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Overseas Technology Protection Issues and Countermeasures of Chinese Infrastructure Enterprises under the "Belt and Road" Initiative

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Abstract

With the in-depth promotion of the "Belt and Road" initiative, Chinese infrastructure enterprises have ushered in an important opportunity for internationalization, but the problem of overseas technology protection is becoming more and more prominent, which has become an important challenge affecting the core competitiveness of the enterprises and national interests. By analyzing the current situation of intellectual property disputes faced by Chinese infrastructure enterprises in countries along the Belt and Road Initiative, this paper reveals the major problems in overseas technology protection, including illegal imitation of patents, over-exploitation of technology by partners, preemptive application of patents for new technologies, and the risk of cross-border data transmission, etc. The study further explores the causes of these problems and the impacts on the core competitiveness and national interests of enterprises. The study further explores the causes of these problems, such as the lack of overseas patent layout, the low cost of breach of contract, the imperfection of the enterprise's intellectual property risk control system, and the lack of data security monitoring system. Aiming at these problems, this paper puts forward countermeasures and suggestions such as strengthening overseas patent layout, improving default cost, and constructing enterprise intellectual property rights prevention and control system and data security prevention and control system, which are aimed at providing theoretical support and practical guidance for China's infrastructure enterprises to "go global", and helping China's infrastructure technology to realize sustainable development on a global scale.

Keywords

"Belt and Road"; Infrastructure Enterprises; Overseas Technology Protection; Intellectual Property Disputes; Patent Layout; Data Security; International Cooperation.

1. RESEARCH BACKGROUND

In recent years, with the profound adjustment of the global economic pattern, China's economy has entered a downward cycle, and the domestic infrastructure market is facing the double pressure of reduced demand and oversupply. According to the National Bureau of Statistics, the number of infrastructure projects under construction in China in 2024 is more than 34,000, a year-on-year decrease of 3.1%. At the same time, competition among domestic infrastructure enterprises has intensified, and traditional construction and design units are gradually facing market saturation and urgently need to find new growth space.

Against this backdrop, the "Belt and Road" initiative provides an important internationalization opportunity for China's infrastructure enterprises. [1] Most of the countries along the route are in the stage of rapid economic development, and the demand for infrastructure construction continues to release. For example, the number of infrastructure projects in Southeast Asia in 2024 will increase by 4.5% year-on-year in Cambodia and 5.1% in

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Laos. In addition, according to the Infrastructure Development Demand Sub-Index of the China Chamber of Foreign Contractors, infrastructure demand in countries along the “Belt and Road” recovered rapidly between 2021 and 2023, and surpassed the pre-2019 epidemic level in 2023.

Southeast Asia and the Middle East are hotspots for infrastructure demand growth along the Belt and Road. Southeast Asian countries due to the transfer of manufacturing and export growth, infrastructure demand is rising rapidly, focusing on areas such as transportation infrastructure, new energy infrastructure and industrial park construction. In the Middle East, due to population growth, accelerated urbanization and economic diversification, infrastructure demand continues to rise, mainly in the areas of municipal infrastructure upgrading, transportation and logistics facilities and new energy infrastructure.

In this context, how to effectively protect the technical achievements of China's infrastructure enterprises and safeguard their legitimate rights and interests under the “Belt and Road” initiative has become an important issue to be resolved. This study analyzes the current situation of intellectual property disputes faced by China's infrastructure enterprises overseas and discusses the path and countermeasures of technology protection, aiming to provide theoretical support and practical guidance for China's infrastructure enterprises to “go out” and help China's infrastructure technology to achieve sustainable development on a global scale.

2. STATUS OF PROTECTION

In the process of “Belt and Road” initiative to promote China's infrastructure enterprises to go international, the current situation of overseas technology protection of our international infrastructure enterprises is not optimistic, and the infringement problems are frequent, which has caused serious economic losses and even threatened national security.

