Comparative Analysis and Policy Recommendations on Remanufacturing Standards and Trade Policies between China and the United States: A Case Study of Automotive Parts

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Abstract: In the context of carbon neutrality and sustainable development, remanufacturing is an important approach to achieving energy conservation, emission reduction, and the development of a circular economy. The development of the remanufacturing industry relies on the support and guidance of policies and regulations. Countries in Europe and America have the mature remanufacturing industries due to their early start. China is currently in a vigorous development stage, particularly in key sectors such as automotive parts remanufacturing. Taking the automotive parts remanufacturing industry as an illustration, this article not only collects and sorts out the policies, regulations, and standards in this sector but also conducts a comparative analysis. Afterward, interviews with experts from automotive parts enterprises and associations are conducted to propose targeted suggestions on the remanufacturing industry in China according to her practical situation. These suggestions are of great significance in promoting the development of China's automotive remanufacturing industry, facilitating international trade, and supporting global sustainable development.

1. Introduction

Remanufacturing, as an effective approach to developing a circular economy and achieving sustainable development, has attracted global attention due to its environmental, economic, and social benefits [1][2]. Remanufacturing involves restoring worn-out durable products to a functional and cost-effective state through the entire production process, which includes disassembly, cleaning, inspection, refurbishment, reassembly, and testing [3]. Its main characteristic is that the quality and performance of remanufactured products are not inferior to new ones, while the cost is only 50% of new products, resulting in 60% energy savings, 70% material savings, which significantly reduces environmental impact compared with manufacturing new products [4]. It is one of the effective ways for China to achieve a carbon emissions peak and carbon neutrality. The development of the remanufacturing industry is highly favorable for promoting China’s industrial restructuring, product upgrading, technological progress, and improvement of personnel quality [5].

Currently, many countries worldwide have implemented relevant policies to boost the development of the remanufacturing industry. For example, the United States federal government enacted the Federal Vehicle Repair Cost Savings Act in 2015 [6], which mandates federal agencies to encourage the use of remanufactured products as parts for repairing federal vehicles. The French government launched the New Industrial France strategy in 2013, implementing 34 industrial plans with the aim of transforming France in terms of energy, digitalization, and economic life over a 10-year medium-term plan [7]. The German government formally introduced the Recommendations for the Implementation of the German Industry 4.0 Strategic Initiative at the Hanover Industrial Fair in 2013, promoting the development of the remanufacturing industry through the advancement of smart manufacturing [8]. The UK government, in its Industrial Strategy 2050 released in 2013, redefined manufacturing as not just the traditional "make and sell" approach but as a "service" centered around remanufacturing (value chain focused on production) [9]. The Japanese government has enacted a

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series of laws and regulations, such as the Basic Law for Establishing a Recycling-Oriented Society, the Waste Management Act, and the Law on Promotion of Effective Utilization of Resources, aiming to construct a resource-circulating society through the promotion of activities like reuse, remanufacturing, and resource utilization.

As an emerging industry, China's remanufacturing industry has achieved steady development in recent years under the guidance of policies. A series of favorable policies for the growth of remanufacturing industry have provided strong support and assurance. In 2005, the State Council issued Several Opinions on Accelerating the Development of the Circular Economy, which regarded "supporting the remanufacturing of discarded electromechanical products" and "green remanufacturing technology" as the government's initiatives to increase financial support. In 2008, the Circular Economy Promotion Law of the People's Republic of China was enacted, legalizing remanufacturing and stating that remanufacturing activities related to automotive components should be conducted in compliance with national standards and regulations. In 2010, the Opinions on Promoting the Development of the Remanufacturing Industry emphasized the need to accelerate the development of China's remanufacturing industry, particularly in the automotive component remanufacturing sector. In 2015, the State Council issued Made in China 2025, which planned to transform China from a manufacturing country to a manufacturing power in three stages [10]. In 2021, the 14th Five-Year Plan for the Development of the Circular Economy was released, supporting the advancements of remanufacturing levels, sectors, and technologies, gradually expanding remanufacturing operations, and nurturing leading remanufacturing enterprises. The Outline of High-quality Development released in 2023 emphasized the acceleration of zero-carbon and low-carbon technology breakthroughs, the promotion of green technologies, standards, and systems, and the popularization of green consumption and lifestyles. It can be known from the policies mentioned above that China's remanufacturing industry has entered a new development stage.

