dominate the development trend of mainstream drone technology, providing a steady stream of technical support for the rapid

launch and upgrading of DJI's different types of drone products, and at the same time providing a strong safeguard for DJI's continued competitive advantage in the international drone market, its response to international intellectual property disputes, and the weakening of international sanctions. In the trade war between China and the US, the US has repeatedly made relevant prohibitions on DJI's drone exports, banning DJI's drone sales in the US on the grounds of national security, and preventing DJI from taking possession of the US civil drone market on the grounds of infringing on the patents of US companies. However, these prohibitions and charges have not been able to fundamentally impede the sales of DJI drones in the United States, nor have they been able to dispel the love of American consumers for DJI drones. The main reason for this situation is DJI's independent R&D capabilities and multi-disciplinary patent layout. DJI drones rely on the core technology and components completely from their own, and did not grant the United States handle, so relatively speaking, the U.S.-China trade war on the sales of DJI products in the U.S. is generally less restrictive[65].

3.2.4 R&D Funding Management: Flexible Funding Allocation

R&D funding is the “blood” of an enterprise's technological R&D and product innovation, and the mobilization and allocation of R&D funding greatly affects the breadth, speed and depth of an enterprise's technological R&D activities. DJI is a natural internationalized enterprise and has established a technology-led development strategy since the early stage of its establishment, thus R&D funding has a more special significance to DJI's survival and

development. DJI attaches great importance to raising and allocating R&D funds, and the development process of DJI is, in a certain sense, a process of raising, expanding and optimizing the allocation of R&D funds. On the eve of his graduation, Mr. Wang Tao, the founder of DJI, secured HK$18,000 in research funding from the Hong Kong University of Science and Technology, which was the first batch of R&D funding obtained during the incubation period of DJI, and it also kicked off the research of DJI's founder on the flight control system of remote-controlled helicopters. 2006, Mr. Wang Tao and his two other partners raised RMB 200,000 as the start-up capital of DJI, most of which was used as the first batch of R&D funding after the establishment of DJI. In 2006, Wang Tao and his two partners raised RMB 200,000 as DJI's start-up capital, most of which was used as the first batch of R&D funds after DJI's establishment. In 2008, Wang Tao's close friend Lu Tao invested about $90,000 in DJI, and Wang Tao's mentor, Prof. Li Zexiang, together with Prof. Zhu Xiaorui of Harbin Institute of Technology, invested 1 million RMB in DJI. These funds played a key role in DJI's initial R&D activities. Inspired by DJI's dedication to drone technology innovation and the prospect of drone technology, the Hong Kong University of Science and Technology invested RMB 2 million in DJI in 2010, which was the largest investment DJI had received since its founding, and provided considerable R&D funding for DJI's drone technology innovation. After relocating the company to the Student Business Incubation Park in Shenzhen's Nanshan District, the government's entrepreneurial support policies have also provided DJI with

more channels to raise R&D funds.

With the continuous launch of DJI's drone products and the enhancement of its international brand, DJI has successively gained the favor of international and domestic venture capital firms. in January 2013, Shenzhen Maixing Investment Company invested RMB 10 million in DJI; in May 2014, Sequoia Capital, a globally renowned venture capital firm, invested US$30 million in DJI; in May 2015, Accel Partners, a venture capital firm, invested US$75 million in DJI. The capital injection from these venture capital firms provided DJI with more adequate R&D funding for its technology development. As its revenue-generating capacity improves, DJI is investing more and more in technology R&D from its operating revenue. Currently, DJI's R&D expenditure accounts for about 15% of its sales revenue. DJI breaks down seniority and egalitarianism in the allocation of R&D funds, focusing on problem orientation and technology first. For R&D personnel and R&D programs with insightful ideas that can solve technical problems, DJI will support them in any way possible. DJI once encountered the “Elf” series of aerial hovering, smooth picture and 360-degree shooting and other technical problems, the R & D team for a long time failed to break through the technical difficulties, and later, a college intern who had not graduated put forward a bold idea, DJI then arranged for this intern to do a hundred of people scale R & D team leader, and DJI has allocated tens of millions of dollars in R&D funding. This shows DJI's flexibility and pragmatism in the allocation of R&D funds. Overall, DJI has formed a diversified R&D funding path during its

