

The Influence and Countermeasure of Technical Barriers to Trade on Export of Mechanical and Electrical Products from China to EU

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Abstract: With the change of global economy and international trade environment, developed countries began to take more covert and diversified trade protection measures, such as technical barriers to trade. As an important export region of mechanical and electrical products in China, EU has adopted strict technical barriers to trade in recent years. It restricts the export of mechanical and electrical products in China by formulating strict technical regulations and standards, complicating conformity assessment procedures, enhancing packaging and labeling requirements and setting intellectual property barriers. On the basis of elaborating the current situation of the mechanical and electrical products in China export to the EU and the main technical barriers to trade in the EU, this paper analyzes the impact of technical barriers to trade on mechanical and electrical products in China export to the EU, and combined with the results of the impact analysis, put forward the corresponding countermeasures and suggestions.

1. Analysis on the current situation of China's mechanical and electrical products export encountering technical barriers to trade of EU

1.1 Changes in the scale of China's mechanical and electrical export to EU

Since China join in the World Trade Organization, the EU has been an important trading partner of China, and bilateral trade volume has been on the rise. In 2019, China's total export volume to the EU reached US \$470.491 billion, an increase of nearly 6.4 times compared with US \$7.343 billion in 2001, of which the export of mechanical and electrical products accounted for 57.2%. From 2001 to 2019, China's export volume of mechanical and electrical products to the EU accounted for more than 50% of China's total export volume to the EU, and even more than 70% in some years.

Due to the impact of technical barriers to trade in the EU, China's export volume of mechanical and electrical products to the EU fluctuates in different ranges, and even has negative growth in some years. According to the UN comtrade statistics, in 2001, the export volume of mechanical and electrical products to the European Union is \$31.119 billion. From 2001 to 2008, under the trade convenience between China and the European Union and the stimulus of demand, the export volume of China's mechanical and electrical products to EU grew rapidly. In 2008, the export volume of China's mechanical and electrical products reached \$179.893 billion, which had risen by nearly 5.8 times compared with 2001. In 2009, influenced by EU RoHS directive and EUP directive, China's export volume of mechanical and electrical products to the EU had 16% negative growth for the first time from 2001. Since then, China's export volumes of mechanical and electrical products to the EU rise slowly, which reached US \$268.711 billion in 2019, a huge rise compared with 2001.

1.2 Changes in China's export structure of mechanical and electrical products to the EU

According to HS code classification and definition, mechanical and electrical products include HS84 -- nuclear reactors, boilers, machinery, mechanical appliances and parts thereof; HS85 - Electrical machines, electrical equipment and their parts, tape recorders and reproducer, equipment

for recording and replaying television images and sounds, their parts and accessories; HS86 -- Railway and tramway locomotives, rolling stock and their parts, railway and tramway track fixtures and their parts and accessories, all kinds of machinery (including electric machinery) traffic signal equipment; HS87 -- Vehicles and their parts and accessories, other than railway and tramway vehicles; HS88 -- Aircraft, spacecraft and parts thereof; HS89 -- Ships and floating structures; HS90 - Optical, photographic, cinematographic, metrological, laboratory, medical or surgical instruments and equipment, precision instruments and equipment, parts and accessories of the above; HS91 -- Clocks and watches and their parts; HS92 -- Musical instruments, their parts, accessories.

In order to facilitate the study of the impact of technical barriers to trade on China's export of mechanical and electrical products to the EU, this paper classifies mechanical and electrical products as labor-intensive and capital-technology-intensive. Labor-intensive products refer to the products with relatively high labor input proportion in the production process and low requirements for technical operation. Capital-technology-intensive products refer to those products which the capital investment in the production process is relatively high, which are characterized by large investment and high requirements for technical operation. In the classification of mechanical and electrical products, labor-intensive mechanical and electrical products include boilers, machines, machinery, parts, etc. in the HS84 category; and parts of aerospace and spacecraft machinery in the HS88 category, HS85, HS90, HS91, HS92; Capital and technology-intensive products include nuclear energy and data processing in HS84 category, and large components of aerospace and spacecraft in category of HS88, HS86, HS87 and HS89.