For the moment, China has seen a significant development in the remanufacturing industry. Nevertheless, there is still much progress to be made, especially in market size, technological standards, trade restrictions, and enterprise development. This paper conducts a comparative analysis of the standards and trade policies in the automotive component remanufacturing sector between China and the United States, according to China's current development situation, and puts forward policy recommendations to promote the automotive component remanufacturing industry in China and the overall remanufacturing industry.

2. Current Situation of Policies and Standards in China and the United States

2.1 Chinese Policies and Standards for Automotive Parts Remanufacturing

China attaches great importance to the development of the remanufacturing industry, especially the automotive parts remanufacturing sector. In recent years, a series of policies have been formulated and revised to promote the industry's development and enhance support. In 2008, the National Development and Reform Commission identified the first batch of pilot automotive parts remanufacturing companies. In 2010, the National Development and Reform Commission and 11 other ministries jointly issued the Opinions on Promoting the Development of the Remanufacturing Industry, emphasizing the development of the remanufacturing industry, particularly in the automotive parts sector. In 2018, the National Bureau of Statistics released the Classification of Strategic Emerging Industries (2018), which included remanufacturing as a strategic emerging industry, with automotive parts remanufacturing as a key product within the sector. In 2019, the National Development and Reform Commission revised the Administrative Measures for the Recycling of Scrap Motor Vehicles, lifting the ban on modifying five major categories of precision components, thereby providing a more relaxed policy environment for developing automotive parts remanufacturing. In 2020, the Ministry of Commerce issued the Implementation Rules for the Administrative Measures for the Recycling of Scrap Motor Vehicles, which established more detailed and comprehensive rules for the recycling of used vehicles. Notably, in April 2021, to promote the standardized development of automotive parts remanufacturing in China, the State Council issued the

Interim Measures for the Management of Automotive Parts Remanufacturing, providing further clarification on the qualifications for remanufacturing enterprises and presenting detailed and targeted guidelines for the management of used parts recycling, remanufacturing production, products and markets, as well as subsequent supervision. In 2022, the Administrative Measures for Comprehensive Bonded Zone Management of the People's Republic of China stipulated that, under certain conditions, bonded repair services for prohibited import of used electromechanical products tha were listed in the repair product catalog can be carried out in comprehensive bonded zones.

With the promotion of policies and the participation of market entities, automotive parts remanufacturing has developed rapidly, and the industry has tremendous growth potential, entering a new stage of development. The National Remanufacturing Industry Demonstration Base in Changsha is developing the remanufacturing industry following the model of "one core and two wings," focusing on complementary resources and differentiated development. The Shanghai Lingang Remanufacturing Industry Demonstration Base relies on leading domestic and foreign manufacturing enterprises such as China State Shipbuilding Corporation, Commercial Aircraft Corporation of China, Aviation Industry Corporation of China, Shanghai Electric, Shanghai Automotive, and Caterpillar. It is constructing public service platforms such as remanufactured product and used part testing and certification platforms, technology research and development centers, and talent training bases. The National Remanufacturing Industry Demonstration Base in Zhangjiagang has initially formed a product system with a focus on automotive engine remanufacturing and auxiliary products in the fields of metallurgical equipment and precision cutting tools. The "14th Five-Year Plan" for the cultivation and development of the remanufacturing industry in Hainan Province proposes to cultivate and explore key areas of remanufacturing based on the "3+2" model, fully utilizing the advantages of the free trade port for higher-level opening. Taking advantage of the best time for policy, the development of the remanufacturing industry will be promoted with efforts, with the aim of achieving a total output value of the remanufacturing and supporting industries in the province of over 2 billion yuan by 2025 [11][12].