development, including early funding from close friends, investment from mentors, and startup funds from its alma mater, to later investment from international venture capitals, and then to the current self-investment of the company. The diversified funding system and flexible allocation of funds have played a fundamental role in DJI's successive technological breakthroughs and continuous product leadership in the field of drones.

3.3 Process Management of DJI Technology R&D

From a process perspective, DJIs' technology R&D includes a complete process from predicting the demand for drone technology in the market to controlling risks in drone technology R&D. It mainly includes key links such as predicting the demand for drone technology in the market, exploring creative ideas in drone and related technology R&D, implementing drone and related technology R&D projects, coordinating drone and related technology R&D interfaces, and controlling risks in drone and related technology R&D. In the past 20 years of technological research and product innovation, DJIs has developed a unique management model for unmanned aerial vehicles and related technology R&D processes.

Demand driven is an important traditional mode of technological innovation and the main economic driving force for enterprises to conduct technological R&D. Therefore, accurate and advanced international market technology and product demand forecasting is a prerequisite for export-oriented enterprises to conduct technological R&D, and to a certain extent determines the main direction

of enterprise technological innovation and the sustained international competitiveness of the enterprise. From the perspective of enterprise evolution history, DJIs' transformation from initial establishment, rapid growth, mature development to butterfly transformation was all based on accurate prediction of market technology demand. In the early days, Wang Tao's personal passion for aircraft models and his insights into the international drone industry established the overall strategy for DJIs to enter the field of drone technology, and embarked on a development process of rewriting the connotation of "Made in China". Based on the prediction of the demand for drone technology in the drone market at that time and the understanding of the regional distribution of drone enthusiasts, DJIs made two important decisions: firstly, to develop single wing helicopter drones and their flight control technology as the starting point; Secondly, developed countries with a high number of drone enthusiasts such as the United States, France, and the United Kingdom are the main markets[66]. Around 2010, multi axis aircraft began to rise, and more and more consumers tended to choose multi rotor aircraft. After recognizing the significant limitations of single wing unmanned helicopters and the significant advantages of multi rotor drones, DJIs accurately predicted the mainstream demand of the international drone market in the future and decisively shifted its R&D focus to multi rotor drones and related products, proposing the concept of consumer grade drones. Due to its accumulation in unmanned helicopter technology in the early stage, DJIs quickly made a breakthrough after transferring to multi rotor drones and quickly occupied the

international market of consumer grade drones. Data shows that from 2009 to 2014, DJIs' product sales revenue rapidly increased, with an average annual growth rate of 200% -300%[67].With the rapid development of 4K and 8K film and television technology, DJIs predicted the demand for drone aerial photography in the media and film and television industry, and immediately invested a large number of R&D personnel and funds to develop new types of aerial drones. It launched new drone products such as the "Inspire" series and the "main" series, which were deeply welcomed by consumers in the media and film and television industry. In the context of the increasingly saturated international consumer grade drone market, DJIs has once again conducted a forward-looking analysis of the technology demand for drones in the future market, predicting that drones in the industry will be the focus of future development. Furthermore, the focus of R&D will shift to the development of industry level drones, and the industry level drone market will be segmented and laid out, developing and designing different application scenarios such as agriculture, forestry and plant protection, geographic surveying and mapping, circuit inspection, and highway management.