From the number of infringement cases, in the past three years, China's enterprises in Southeast Asia suffered 67 major intellectual property disputes. Saudi bin Laden Group without China's Southwest Design and Research Institute, unit permission to modify part of the design drawings, misconduct serious infringement of our copyright. Infringement cases such as these directly lead to the economic losses of China's infrastructure enterprises exceeded 20 billion yuan. A large number of infringement cases led to the development of China's infrastructure enterprises in overseas markets are facing serious obstacles. The normal operation of enterprises and market expansion has been greatly affected. [2]

More seriously, technology leakage may also jeopardize national security. When Sichuan Highway and Bridge Construction Group Co., Ltd. was involved in a high-speed rail project in the Middle East, the key technical data was obtained by a third party, and the leakage of the technology will threaten the security of the national transportation lifeline. These problems show that China's infrastructure enterprises have large loopholes in overseas technology protection, and there is an urgent need to take effective measures to improve.

3. OVERSEAS TECHNOLOGY PROTECTION PROBLEMS OF CHINESE INFRASTRUCTURE ENTERPRISES UNDER THE “BELT AND ROAD” INITIATIVE

3.1. Illegal Patent Imitation Patent Problems

In the process of China's infrastructure enterprises expanding overseas markets, the problem of illegal imitation of patented technology products appears frequently, bringing many negative impacts to enterprises.

Construction equipment, Guizhou Tunnel Construction Engineering Co., Ltd. for the Algeria East-West Highway Terminal Tunnel Project spent several years, developed a new type of tunnel boring machine. This equipment integrates a number of high-precision technology patents such

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as intelligent control, tool design, rock adaptability technology, etc., representing the core technology achievements of Guizhou Tunnel Construction Engineering Co. However, without any authorization, local company A illegally copied the tunnel boring machine and sold it in the local market. As a result of this behavior, Guizhou Tunnel Construction Engineering Co., Ltd. lost a large number of potential customers, and the economic loss was estimated to be about 2.52 million. The imitation equipment flooded the local market at a low price, which not only seriously disrupted the market order, but also weakened the competitiveness of our products.

In the field of construction materials, Nanjing Tongli Construction Group Co., Ltd. utilized its self-developed patent technology of high-performance concrete for tunnel reinforcement in the construction of Metro Line 1 project in Manila, Philippines. The patent covers special formula, precise raw material proportioning and mixing process, with significant technical advantages, which played a great role in the construction of the project. However, local company B, after illegally obtaining the relevant technical information, imitated it without authorization and put it into production. The imitated concrete was of low cost and poor quality, which was counterfeit and shoddy products, and was sold locally in the Philippines at a price far lower than the price of China's high-performance concrete, which made the market share of Nanjing Tongli Construction Group Co., Ltd. drop by about 30%, and the brand reputation of the enterprise was damaged as a result, which seriously affected the sustainable development of China's infrastructure enterprises in the overseas market.

3.2. The problem of over-utilization of partners

While China's infrastructure enterprises are actively engaged in overseas markets, the importance of the protection of patented technology is self-evident. However, in specific infrastructure projects, it is not uncommon for partners to use Chinese infrastructure technology beyond the agreed scope. The use of Chinese infrastructure technology by partners in excess of the agreed scope not only affects the construction process of the infrastructure project and the relationship between the two parties, but also brings certain economic losses to the Chinese enterprise, and even negatively affects the technical reputation of the Chinese enterprise.

Take the case of technical dispute between a Chinese enterprise and a Thai enterprise as an example, both parties have clearly stipulated the scope of technical authorization in the cooperation agreement. According to the agreement, the Chinese enterprise authorized the Thai enterprise to use the specific infrastructure technology developed by us in the cooperative railroad project, and it was limited to the construction process of the project and could not be used for other projects or purposes. This scope of technology authorization is designed to ensure that the Chinese enterprise's technological advantages are reasonably protected, and at the same time meet the actual needs of the partners in the project. However, the Thai enterprises have taken the liberty of applying the technology authorized by the Chinese side to their own development in the course of the project, which they believe can effectively help them to improve the construction quality and efficiency of other projects, but this behavior has seriously violated the technology authorization agreement. When the Chinese infrastructure enterprise found this situation, it immediately launched an investigation and confirmed the fact that the Thai enterprise had used the technology beyond the scope of the agreement by analyzing various aspects. In order to solve this problem, the Chinese enterprise repeatedly negotiated with the partner to defend its rights, but the partner refused many times, which seriously affected the relationship between the two parties and the process of the cooperation project. In this typical case, we can clearly recognize the seriousness of the issue about the partner's over-use of authorized technology. In specific offshore infrastructure projects, there are many cases in which the project process has been affected due to the partner's use of Chinese licensed technology beyond the agreed scope. In this case, not only the project process

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202505_11(5).0001

of the cooperation is affected, but also the technical reputation of the Chinese enterprise is affected by the misuse of the unique technology of the Chinese enterprise. At the same time, the economic benefits derived from the technology of the Chinese enterprise will also be affected. Therefore, it is urgent to solve the problem of over-use of technology by partners.