To regulate the development of the remanufacturing industry, China has issued and implemented over a hundred standards in the field of remanufacturing, covering areas such as resource recycling, energy, automotive, machinery, petroleum and natural gas, and import-export inspection and quarantine. Based on the different standard-making bodies and application scopes, there are 13 national standards and 8 industry standards that reflect the standardization of automotive parts remanufacturing in China. The specific overview of the standards is presented in the following table (Table 1).

Table 1: Overview of Automotive Parts Remanufacturing Standards in China

Department	Type	Quantity
Ministry of Industry and Information Technology of the People’s Republic of China	National Standards	13
Ministry of Industry and Information Technology of the People’s Republic of China	Industry Standards	8

2.2 US Policies and Standards for Automotive Parts Remanufacturing

The United States is the world's largest producer, consumer, and exporter of remanufactured products. Remanufacturing is widespread across various industries in the United States, with a focus on aerospace, heavy-duty off-road (HDOR) equipment, automotive parts, machinery, IT products, medical equipment, refurbished tires, and consumer products. Canada, the European Union (EU), and Mexico are the main suppliers of remanufactured products to the United States and also major export markets. In terms of environmental protection, the United States Environmental Protection Agency (EPA) regulates environmental protection standards in the remanufacturing industry through laws such as the Resource Conservation and Recovery Act. Remanufacturing companies are required to comply with environmental regulations, including waste management, emission restrictions, and pollution control. Regarding quality standards, the U.S. government, industry organizations, and

standardization bodies have established a series of standards and certification procedures to ensure that remanufactured products meet relevant requirements in terms of quality and performance. Regarding product labeling, remanufactured products typically require labeling to allow consumers to identify their remanufacturing status and distinguish them from brand-new products, providing necessary information. In order to reduce federal vehicle maintenance costs, the U.S. federal government enacted the Federal Vehicle Repair Cost Savings Act in 2015, which encourages the use of remanufactured products as parts for federal vehicle repairs. Federal regulations in the United States provide legal provisions regarding the definition, certification, testing, inspection, and compliance of remanufactured products. The Rebuilding, Remanufacturing, and Other Second-Hand Automobile Parts Industry Guide issued in the United States provides relevant regulations and explanations for remanufactured or repaired products. The Right to Repair Act of 2001 in the United States regulates automobile repairs, allowing consumers to choose convenient, reliable, and affordable repair facilities for their motor vehicles due to strict non-original equipment manufacturer (OEM) parts certification and quality supervision systems, as well as the presence of a developed insurance industry. Non-OEM parts account for as much as 70% of the aftermarket. The government's main responsibility in ensuring consumer acceptance of remanufactured products is to make consumers aware that remanufactured products can meet the quality requirements of new products.

The market-oriented principles and management measures in the United States determine that its standardization process aligns with market characteristics. In addition to standards developed independently by companies, there are nearly 400 professional organizations, associations, and government agencies involving in the development and publication of standards in their respective fields. The United States has a diverse range of standards related to remanufacturing that cover multiple industry sectors. As for the standards of automotive parts remanufacturing, they can be found on the websites of the American National Standards Institute (ANSI), the Society of Automotive Engineers (SAE), and the American Society for Testing and Materials (ASTM). A search reveals 1 standard from ANSI, 14 standards from SAE, and 1 standard from ASTM. The specific overview of these standards is provided in the following Table 2 [13].

Table 2: Overview of Remanufacturing Standards in the United States

Department	Abbreviation	Quantity
American National Standards Institute	ANSI	1
Society of Automotive Engineers	SAE	14
American Society for Testing and Materials	ASTM	1

3. Methodology

3.1 Literature research

Research was conducted by using various sources, including Google Scholar, official websites of the governments of China and the United States, industry association websites, and academic databases, to collect and organize literature, policies, and relevant standards on the remanufacturing industry, particularly the automotive parts remanufacturing industry. The keywords used for the search included "remanufacturing" and "automotive parts remanufacturing." The websites visited include, but are not limited to, official websites of Chinese government departments, the Chinese Standards Service Platform, CNKI (China National Knowledge Infrastructure), Google Scholar, Elsevier Science database, the Federal Trade Commission (FTC) of the United States, the Congress of the United States, the International Trade Commission (ITC) of the United States, the American National Standards Institute (ANSI), and the Society of Automotive Engineers (SAE) International. Please refer to Attachment 1 for specific automotive parts remanufacturing standards [14].