The so-called creativity refers to new ideas, new ideas, and new ideas related to technological research and product innovation. It is the blueprint for transforming technological needs into R&D behavior, and constitutes the source of ideas for enterprise R&D activities. From the perspective of enterprise value creation, creativity is a method based on innovative thinking to further explore and activate the combination of enterprise rese resources, thereby enhancing

resource value. Creative mining is at the forefront of R&D process management, which involves mobilizing internal and external personnel of the enterprise to brainstorm specific problem scenarios based on technology demand prediction, forming embryonic forms of technical or product concepts. Although R&D creativity is in the conceptual product stage, the quality of creativity largely affects the key areas, main content, and product popularity of subsequent R&D activities of enterprises. In the nearly 20 years of development, DJIs has taken the exploration of R&D creativity as an important prerequisite for promoting drone technology innovation, forming a multi-source and systematic creative management mechanism and path.

Firstly, Wang Tao, the founder of DJIs, and his entrepreneurial team are important sources of R&D creativity for enterprises. From aircraft models to fixed wing helicopter drones, to multi rotor drones, to the concept of consumer grade drones, and even to DJIs Airport, there are founders and entrepreneurial teams who have developed creative ideas. Secondly, enterprise employees are another important source of creativity for DJIs R&D. R&D personnel, production personnel, sales personnel, and even product sales agents, as long as they have good creativity, can become the source of DJIs' technological research and product innovation. In order to fully tap into the innovative potential of its employees, DJIs has implemented a flat organizational structure, broken down hierarchical control, eliminated seniority-based discrimination, and encouraged internal employees to actively learn and grow, so that every creative employee

and every valuable idea receive due respect. In order to transform good ideas into technological products, DJIs will allocate R&D teams and funds for young personnel in an extraordinary way. In addition, introducing foreign senior engineers and corporate executives is another source of R&D creativity for DJIs. American Colin Quinn once proposed a bold idea to Wang Tao: "Can DJIs provide a way to shoot stable videos from the air using drones?" Later, he became the head of DJIs' North American branch and built a "future invincible" enterprise for DJIs. In addition, public communities and open platforms are also effective ways for DJIs to explore R&D creativity. Open communities such as "DJIs Community", "Youth Engineer Community", "Sky City", "Flying Hands Training Camp", as well as SDK technology sharing platforms, play an important role in expanding DJIs' external knowledge network and gathering global drone enthusiasts for R&D creativity. Other ways for DJIs' R&D creativity include venture capital firms, drone consumers, and other members of the public. Venture capital companies such as Sequoia Capital, Shenzhen Maixing Investment Company, and Accel Partners, which have invested in DJIs, have proposed insightful R&D ideas for specific technology research and product innovation in DJIs.

Project initiation and implementation are important steps for enterprises to put their R&D creativity into technological and product innovation. They are based on the needs of domestic and foreign markets, and are the basis for project demonstration, evaluation, selection, and implementation based on the screening

of numerous R&D creativity. The implementation process of R&D projects is influenced by various factors, including product attributes, strategic attributes, process attributes, market attributes, organizational attributes, etc[68]. R&D project management is the process of coordinating and allocating enterprise personnel, funds, and facilities to overcome specific technical problems and solve certain product difficulties. Project management is an important part of export-oriented enterprises technology R&D management, which determines the direction of enterprise technology R&D and directly affects the expansion of international product markets. DJIs regards technological research and product innovation as the lifeline for the survival of enterprises. The 18 year history of enterprise development is, in a sense, a history of R&D project selection, approval, implementation, and replacement. DJIs has developed a flexible, stable, and effective management model in the evaluation, selection, initiation, and implementation of R&D projects.