According to China's export structure of mechanical and electrical products to EU, labor-intensive products accounts for a large proportion, mainly because China has rich labor resources. According to the factor endowment theory, the export of labor-intensive mechanical and electrical products has advantages over the export of capital technical mechanical and electrical products in China. In recent years, the proportions of the amount of capital and technology-intensive mechanical and electrical products are on the rise year by year, and labor-intensive export proportions of mechanical and electronic products are on the decrease in recent years, suggesting that China's mechanical and electrical products exports to EU gradually transform from the labor-intensive to technology-intensive products, which is mainly due to the improvement of China's capital and technology level and the technological transformation and upgrading of China's export mechanical and electrical products. [1]

2. Major technical barriers to trade of mechanical and electrical products of EU

In the case of low tariff level worldwide, TBT becomes important non-tariff trade barrier measures by virtue of its concealment and flexibility. The developed countries and regions in the world take the technical barriers to trade as an important means to protect domestic trade and restrict market access by virtue of their technological and economic advantages. At present, the main technical barriers to trade of mechanical and electrical products implemented by EU include four aspects: technical regulations and standards, conformity assessment procedures, packaging and labelling requirements, and the special form of technical barriers to trade -- intellectual property barriers.

2.1 Technical regulations and standards

(1) WEEE directive

On 27 January 2003, the European Parliament and the Council of the European Union jointly promulgated Directive 2002/96/EC (WEEE directive) on the use of obsolete electronic and electrical equipment. According to the WEEE directive, from 13 August 2005, producers of electronic and electrical equipment in circulation in the EU market must legally assume the responsibility to bear the cost of recycling scrapped products. Member States of the European Union are obliged to develop their own recycling plans for electrical and electronic products and to establish supporting

recycling facilities so that end-users of electrical and electronic products can dispose of their discarded equipment conveniently and freely. [2]

WEEE directive is suitable for large home appliances, small household appliances, information technology and telecommunications equipment, the user equipment, lighting equipment, electrical and electronic tools (excluding large static industrial tools), toys, leisure and sports equipment, medical equipment (except for all the implant and infected products), monitoring and control equipment, vending machines and other products, for higher scrap rate of recovery and recycling of electronic electrical products, and reducing the pollution to the environment. WEEE Directive involves most of China's mechanical and electrical products exported to EU, which limits China's export of products to EU to some extent, and to speed up the development and production of environmentally friendly mechanical and electrical products.

(2) RoHS directive

On 23 January 2003, the European Parliament and the Council of the European Union jointly promulgated Directive 2002/95/EC (RoHS directive) on the restriction of the use of certain hazardous substances in electrical and electronic equipment. RoHS directive requires that limit the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) of six kinds of harmful substances from July 1, 2006, in the new electrical equipment on the market of electronic products. On June 4, 2015, the European Union's official communique released RoHS2.0, officially listed four kinds of phthalic acid ester (of DEHP, BBP and DBP, DIBP) in the restricted substances list. [3]

The RoHS directive involves a wide range of products, almost covering all electronic, electrical, medical, communications, toys, security information and other products, it includes not only the machine products, but also the parts, raw materials and packaging used in the production of the machine, related to the entire production chain. As a strict green and environmental protection directive, RoHS directive has raised the threshold of China's mechanical and electrical products export to the European Union, which has caused an impact on some mechanical and electrical products export enterprises in China.

(3) EUP directive

On July 6, 2005, the European Parliament and the Council officially published the Directive 2005/32/EC (EUP directive) on the formulation of the framework of environmental design requirements for energy consumption products. The EU requires each member state to formulate specific requirements for relevant products and translate them into national regulations by August 11, 2007 at the latest. The directive covers all electrical products, introducing life cycle theory into product design for the first time, and setting environmental requirements for all stages of product design, production, maintenance, final elimination, recycling and disposal. [4]

The EUP directive requires manufacturers to do a lot of tedious work, such as attaching the CE mark to their products; Conduct compliance assessment; establish ecological archives; ensure compliance assessment is carried out; need to retained documents related to the assessment for 10 years; retained qualified declaration for 10 years, etc. EUP directive is a more stringent environmental protection directive issued by the EU after the RoHS directive and WEEE directive. Products which are not conformed to EUP directive can't enter the EU market, which poses a challenge to the export of Chinese mechanical and electrical products to the EU.