3.2 Interview

This study employed interviews to gather insights from automotive parts-related companies and experts from associations. Prior to the interviews, an interview outline was designed, focusing on the

development stages of automotive parts remanufacturing, policies and standards, and the role in carbon reduction. The aim was to ensure the acquisition of targeted information. Please refer to Attachment 2 for specific details. The interviewees were contacted through phone calls, instant messaging, and other means to confirm the interview schedule and format, while also informing them of the purpose of the interview. Finally, with the interviewees' consent, the interviews were conducted in a question-and-answer format, and the contents of the interviews were recorded. The Overview of Interview Participants is shown in table 3:

Table 3: Overview of Interview Participants

Company	Interviewee	Time	Method
Zhangjiagang Qingyan Testing Technology Co., Ltd.	Jinsong Yin	Apr 18,2023	Telephone
China Association of Automobile Manufacturers - Automotive Parts Remanufacturing Subdivision	Haixiao Xu	Apr 18,2023	Telephone
China Association of Automobile Manufacturers	Shengji Ye	May 2,2023	Telephone

4. Analysis

The release of the Interim Measures for the Normative Management of Automotive Parts Remanufacturing is an important milestone for the development of China's automotive parts remanufacturing industry as well as a crucial component of the remanufacturing sector. It signifies the transition from pilot projects to large-scale and standardized development. However, as the industry enters a new phase of development, Chinese automotive parts remanufacturing industry is confronted with some challenges.

In China, remanufactured products are treated as used parts for import management purposes. The Automobile Industry Development Policy" and "Automobile Trade Policy explicitly prohibits the importation of used automotive parts and remanufactured parts. In 2018, the Administration Measures for the Import of Mechanical and Electrical Products were revised to include a definition of "remanufacturing," but it still prohibits the importation of related used parts and corresponding remanufactured products. The Catalog of Prohibited Imported Mechanical and Electrical Products includes the automotive category (Chapter 87) in the list of prohibited imports, which means that the majority of automotive parts (including engines, transmissions, steering systems, brakes, etc.) fall under the prohibited import management. Only a few general parts, such as generators, starters, pumps, are not included in the scope of prohibited imports. The Ministry of Commerce revised the Administration Measures for the Import of Key Used Mechanical and Electrical Products to allow the importation, repair (including remanufacturing), and re-exportation of used mechanical and electrical products listed in the Catalog of Prohibited Imported Goods. After the revision, enterprises can import used automotive parts such as engines and transmissions through processing trade, engage in remanufacturing processing trade, broaden the source of used parts for enterprises, and promote their entries into the global remanufacturing market.

The scope of the automotive parts remanufacturing industry is relatively narrow, and the types of components and the upstream and downstream industry chains involved in remanufacturing activities are limited, which to some extent restricts the development scale of the industry. For example, according to the Interim Measures for the Management of Remanufacturing of Automotive Parts, remanufacturing activities are supported for components such as engines, steering systems, transmissions, front and rear axles, and chassis (collectively known as the "Five Major Assemblies") from scrapped vehicles. Parts that are not used for remanufacturing should be sold as scrap materials to smelting or crushing enterprises. Similar provisions can also be found in the Management Measures for the Recycling of Scrap Motor Vehicles. Experts interviewed stated, "According to statistics, a typical car has about 300 components that can undergo remanufacturing processes. China's opening of automotive parts remanufacturing mainly focuses on mechanical and electrical products, with a relatively limited variety. Moreover, the prohibition of importing scrap parts limits the sources of used parts for remanufacturing activities compared with countries with similar or smaller automotive

industry scales."