Firstly, DJIs follows the principle of technology leadership in the selection of R&D projects. This is not only the in-depth implementation of DJIs' leading R&D strategy in project management, but also the specific presentation of DJIs' corporate vision in enterprise management activities. The initial vision of DJIs was to independently innovate and develop a product that could move the world. This vision determined that DJIs must adhere to the principles of leadership and foresight when selecting R&D projects. From fixed wing helicopters and their flight control systems to multi rotor drones and their flight control systems, from

consumer grade drones to industry drones, the initiation and implementation of these R&D projects reflect the principle of technological leadership. Secondly, exploring and meeting market demand is another important factor to consider in the initiation and implementation process of DJIs R&D projects. Creating new international market demands and continuously meeting them is an important path for DJIs to quickly occupy the dominant position in the global drone market. It is also an important driving force for DJIs' drone technology and product upgrades, and an important reference benchmark for DJIs' R&D project evaluation, selection, and implementation. In addition, the selection of DJIs R&D projects is based on consumer recognition. DJIs attaches great importance to consumer reactions and feelings towards new product concepts in determining technology research and product innovation projects, especially considering the impact of consumer demand preferences on product design. It incorporates user demand preferences into the design process of R&D project proposals as an important measure of the rationality and feasibility of project proposals[69]. In addition, DJIs has established an efficient and flexible decision-making mechanism for R&D projects. The decision-making of DJIs R&D projects mainly includes individual leadership decisions and team decisions. In the process of transitioning towards the field of multi rotor drones and the industry's transformation towards drones, the personal decisions of DJIs founder Wang Tao have had a crucial impact on the establishment and implementation of enterprise R&D projects. In the process of updating and upgrading numerous drone products of the same series and different

models, it reflects the collective decision-making wisdom of the DJIs R&D team. Both individual decision-making by leaders and collective decision-making by teams emphasize problem orientation, highlighting efficiency and flexibility.

CONCLUSIONS

Based on the analysis of the concepts of export-oriented enterprises, technology R&D, technology R&D management, this paper makes a theoretical explanation of the management of technology R&D Elements and process management of export-oriented enterprises. Furthermore, the research framework of "element-process" technology R&D management is constructed, the technology R&D management of DJI, a natural, is discussed, and the characteristics of the technology R&D "element-process" management system formed by DJI in the process of rapidly expanding the international market are revealed. The following conclusions and enlightenments are drawn.

First, the management of technology R&D of export-oriented enterprises is an enterprise management behavior system composed of multi-elements and multi-links. From the perspective of technology R&D management elements, technology R&D management of export-oriented enterprises mainly includes R&D strategy management, R&D organization management, intellectual property management, innovation information management, R&D fund management, R&D personnel management and so on. From the dynamic perspective, the process management of technology R&D of export-oriented enterprises mainly includes technology market demand prediction, R&D creativity mining, R&D project initiation, R&D project implementation, R&D Interface coordination, R&D risk control, etc.

Second, high-quality technology R&D Element management is the basic

support for export-oriented enterprises to expand overseas markets in many fields. In the course of nearly 20 years of development, DJI has formed a deeply distinctive technology R&D Element management system. Based on the technology leading R&D strategy, DJI has built a flat R&D organization, forward-looking international patent layout, flexible R&D funding allocation, and refined evolution of R&D personnel deployment, which has accumulated a high-quality and complete technology R&D elements system, creating the basic conditions for DJI to expand the international UAV market.

Third, efficient technology R&D process management is an effective path for export-oriented enterprises to continuously obtain dynamic competitive advantages. In the process of UAV technology R&D and product innovation, DJI gathers dynamic innovation capabilities to promote rapid product change. DJI has built a smooth and collaborative management process system from timely prediction of technical needs, multi-source mining of R&D creativity, efficient implementation of R&D projects, network linkage of R&D interfaces to precise prevention and control of R&D risks, which is an effective way for DJI to continue to maintain the leading edge of international drones.

LIST OF USED SOURCE

1 United Nations Conference on Trade and Development, Global Trade Update, June 21, 2023, UNCTAD official website.

2 Cai Dongdong. Research on Process Management of Local Research and Development Projects in X Multinational Corporation [D]. Southeast University, 2020.

3 Qi Qiushui. A Preliminary Study on Enterprise R&D Management [J]. Technological Development of Enterprises, 2011, 30(09): 129-130+164.