3.3. New Technology Preempted by Partners to Apply for Patents

Infrastructure projects are huge and complex, in the process of advancing the project, will always encounter a variety of problems, in order to overcome these problems, the two sides will often work together to research and development of some new technologies. However, these new technologies, in the contract before the start of the project does not provide for the attribution, which leads to new technologies of the patent ownership of the unknown, at this time, if the partner company pre-empted the registration, then the Chinese company will lose the dominant right to invest efforts in research and development of new technologies. This will not only cause huge losses to the Chinese enterprise, but also cause disputes with partners, thus affecting the engineering process.

Take the case of a Chinese enterprise litigating against a Southeast Asian enterprise as an example, a Chinese enterprise and a Southeast Asian enterprise jointly developed an intelligent transportation system . However, due to the unique local geological structure, the project could not be continued. Therefore, the Chinese enterprise and the Southeast Asian enterprise jointly dealt with the complex geological conditions and strict technical requirements, and developed a new type of technology. This technology is not only significant for this project, but also for similar projects in the future. However, when the Chinese company was about to apply for a patent for the new technology, it was shocked to learn that its partner had already registered it first, which put the Chinese infrastructure company in an extremely passive situation. Chinese infrastructure companies could face patent infringement charges if they continue to use the technology they have been involved in developing. Similar situations occur from time to time in China's overseas infrastructure projects. This is not only a pain point in the infrastructure industry, but also in the field of intellectual property rights, so it is urgent to solve the problem of new patents being registered by partners beforehand!

3.4. Risks of cross-border data transmission

With the in-depth promotion of the “One Belt, One Road” initiative, Chinese infrastructure companies are increasingly involved in overseas projects, and cross-border data transmission has become an important part of engineering projects. However, the risks in cross-border data transmission are becoming more and more prominent, which not only affect the smooth progress of the project, but also may pose a serious threat to the technical security and commercial interests of enterprises. In a Southeast Asian smart port project, a Chinese company was forced to suspend its original plan of relying on China's public cloud platform for centralized data processing due to the Indonesian government's requirement that all terminal operation data be stored on local servers, which increased project costs and time costs. In the case of a deep-water port project in Africa, the database of a project constructed by a Chinese company was hacked, and data involving BIM technology was stolen and traded on the black market, threatening the company's technological security and business interests. The causes of these risks mainly include the strict requirements on data storage and transmission in the target countries, the lack of perfect confidentiality processes and technical means (such as data encryption and authority management) within the enterprises, and the imperfect organizational structure and staffing, which make it difficult to detect and respond to data security risks in a timely manner. In addition, some enterprises have insufficient understanding of data regulations in target countries and fail to fully comply with local laws and regulations, further exacerbating compliance risks. The complexity and diversity of cross-border data

ISSN: 2472-3703 DOI: 10.6911/WSRJ.202505_11(5).0001

transfer issues indicate that data security has become an important challenge that cannot be ignored in “Belt and Road” infrastructure projects.

4. ANALYSIS OF OVERSEAS TECHNOLOGY PROTECTION PROBLEMS OF CHINESE INFRASTRUCTURE ENTERPRISES

In the process of “going out” under the “Belt and Road” initiative, China's infrastructure enterprises are facing many influencing factors. These factors not only increase the operational risk of enterprises, but also may cause damage to the core competitiveness of enterprises and national interests. The following is an in-depth analysis of four aspects: the lack of overseas patent layout, the low cost of breach of contract, the lack of intellectual property risk control system and the lack of data security monitoring system.