In the United States, there is encouragement from government and public institutions to use remanufactured products or components, and the rights to use remanufactured products or non-OEM parts are protected in the automotive aftermarket. In terms of cross-border trade, the US federal government does not impose restrictions on the import of used parts. Some goods have corresponding tariff codes for used parts, but certain states may have special restrictions on used parts imports based on pollution control requirements. Remanufactured products in the US are not assigned separate tariff codes; they are treated the same as new products. Furthermore, under the United States-Mexico-Canada Agreement (USMCA), remanufactured products are explicitly considered new products rather than used products and must not be discriminated against or regarded as inferior in quality. Additionally, the USMCA requires compliance with the same technical standards and quality control requirements as new products when trading remanufactured products to ensure their safety and performance to meet the corresponding standards. The Free Trade Agreement (FTA) signed between the United States and Australia also explicitly includes the term "remanufacturing," stating that remanufactured products should be treated as new products and enjoy the trade treatment of that country.

In terms of the construction of standards for automotive parts remanufacturing, China adopts a national standard system that is managed by relevant national ministries and the National Standardization Management Committee. This system covers standards across various industries. By contrast, the United States follows an industry standard system that industry associations are responsible for the development and management of standards. As for timeline, China started its remanufacturing industry relatively late, and the market scale is smaller, resulting in a later standardization process compared with that of the United States. Regarding technical standards, the United States has not specifically developed standards for remanufactured automotive parts but has established detailed standards for the technical processes involved in remanufacturing. Additionally, the United States also has strict standards for the quality and performance of remanufactured products. In contrast, China's standards primarily focus on processes such as disassembly, cleaning, acceptance, and assembly of parts. Due to China's restrictions on the import of electromechanical products, specific standards and requirements have been established for imported electromechanical products. The detailed information is presented in Table 4 below:

Table 4: Overview of Automotive Parts Remanufacturing Standards Comparison between China and the United States

Aspect	China	United States
Time	2012	2007
Remanufactured Automotive Parts	Alternator, Starter, Steering gear, Water pump, Oil pump, Spark and compression ignition engines, Automatic transmission, Cylinder block assembly, Crankshaft, Connecting rod, Cylinder head	Automotive starter, Steering, Automotive Starter drive, Automotive starter solenoid, Manual transmission, Clutch assemblies, Motor vehicle brakes, Alternator, Engine water pump, Rack and pinion steering gears, Automotive drum brakes
Technical Standards	Primarily focused on processes such as disassembly, cleaning, pre-delivery inspection, and assembly of parts	Detailed standards for technical processes and strict quality and performance standards for remanufactured products
Imported Electromechanical Products Standards	Specific standards and requirements for imported electromechanical products due to import restrictions	No specific standards for remanufactured automotive parts, but detailed standards for technical processes and no discrimination against remanufactured products

With the increasing amounts of privately-owned vehicles in China, the aging of vehicles and the

expanding demand in the automotive aftermarket, the Chinese market for automotive parts remanufacturing is expected to gain tremendous growth in the future. The following measures might offer support to this momentum. Domestically, it would be great if the scope of permissible automotive parts remanufacturing activities could be promoted and more participation from remanufacturing enterprises could be intrigued. Restrictions would be gradually reduced in the domestic industry. Internationally, those existing trade agreements, such as the United States-Mexico-Canada Agreement (USMCA) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), are probably good cases. With these efforts, Chinese people can meet the needs of enterprises' needs, promote their engagement in international competition, and enhance their competitiveness. Regarding the establishment of remanufacturing standards, the influence of Chinese standards will be enhanced by bringing in advanced standards and learning the latest standardization techniques and experiences from foreign remanufacturing sectors. By leveraging regional and international trade activities, the influence of Chinese standards can be strengthened. Ultimately, this will further drive the high-quality development of China's automotive remanufacturing industry, promoting the deeper development of the circular economy.