2.2 Conformity assessment procedures

Conformity assessment procedure is directly or indirectly used to determine whether a product meets the relevant requirements of technical regulations and standards, which can be divided into three forms: certification, accreditation and mutual recognition. Usually, the products enter into the EU market, need to carry on the CE certification. CE mark is a safety certification mark, whether the products produced by enterprises within the EU, or imported from other countries, CE mark must be affixed in order to circulated in the EU market, which means that they have met the basic requirements of the EU "new methods of technical coordination and standardization" directive. The European Union CE certification includes production internal control, formal inspection, compliance

requirements, production quality assurance, product quality assurance, product inspection, single verification, complete quality assurance and other eight modes. The EU requires CE certification directives have low voltage electrical equipment directives, electromagnetic compatibility directives, mechanical directives, medical devices directives and other more than 20 directives. The EU Product Directive usually gives manufacturers several CE certification modes, and manufacturers can choose two or three of them according to their own circumstances. [5]

CE certification covers a wide range of products, including almost all of China's mechanical and electrical products exported to EU, which provides the technical specifications and simplifies trade procedures. Because of the standards set by the CE certification is higher, it puts forward higher requirements for production technology level of export manufacturers, and set a strict technical barriers.

2.3 Packaging and labelling requirements

The EU has raised the threshold for foreign mechanical and electrical products to enter the EU market by setting up strict packaging and labelling regulations. The Commission Directive 95/12/EC on Energy Consumption Labelling and Product Information Standards of Household Electrical Appliances issued by the European Union in 1992 requires that the household electrical appliances such as refrigerators and washing machines for sale, rental and installment sale must be accompanied with labels related to energy consumption, and the information contained in the labels must be accurate. [6] The directives issued by EU later require setting energy labels and grades for household refrigeration equipment such as refrigerators and iceboxes, and setting energy efficiency labels and grades for household washing machines.

According to the relevant technical regulations and standards, the EU also requires the relevant mechanical and electrical products entering the EU to be affixed with WEEE label and CE label. For flammable, explosive, corrosive and poisonous products, the EU also promulgated laws stipulating that their packaging and labels should meet the requirements of special marks to ensure that the labels are clear and accurate. The European Union has also introduced the Ecological label System which based on the principle of voluntary application, and aimed at identifying environmentally friendly products through full life cycle assessment and encourage product manufacturers to produce environmentally friendly products.

In the aspects of packaging, the EU sets up the green packaging system, which requires that products entering the EU market must be easy to be recycled or reused and easy to be decomposing naturally to reduce pollution and damage to the environment. European Union countries also has formulated many laws for recycling of packaging materials, in order to clarify the responsibility of the main body and standardize recovery behavior. The European Union has also set special regulations on China's wooden packaging materials, requiring that wooden packaging from China must be fumigated and heat treated. The EU's regulations on packaging and labeling increase the cost of exporting to the EU to some extent, and the resulting higher price reduces the competitiveness of products.

2.4 Special forms of technical trade barriers -- intellectual property barriers

As the EU's technical level and degree of intellectual property protection are higher than China's, the EU often takes intellectual property as a special technical barrier to regulate China's exports to the EU. The EU always set up barriers to intellectual property through all kinds of approaches. In the agreement on trade-related intellectual property rights (TRIPS) implementation framework, due to the European Union masters more intellectual properties than China, they often set strict technical standards and intellectual property system, and impose high patent fees to limit the export from China and other developing countries. The EU also actively participates in the formulation of technical standards and industry requirements to link patents with technical standards and to raise the technical threshold for products exported to the EU. In addition, the EU often abuses intellectual property rights, such as refusing other countries to use EU-controlled intellectual property rights or selling intellectual property rights with other products.

3. The impact of technical barriers to trade on China's mechanical and electrical products exports to the EU

3.1 Increase the export cost of mechanical and electrical products

The advantage of China's mechanical and electrical products export to the EU lies in the price advantage. Because of the implementation of technical barriers to trade leads to China's mechanical and electrical enterprises have to invest a lot of funds and personnel in recovery and processing of product and transformation and upgrading of production technology, which leads to the increase of China's mechanical and electrical products export costs. The increase of export costs is mainly manifested in the following aspects:

The costs of recycling and disposal of waste mechanical and electrical products. WEEE directive makes strict requirements on the recovery and use of products, which requires disposing waste electronic and electrical equipment with special treatment procedures, and requires manufacturers or third parties to establish a recovery system and stipulate for all kinds of goods to achieve the recovery rate. Because the profit of mechanical and electrical products in China is small, the cost of exporting to the EU is calculated with the human cost of Europe, which leads to cost control pressure and profit difficulties for some mechanical and electrical enterprises in China.