4.1. Lack of Overseas Patent Layout

The patent layout of China's infrastructure enterprises overseas is obviously insufficient, which makes enterprises face greater intellectual property risks overseas. [3] According to relevant data, China's 20 overseas infrastructure projects in the past five years, 60 contractors, a total of 156,572 patents in the country and only 1,822 patents outside, accounting for only 1.16%, and 60 enterprises, as many as 27 enterprises outside the number of patents for the 0. This lack of patent layout makes it difficult to form an effective intellectual property rights protection barriers in overseas markets, and is prone to suffer from patent infringement and other intellectual property disputes. infringement and other intellectual property disputes. For example, in the terminal tunnel project of the East-West Highway in Algeria, Guizhou Tunnel Construction Engineering Co., Ltd. invested several years to develop a new type of tunnel boring machine, which covers a number of technical patents, such as intelligent control, tool design, and rock adaptability technology, etc. However, the local company A illegally imitated the tunnel boring machine without authorization, which resulted in the loss of the potential customers of our enterprise and led to an economic loss of about 2.52 million.

4.2. The cost of breach of contract is too low

In many countries along the “Belt and Road” route, there is no punitive damages system in the legal system, which leads to the low cost of breach of contract. Some partners may maliciously breach the contract in the process of cooperation, which brings huge economic losses to China's infrastructure enterprises. For example, in the 67 major intellectual property disputes encountered by China's enterprises in Southeast Asia in the past three years, the defaulting party in some of the cases was only required to pay low liquidated damages, which were far less than the benefits it had gained through the breach of contract. [4] This environment of low default costs makes some enterprises or individuals, driven by profit, choose to take the risk of infringing on the intellectual property rights of China's infrastructure enterprises. In the case of the China-Thailand railroad, the Thai side used the core technology for its own development without authorization, infringing on our intellectual property rights and affecting the process of the subsequent project, and because the cost of breach of contract was too low, the Thai side was not sufficiently punished, which further aggravated the losses of our enterprises. [5]

4.3. Lack of Intellectual Property Risk Control System

Many infrastructure enterprises lack a perfect intellectual property risk control system in the process of “going out”. This is mainly reflected in the organizational structure and staffing is not perfect, the lack of professional intellectual property management personnel and effective collaboration mechanism, resulting in the face of intellectual property issues, the enterprise is difficult to form an effective internal response strategy. For example, some enterprises have not

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set up specialized intellectual property management positions in overseas projects, resulting in no one being responsible for patent application and maintenance, which increases the risk of patent infringement. In addition, the system construction and implementation are not in place, and there is no perfect intellectual property risk management system and process, which makes the enterprise have many loopholes in intellectual property protection, and it is difficult to effectively prevent and respond to intellectual property risks. For example, in the process of technology research and development, enterprises did not make timely patent applications for technical achievements, resulting in technical achievements being patented by others. At the same time, the lack of awareness and training, management and employees of intellectual property risk awareness is insufficient, and the lack of relevant training, resulting in the actual work, often ignoring intellectual property issues, and even inadvertently violating the intellectual property rights of others or their own intellectual property rights are infringed upon without realizing it. For example, some enterprise employees in the process of communication with partners, accidentally leaked the enterprise's technical secrets, which brought great losses to the enterprise.

4.4. Lack of data security monitoring system

With the digital and intelligent development of infrastructure projects, data security issues are becoming more and more prominent. However, many enterprises have obvious deficiencies in data security management. The lack of effective technical means of data security monitoring cannot guarantee the confidentiality, integrity and availability of data, making it easy to leak the core technology and commercial secrets of enterprises. For example, in the African deep-water port project, the project database of the Chinese enterprise was hacked, and the technical data was stolen and later appeared in the black market transactions, and the lack of data security management of the BIM technical data involved led to data leakage. In addition, no perfect data security management system and process have been established, and the responsibility for data security is not clear, making it difficult to effectively prevent and respond to data security risks. For example, the enterprise has not encrypted the data in the process of data storage and transmission, resulting in the data being intercepted in the transmission process. The internal personnel of enterprises have insufficient understanding of the importance of data security and lack of data security awareness training, resulting in a high frequency of data security incidents. For example, some enterprise employees accidentally uploaded the sensitive data of the enterprise to the public cloud platform when using the public network, resulting in data leakage. [6]

To summarize, China's infrastructure enterprises face many influencing factors in the process of “going out” under the “Belt and Road” initiative. These factors not only increase the operational risk of enterprises, but also may cause damage to the core competitiveness of enterprises and national interests. Therefore, it is of great significance to strengthen the protection of intellectual property rights, improve the risk prevention and control system, and enhance the awareness and management level of intellectual property rights of enterprises to safeguard the legitimate rights and interests of China's infrastructure enterprises overseas.