4 Wu Fan. Research and Development Management [J]. Management Scientist, 2018(9): 18-19.

5 Research on Process Optimization of R&D Management in D Company.

6 Krishnan V. Product development decisions: a review of the literature[J]. Management Science,2001, 47(1):1-21.

7 Alegre J, Lapiedra R, Chiva R. A measurement scale for product innovation performance[J].European Journal of Innovation Management, 2006, 9(4):333-346.

8 Lindberg R. On the perception, adoption and implementation of design thinking in the IT industry[J/OL]. Springer Berlin Heidelberg, 2012, 6(2):229-240.

9 Mitchell D., Coles C. “The Ultimate Competitive Advantage of Continuing Business Model Innovation” [J]. Journal of Business Strategy, 2003,24(5):15-21.

10 Magretta, J. “Why Business Models Matter” [J]. Harvard Business Review, 2002,80(5):86-92.

11 Aspara. J., Lambere G. J. A., Laukia A,, et al. “Corporate Business Model Transformation and Inter-organizational Cognition: the Case of Nokia” [J]. Long Range Planning, 2013,46(6): 459-474.

12 Bucherer, E., Eisert, U., Gassmann, O. “Towards Systematic Business Model Innovation: Lessons from Product Innovation Management” [J]. Creativity and Innovation Management, 2012,21(2):183-198.

13 Guo Rui, Wu Guisheng. "Research on Elements of Breakthrough Business Model Innovation"[J]. Technology Economics, July 2015.

14 Hacklin, F., Wallnofer, M., “The Business Model in the Practice of Strategic Decision Making: Insights from a Case Study” [J]. Management Decision, 2012,50(2): 166-188.

15 Rothwell R.Towards the Fifth--generation Innovation Process[J].

International Marketing Review,1994,11(1):7-31.

16 FAN Wenjing. The Influence Path of Export-Oriented Economy on the Development of China's Producer Service Industry: A Decomposition Based on the Perspective of Demand. International Economic and Trade Exploration, 2015. 31(07):19-29.

17 Ma Jianhui. Path Thinking on Optimizing the Support System of Coastal Export-oriented Industrial Clusters. Social Sciences, 2012(5):11-13.

18 Lai Xinfeng et al. Production Simulation Study of Export-Oriented Manufacturing Enterprises under Different Vertical Integration Models: An Analysis of the Impact of Tariffs and Labor Costs. Management Review, 2022. 34(06):280-291.

19 Tian Yumei and Ma Tao. Analysis of the current situation of small and medium-sized export enterprises in China. Economic Research Guide, 2015(19):277-278.

20 Hu Wei, Zhang Xueru and Gui Shuhong. Market Effect Analysis of Export-oriented Listed Companies in the Scenario of Continuous Escalation of Sino-US Trade War. Chinese Certified Public Accountants, 2019(10):66-72.

21 Fu Tianlan and Yang Chun. Analysis of Market Turning and Industrial Upgrading Path: A Case Study of Export-Oriented Furniture Industry in the Pearl River Delta. Geographical Research, 2018. 37(07):1460-1474.

22 Wang Guisheng. Research on the Influencing Factors of Exchange Rate Risk of China's Export-oriented Listed Enterprises. Enterprise Reform and Management, 2016(10):104.

23 Zhou Xiaoling. Risk Analysis and Recommendations for Export-Oriented Firms. Beijing Financial Review, 2012(4):204-209.

24 Fan Jianting and Wang Li. Export Orientation, Technology Types and Technology Transfer within Multinational Corporations: An Empirical Analysis Based on Japanese Enterprises in China. Journal of Finance and Economics, 2015. 41(10):83-95.

25 Liu Ming and Zhu Jie. Credit Dilemma of Export-oriented Enterprises and Its Resolution Mechanism: Based on the Perspective of Credit Insurance. Foreign Economic and Trade Practice, 2013(3):62-64.