The costs of mechanical and electrical products testing and certification. The RoHS directive requires that the content of ten kinds of hazardous substances used in raw materials and parts of mechanical and electrical products entering the EU market should not exceed the limit. The EUP directive regulates energy consumption levels for mechanical and electrical products. A series of directives issued by the European Union require Chinese mechanical and electrical enterprises to test their mechanical and electrical products exported to the EU for hazardous substances and certify their energy consumption levels. Due to the backward testing technology and equipment in China, some mechanical and electrical export enterprises need to import equipment or specially test in the EU, which increases the production cost of mechanical and electrical products.

The costs of raw material replacement and technology renewal of mechanical and electrical products. Because RoHS directive limits the amount of harmful substances in raw materials and parts of products, and most mechanical and electrical enterprises in China are difficult to meet the requirements, so it is necessary to invest capital to find alternative materials or raw material process to improve technology, which increases the export cost of mechanical and electrical products. The directives issued by the European Union on the recycling rate and energy consumption of mechanical and electrical products, prompt China's mechanical and electrical enterprises to update production technology and equipment, thus increasing the export cost of enterprises.

3.2 Slow down the growth rate of mechanical and electrical products export to EU

In 2020, China surpassed the United States to become the EU's largest trading partner for the first time, and China is the EU's largest importer of mechanical and electrical products. With its low price, the mechanical and electronic products of China account for a larger share in the EU market. In order to protect the mechanical and electrical companies in EU and to protect the environment, EU formulates the strict technical barriers to trade which hinder China's mechanical and electrical products export to the EU to a large extent. The EU's main instructions and regulations of technical barriers to trade are related with product recycling, harmful substance content, noise pollution and pollution limits, and also apply the product life cycle theory to product design, which has formed the production technology and process difficulties to the some mechanical and electronic enterprises in China.

The growth rate of China's export of mechanical and electronic products to the EU grows in a high speed from China establish a good trade cooperative partnership with EU in 2001 to the strict implementation of the WEEE directive and RoHS directive, and the growth rate slow down after the EU implement strict technical barriers to trade to China.

3.3 Influence the upstream and downstream supply chains of the mechanical and electrical industry

The EU's technical barriers to trade aim at the whole circulation links of mechanical and electrical products, including production, design, packaging, recycling and other links which related to the upstream and downstream supply chain of the mechanical and electrical industry. WEEE directive stipulates that the minimum standard of recycling rate of each product must reach 70% of the weight of the product, the European Union countries can also increase the recycling rate of scrap products according to the national conditions and environmental protection treatment level, which puts forward the requirements of degradable and renewable for the use of raw materials of mechanical and electrical production enterprises in our country. Due to the limited technical level in China, many raw materials of mechanical and electrical products are not biodegradable and recycled which are not conform to the requirement of green environmental protection.

RoHS Directive limits the amount of several hazardous substances contained in mechanical and electrical products, which related to the upstream industries of the mechanical and electrical supply chain, such as the plastic industry, rubber industry, battery industry, electroplating industry, packaging material industry and so on. These upstream enterprises are faced with the huge manufacturing costs and technical difficulties brought by the non-toxic improvement of products and raw materials. Many small and medium-sized enterprises go bankrupt due to lack of funds or substandard technology, and the mechanical and electrical industry supply chain is reshuffled. The EUP directive is related to the energy consumption and green environmental protection of mechanical and electrical products, and involves the upstream and downstream supply chain of the mechanical and electrical industry. The directives and regulations related to technical barriers to trade issued by the EU have impacted the upstream and downstream supply chains of China's mechanical and electrical industry and caused a huge impact on the export of mechanical and electrical products in China.