5. COUNTERMEASURES FOR OVERSEAS TECHNOLOGY PROTECTION OF CHINESE INFRASTRUCTURE ENTERPRISES UNDER THE “BELT AND ROAD” INITIATIVE

5.1. Strengthening Overseas Patent Layout

Strengthening overseas patent layout is an important means for enterprises to gain advantages in international market competition. Strategies such as combined patent layout,

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reverse binding of standard-essential patents and peripheral patent encirclement provide enterprises with comprehensive and targeted patent layout ideas.

Combined patent layout emphasizes the organic combination of multiple patent types and technology modules. In the pre-layout planning, enterprises need to clarify the direction of combined patent layout. On the one hand, the complex technology will be modularized unit processing, the overall technology is divided into a number of relatively independent and interrelated modules, respectively, for patent application, in order to form a comprehensive patent protection network. On the other hand, we build a market screening matrix model, taking into account the demand of the target market, competitive situation and other factors, and screen out the most valuable technology points for patent layout. At the same time, we check the patent obstacles and risks to avoid affecting the layout effect due to patent conflicts and other problems. [7]

Standard Essential Patent Reverse Binding is to embed its own patented technology into the industry standard of the target place. Enterprises need to study in-depth the process and trend of industry standard setting in the target market, integrate their own advantageous patented technologies into it, and realize the mandatory association between technical standards and their own patents. Once the industry standard is established, other enterprises must use the relevant patented technology to follow the standard, thus forming market access barriers and enhancing the competitiveness of enterprises in overseas markets.

Peripheral patent encirclement through the drawing of technology tree for technology dismantling analysis, comprehensive combing of core technologies around the relevant technology points. On this basis, patent cluster design is carried out to form a satellite protection network around the core patents. By applying for a large number of peripheral patents, not only can we further improve the patent protection system, but also increase the difficulty for competitors to bypass the patents. At the same time, build a market prioritization matrix to reasonably allocate patent resources according to the importance and potential of different markets and improve the efficiency of patent layout.

5.2. Increase the cost of breach of contract

In order to effectively deal with the problem of over-utilization by partners, increasing the cost of breach of contract has become a key countermeasure. Firstly, high liquidated damages should be clearly set in the contract, and the amount of liquidated damages should be reasonably determined by combining the cost of technology research and development, market value and potential loss. Secondly, it is necessary to specify in the contract the full scope of liability of the defaulting party, to ensure that the defaulting party needs to compensate for all the losses suffered by the enterprise, including direct economic losses, indirect loss of income and legal costs incurred in defending rights. In addition, the international experience can be used to introduce a punitive damages system, which requires the breaching party to pay several times the actual loss of compensation for malicious breach of contract, and strengthens the legal deterrent through economic leverage. The above measures can not only make up for the losses of enterprises, but also significantly increase the illegal cost of the defaulting party, effectively curb the behavior of partners using technology beyond the scope, so as to build a more binding compliance environment, safeguard the technological rights and interests of Chinese enterprises and the sustainability of their overseas investment, as well as the technological security and legitimate rights and interests of Chinese infrastructure enterprises overseas.

5.3. Construct enterprise intellectual property prevention and control system

Enterprises should introduce automated early warning tools to monitor abnormal patent applications in real time. It is crucial to utilize patent database to monitor the trend of competitors' patent applications in target countries. Enterprises can analyze the distribution of

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competitors' patent applications in technical fields, application time nodes, application geographical scope and other information, to gain an in-depth understanding of the direction of their technological research and development and market layout strategy. For example, if it is found that competitors frequently apply for patents in an emerging technology field, enterprises can assess the potential impact of this technology on their business in advance, and then adjust their R&D and IP layout strategies.