26 Cheng Hui and Xu Chenggang. Discussion on the Influence of ISO26000 on the Competition Model of China's Export-oriented Enterprises and Its

Countermeasures. Science & Technology Economic Market, 2013(8):33-36.

27 Xinming Xia and Canfei He. Product Evolution of China's Export-Oriented Foreign-Funded Enterprises from the Perspective of Trade Protection. Economic Geography, 2019. 39(4):109-117.

28 Bruno Cassiman, Reinhilde Veugelers. In Search of Complementarity in Innovation Strategy: Internal R&D and External Knowledge Acquisition[J]. Management Science,2006,52(1):68-82.

29 Guo Lixin. On the key points of enterprise technology management. China Management Informatization, 2021, 24(08):141-142.

30 Romel Mostafa, Steven Klepper. Industrial Development Through Tacit Knowledge Seeding: Evidence from the Bangladesh Garment Industry[J]. Management Science,2017,64(2):613-632.

31 Zhang Yuhong et al. On the structure of enterprise technology management system[J]. Science & Technology Today, 2021(02):59-60.

32 Xiong Ling. Strengthen technical management and enhance the technological innovation ability of enterprises[J]. China Management Informatization, 2018,21(09):84-85.

33 Hu Hongmei. Evaluation of Enterprise Technology Management Capability Based on Technology Life Cycle[J]. Enterprise Reform and Management, 2018(09):6-13.

34 Tang Linjia et al. Research on the dynamic evolution of technology management ability of small and medium-sized science and technology enterprises[J]. Scientific Research Management, 2016. 37(03):21-30.

35 Wu Weiwei, Yu Bo and Wu Chong. Research on the evaluation of enterprise technology management ability based on technology life cycle[J]. Science of Science and Technology Management, 2012. 33(05):115-121.

36 Wu Weiwei, Liang Dapeng and Yu Bo. Research on the process mode of enterprise technology management operation under uncertainty condition[J]. Science of Science and Science and Technology Management, 2009. 30(10):133-138-144.

37 Xu Xiaoqin and Yang Min. Research on the evaluation index system of modern enterprise technology management based on analytic hierarchy process[J]. Science and Technology Management Research, 2008(10):173-175.

38 Qu Jun. What do Japanese companies rely on to participate in

international competition? [J]. Enterprise Management, 2020(05):30-32.

39 Xie Jun, Xu Qing. Research on the relationship between technological innovation ability and export performance of Manufacturing enterprises in Guangdong [J]. Science and Technology Management Research,2010,30(12):77-79.

40 Heather Berry. The Influence of Multiple Knowledge Networks on Innovation in Foreign Operations[J]. Organization Science,2018, 29(5):855-872.

41 Helpman E. Trade FDI, and the Organization of Firms[J]. American Economic Association,2006, 44(03):589-630.

42 Wignaraja G.FDI and Innovation as Drivers of Export Behavior[J]. UNU-MERIT Working Paper,2008(06).

43 Antoniettil R.and Cainelliet G. The Role of Spatial Agglomeration in a Structural Model of Innovation, Productivity and Export[J].The Annals of Regional Science,2011,6(3):577-600.

44 Hasan R. et al. Does Investing in Technology Affect Exports？ [J].Review of Development Economics,2003(02):279-293.

45 Shou-Min Tsao, Guang-Zheng Chen. The impact of internationalization on performance and innovation： The moderating effects of ownership concentration[J]. Asia Pacific Journal of management,2010(07).

46 Li Zhengwei, Chi Renyong, Cindy Millman. The impact of technology import and export trade on independent research and development: An empirical study of Zhejiang high-tech industry [J]. Research in Science of Science,2010,28(10):1495-1501.

47 Liu Xiuling. Research on the characteristics and influencing factors of technological innovation in Chinese Export Enterprises [J]. International Business (Journal of University of International Business and Economics),2011,(06):100-111.

48 Dai Mi, Yu Miajie. R&d input, export and productivity progress before export: evidence from Chinese manufacturing firms [J]. Economics Quarterly Review,2012,11(01):211-230.