3.4 Accelerate the technical transformation and upgrading of mechanical and electrical enterprises

The negative impact of technical barriers to trade imposed by EU on China's export of mechanical and electrical products is mostly due to the limited technical level of China's mechanical and electrical enterprises, and the mechanical and electrical products are difficult to meet the technical standards of EU. In order to export the mechanical and electrical products to the EU, some small and medium-sized mechanical and electrical enterprises in China have to find substitutes for raw materials, update technical equipment, transform and upgrade technical and adopt international technical standards and production processes, which to reach the threshold of export to the EU. The fair and reasonable technical barriers to trade implemented by the EU has improved the technical level and promoted the transformation and upgrading of China's mechanical and electrical industry, which is conducive to the future export of China's mechanical and electrical products to the EU.

Technical barriers to trade also help to complete the China's mechanical and electrical industry technical regulations and policies to reach the international standards. The China government has promulgated many laws and regulations related to technical barriers to trade, such as the Standardization Implementation Regulations, the Import and Export Inspection and Quarantine Law and the Product Quality Law, so as to improve the industrial technology level and reduce the impact of foreign technical barriers to trade on the export of mechanical and electrical products of China.

3.5 Enhance the environmental awareness of mechanical and electrical enterprises and consumers

The technical barriers to trade of EU require enterprises to enhance the awareness of green environmental protection and reduce the pollution to the environment caused by products. WEEE Directive requires the recycling of discarded mechanical and electrical products, RoHS Directive requires the detection and CE certification of electronic products, and EUP Directive requires the

control of the harm of mechanical and electrical products to the environment at all stages of product circulation. Under the restrictions of various technical barriers to trade measures of the European Union, mechanical and electrical enterprises begin to research and develop raw materials and parts of mechanical and electrical products with little environmental harm, recycle and use discarded mechanical and electrical products, and gradually enhance the awareness of green and environmental protection.

The European Union technical barriers to trade on mechanical and electrical products of the environmental pollution degree of attention to promote consumer awareness of green environmental protection, consumers began to choose to buy the product which have the green environmental protection certification, and to promote the circulation of green mechanical and electrical products in the market.

4. Suggestions for China's mechanical and electrical products to deal with EU technical barriers to trade

4.1 Countermeasures and suggestions at the government level

(1) Establish and improve technical regulations system and policy guidance

China's mechanical and electrical products of export are restricted by EU technical barriers to trade mostly because of the difference between China's current technical standards and regulations system and EU's technical regulations. China should improve the technical standards and regulatory system of the mechanical and electrical industry to narrow the gap with developed countries, and reduce the difficulties encountered by mechanical and electrical enterprises in export while improving the overall technical level of the mechanical and electrical industry.

Some mechanical and electronic enterprises in China don't know clearly the regulations of limit of harmful substance content, technical standards and recycling requirements formulated by EU, and the production research and development have difficulties. The government departments should actively introduce related policies and plans, helping enterprises to learn accurately the harmful material type involved by mechanical and electrical products, provide policy support for mechanical and electrical enterprises to develop alternative materials, and make mechanical and electronic products recycling process, actively help mechanical and electrical enterprises to reduce the difficulty in process of export.

(2) Improve the early warning mechanism of technical barriers to trade against EU, and strengthen communication and cooperation with EU

China's mechanical and electrical enterprises influenced by the EU's technical barriers to trade measures sanctions, mostly because they are not familiar with the EU's technical barriers to trade laws and regulations, or can't timely respond to the EU's technical barriers to trade regulations changes, so our government should establish and improve the EU technical barriers to trade early warning mechanism. Relevant government departments need to focus and monitor of the EU's technical barriers to trade, and set the EU technical barriers to trade an integrated information platform including the TBT notification, appraisal, consulting and warning system. The government should publish the policy changes which effect on our country's mechanical and electrical enterprises timely, and to realize the interaction between mechanical and electrical products export information and sharing.

Our government should also strengthen the communication and cooperation with the EU, establish a good trade cooperation relationship, timely communication and consultation with the EU related institutions on the potential change of technical barriers to trade measures, and reduce the impact on the export of Chinese mechanical and electrical enterprises.