The strategy of "early disclosure + priority" is an effective means for enterprises to seize the advantage of the filing date in the process of patent application. Early disclosure can enable enterprises to obtain temporary protection for their technical solutions to a certain extent, and at the same time lay the foundation for subsequent application for priority. For some technologies that are not suitable for patent application for the time being, enterprises may disclose them through open source platforms. The purpose of this practice is to undermine the novelty of potential robbers.

Enterprises should split core technologies into multiple technology points for patent layout. Doing so can avoid a comprehensive blockade of the core technology by a single robbing behavior. When making patent layout, enterprises should prioritize the coverage of core markets. The core market is usually the main source of enterprise revenue, but also the competitors focus on the region. By laying out patents in the core market in advance, enterprises are able to compress the technology application space of the squatters, making it difficult for them to obtain effective patent protection in that market. For example, for a technology enterprise with globalized operations, applying for patents in advance in major markets such as Europe and the United States can effectively prevent the malicious squatting behavior of local competitors and stabilize the enterprise's competitive position in these markets.

5.4. Construct enterprise data security prevention and control system

Constructing a perfect enterprise data security prevention and control system is not only a necessary means to protect the core competitiveness of enterprises, but also a key measure to cope with the increasingly complex network security threats. In the following, we will discuss how to build an efficient enterprise data security prevention and control system from four aspects: code intellectual property rights, access control, security testing and code encryption.

As an important carrier of enterprise technological innovation, the intellectual property protection of code is crucial. Enterprises can protect code assets through various legal means: first, apply for copyright for software code with originality to ensure its legal status; second, for novel algorithms or technologies, apply for patent protection to prevent others from using them illegally; lastly, for inconveniently publicized core technologies, they can be protected as trade secrets, and their security can be ensured through internal confidentiality agreements and authority management. Through multi-level protection measures, enterprises can effectively prevent code leakage and infringement and maintain technical advantages.

Strict access control is the foundation of data security. Enterprises should restrict the access rights of authorized personnel to ensure that only specific personnel have access to sensitive data or core code. In addition, establishing an activation code acquisition mechanism and generating unique serial numbers can effectively verify the legitimacy of users or devices and prevent unauthorized access. With dynamic rights management and multi-factor authentication technology, organizations can further enhance the security of access control and reduce the risk of internal and external threats.

Security testing is an important means of discovering and fixing system vulnerabilities. Enterprises should conduct regular simulated attack tests to proactively look for weaknesses in the system and remedy vulnerabilities in a timely manner. Meanwhile, a combination of manual review and automated vulnerability scanning tools can provide comprehensive coverage of

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code and system security issues. Through continuous security testing, organizations can significantly improve the system's ability to resist attacks.

Encryption of code and data during storage and transmission is the last line of defense against information leakage. Organizations should set up specific secret keys for sensitive data and change them regularly to enhance security. The use of full-process encryption during data transmission can effectively prevent man-in-the-middle attacks. Through comprehensive encryption measures, enterprises can ensure the security of data in all aspects.

To summarize, the construction of enterprise data security prevention and control system needs to start from multiple dimensions such as legal protection, authority management, vulnerability repair and technical encryption. Only through systematic measures and continuous optimization can enterprises ensure data security in the complex and changing network environment and lay a solid foundation for sustainable development.

6. CONCLUSION

With the in-depth promotion of the “Belt and Road” initiative, Chinese infrastructure enterprises are using technology as a bridge to connect the world and build the future together. However, the issue of technology protection has become an important challenge affecting the internationalization of Chinese infrastructure enterprises, which not only threatens the technological security and commercial interests of enterprises, but also concerns the national technological sovereignty and the fairness of global technological governance. Through an in-depth study of 68 cases of foreign-related intellectual property disputes, this paper puts forward the technical protection problems of infrastructure projects going overseas and proposes targeted strategies, which are not only the response to the existing problems, but also the exploration of the future technical protection system.

Looking ahead, the internationalization of China's infrastructure technology is not only an inevitable trend of economic globalization, but also a practical action to build a community of human destiny. We firmly believe that through technological innovation and system improvement, Chinese infrastructure enterprises will connect the world with a more solid technological bridge, win greater voice and competitiveness in the wave of globalization, and promote global infrastructure construction to a higher level.

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