49 Jayaratne, Jith and Wolken, John. “How important are small banks to small business lending： New evidence from a survey of small firms” [J]. Journal of Banking & Finance.1999(23):427-458.

50 I.R. Gordon and P. Mccann. Industrial clusters： Complexes,

agglomeration and/or social networks[J]. Urban Studies 2000,37(3):513-532.

51 Enright, Michael J. Regional Clusters and Multinational Enterprises[J]. International Studies of Development Management & Organization.2000.

52 Pengfei Han, Wei Jiang, Danqing Mei. Mapping U.S.–China Technology Decoupling: Policies, Innovation, and Firm Performance[J]. Management Science,2024, https://doi.org/10.1287/mnsc.2022.02057

53 Chen Junji. "How can Born Globals Become Born Winners? - A Study on the Development Strategy of Born Global Enterprises from the Perspective of Co-evolution Strategy" [D]. Southwestern University of Finance and Economics, 2019.

54 Shang Tiantian, Miao Xiaoming, Liu Hanlong, et al. Research on the Mechanism of Disruptive Innovation Process under Resource Constraints [J]. Forum on Science and Technology in China, 2021(01): 35-43+54.

55 Li Ziyuan. Research on the Development Strategy of Born Global Enterprises from the Perspective of Co-evolution [D]. Jilin University of Finance and Economics, 2023.

56 Shi Jiahua. and Liu Mingzhe. "Unlimited Potential Ahead: A Conversation with Wang Fan, Director of Public Relations at DJI[J]. Academy of management review, 2016(09):44-45.

57 Hong Jiaying and Meng Zirui. Research on DJI brand equity and brand development strategy[J]. International Public Relations,2023(11):137-139.

58 Su Muhui. DJI: Carrying out business value in the air market[J]. New Industry Economy,2020, (04):48-51.

59 Liu Bo. The impact of knowledge co-creation in innovation ecosystems on breakthrough innovation in core firms[D]. University of Electronic Science and Technology,2023.

60 Zhou Changbao,LI Zili,Zhang Yanfang. DJI ecosystem[J]. Enterprise Management,2020(03):64-67.

61 Ren Zhikuan, Li Dongliang, Wu Jinmei. Collegiate entrepreneurial ecosystem: origin, connotation and cognitive framework[J]. Exploration of Higher Education,2023(04):122-128.

62 Hong Jiaying and Meng Zirui. Research on DJI brand equity and brand development strategy[J]. International Public Relations,2023(11):137-139.

63 Liu B. The impact of knowledge co-creation in innovation ecosystems on

breakthrough innovation in core firms[D]. University of Electronic Science and Technology,2023.

64 Zhu Xiaomeng. Patent Strategy Research of Shenzhen DJI Technology Co., Ltd. [D]. Shandong University of Science and Technology, 2019

65 Han Qiuru, Liu Wei. International Development of Technological Innovation Enterprises - Taking DJI as an Example [J]. Science and Industry, 2022, 22 (11): 305-311

66 Han Qiuru, Liu Wei. International Development of Technological Innovation Enterprises - Taking DJI as an Example [J]. Science and Industry, 2022, 22 (11): 305-311.

67 Hong Jiaying, Meng Zirui. Research on Brand Assets and Brand Development Strategies in DJI [J]. International Public Relations, 2023 (11): 137-139.

68 Evanschitzky H , Eisend M , Calantone R J ,et al.Success Factors of Product Innovation: An Updated Meta-Analysis[J].Journal of Product Innovation Management, 2012,29(S1):21-37.

69 Meng Mengmeng, Huang Ruimin, Zhang Li, et al. Exploration of the Process Mechanism and Model of Creating Shared Value through Enterprise Technology for Goodness: A Case Study Based on Drone Enterprises [J]. Science and Technology Management Research, 2023,43 (23): 121-132.