(3) Encourage mechanical and electrical enterprises to improve the technical content and environmental performance of products to enhance international competitiveness

The technical level gap between China's mechanical and electrical enterprises and the EU is the fundamental reason that the export is restricted by the EU's technical barriers to trade, so our

government should actively guide the mechanical and electrical enterprises to carry out technological innovation and transformation and upgrading, improve the technical content of mechanical and electrical products. The relevant government departments should encourage mechanical and electrical enterprises to combine with universities and research institutes to carry out technological research and innovation, establish technological innovation bases, and strengthen the protection and support of patented technologies. In order to improve the environmental performance of mechanical and electrical products, the government should advocate the purchase of green mechanical and electrical products, reduce or exempt taxes for green mechanical and electrical enterprises, and provide financial support for the research and development of green mechanical and electrical products.

4.2 Countermeasures and suggestions at the level of industry associations

(1) Establish and improve the technical standards and regulations of mechanical and electrical industry

Since the mechatronics industry association has better understanding of the technical development of China's mechatronics industry, it should assist the government to establish and improve the technical standards and regulations of the mechatronics industry to make them more enforceable. At present, the problems such as low efficiency of China's mechanical and electrical industry association, imperfect technical regulations, and gap with international technical standards hinder the development of China's mechanical and electrical industry. China's mechanical and electrical industry associations should improve the management and operation mode, improve operation efficiency, and formulate industry technical regulations and standards in line with international standards. At the same time, mechanical and electrical industry associations should help mechanical and electrical enterprises to carry out relevant international certification work, provide technical and information support to small and medium-sized mechanical and electrical enterprises, and promote the export of mechanical and electrical enterprises.

(2) Timely report the trend of EU technical barriers to trade to enterprises and relevant departments

Our individual mechanical and electrical enterprises have difficulties in obtaining the EU technical barriers to trade in real time dynamic and spend high cost , so the mechanical and electrical industry association should create specialized information services and consultation services platform, pay attention to the promulgation and implementation of technical barriers to trade policy of the relevant authorities, make timely forecast and track policy changes of the technical barriers to trade, in-depth analysis the influence of the technical barriers to trade policy changes on mechanical and electrical enterprises in China and set up special website or publication timing issues to publish related information, so that the mechanical and electrical companies and government departments timely master relevant information and actively respond to EU technical barriers to trade measures.

4.3 Countermeasures and suggestions at the enterprise level

(1) Enhance the awareness of environmental protection and improve the environmental performance of products

Many technical barriers to trade in the EU mostly involve harm to the environment and animal and plant of mechanical and electrical products, the research and development of China's mechanical and electrical enterprises in the past often ignore the pollution of mechanical and electrical products to the environment, so mechanical and electrical enterprises should transform the concept of product production and recycling, improve the awareness of environmental protection. Mechanical and electrical enterprises should consider the impact on environmental of mechanical and electrical products from the source and adopt green raw materials and components; adopt environmental supervision system in the production process to reduce waste discharge and energy consumption in the production process; actively research, develop and design green mechanical and electrical products to improve the environmental performance of mechanical and electrical products.

(2) Select reasonable technical standards to improve the technical content of products

Compared with China, the technical standards of the EU are more strict. Chinese mechanical and electrical enterprises must produce mechanical and electrical products according to the technical standards of the EU so that they can export to EU. China's mechanical and electrical enterprises should pay attention to the inconsistency between the EU technical standards and China's technical standards, and abide by the EU technical standards in the procurement of raw materials and parts, production of mechanical and electrical products, product sales and recycling. The products produced by mechanical and electrical enterprises should strive to pass the ISO9000 quality certification system and ISO4000 quality certification system, in order to meet the international certification standards, to avoid the loss of EU technical barriers to trade to China's export of mechanical and electrical products. China's mechanical and electrical enterprises should also strengthen technological innovation, increase the scientific research investment in mechanical and electrical products, or upgrade the technical level of enterprises through the introduction of foreign advanced production technology and equipment and combined with the actual situation of the enterprise to improve the technical content of mechanical and electrical products.

(3) Realize diversified export products and optimize export structure

Mechanical and electrical companies in China should divide the types of mechanical and electrical products export to the EU market according to the specific function and purpose of mechanical and electronic products and on the basis of guarantee the quality of the product to avoid the mechanical and electronic products involving widely technology but not pure so that are influenced by the EU technical barriers to trade and realize the multiplication of mechanical and electrical products exports. China's mechanical and electrical enterprises should strictly follow the technical standards and regulations of EU in all aspects of production and circulation on the basis of clear positioning, ensure product quality, increase the export of technology-intensive mechanical and electrical products, and optimize the export structure.

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