5. Recommendations

Achieving carbon reduction goals and developing a circular economy through the implementation of remanufacturing activities hold significant importance. Drawing on the experiences of the United States in the automotive parts remanufacturing field, the following five recommendations are proposed to promote the development of automotive parts remanufacturing and the remanufacturing industry in China

(1) Strengthen government policy support and guidance: On the one hand, the government should encourage domestic automotive manufacturers to engage in automotive parts remanufacturing activities in the country, providing them with tax incentives and reducing entry barriers for enterprises. On the other, the government can actively encourage third-party enterprises to participate in automotive parts remanufacturing activities.

(2) Address cross-border trade restrictions: The authority gradually eliminates policy restrictions on the import of parts. Considering the experiences of the remanufacturing industry in Europe and the United States, foreign markets serve as the primary source of the remanufactured industry. Import restrictions on remanufactured products should be removed so that it can address the supply challenges that the remanufacturing enterprises are facing. What’s more, it's necessary to facilitate cross-border remanufacturing trade and investment activities, promote cooperation in the automotive parts remanufacturing industry, and expand the scale of trade activities for enterprises.

(3) Promote standardized development and supervision systems: It is also important to strengthen industry quality supervision and management, and enforce strict regulations to ensure market standardization of automotive remanufactured products. Besides, the authority is supposed to promote research on carbon reduction in academia and the industry, and facilitate carbon emission trading in automotive parts remanufacturing.

(4) Improve the standards and regulatory framework for the remanufacturing industry: It’s the time to seize the opportunity provided by mature automotive parts remanufacturing pilot projects to expand the scope of the remanufacturing sector, and improve standards in production, manufacturing, and quality evaluation processes. A comprehensive legal framework for the remanufacturing industry is to be established so as to create a favorable legal environment for remanufacturing enterprises to conduct production and business operations.

(5) Enhance consumer awareness: The characteristics of automotive parts remanufactured products have a close connection with consumers. Consumer awareness plays a crucial role in determining the market acceptance of remanufactured products. Accordingly, it is indispensable to increase consumer understanding of remanufactured products and enforce strict regulations in the automotive aftermarket to protect consumers' legitimate rights and interests during vehicle repairs. These recommendations aim to drive the high-quality development of China's automotive remanufacturing industry, promote carbon reduction efforts, and advance the circular economy

towards a more sustainable level.

References

[1] Hatcher G D, Ijomah W L, Windmill J F C. Design for remanufacture: a literature review and future research needs[J]. Journal of Cleaner Production, 2011, 19(17-18): 2004-2014.

[2] Zhao J, Wang C, Xu L. Decision for pricing, service, and recycling of closed-loop supply chains considering different remanufacturing roles and technology authorizations[J]. Computers & Industrial Engineering, 2019, 132: 59-73.

[3] Lund R T. Remanufacturing: the experience of the United States and implications for developing countries[J]. (No Title), 1984.

[4] Xu B S. Recent progress of remanufacture industry and technology in China[J]. Therm Spray Technol, 2010, 2: 1-6.

[5] Zheng B, Jin L. Relicensing scheme selection in closed-loop supply chains with differentiated new and remanufactured products[J]. Computers & Industrial Engineering, 2022, 171: 108443.

[6] Palmer K, Tate J E, Wadud Z, et al. Total cost of ownership and market share for hybrid and electric vehicles in the UK, US and Japan[J]. Applied energy, 2018, 209: 108-119.

[7] Aiginger K, Rodrik D. Rebirth of industrial policy and an agenda for the twenty-first century[J]. Journal of industry, competition and trade, 2020, 20: 189-207.

[8] Rojko A. Industry 4.0 concept: Background and overview[J]. International journal of interactive mobile technologies, 2017, 11(5).

[9] Benke K, Tomkins B. Future food-production systems: vertical farming and controlled-environment agriculture[J]. Sustainability: Science, Practice and Policy, 2017, 13(1): 13-26.

[10] Pesce M, Tamai I, Guo D, et al. Circular economy in China: Translating principles into practice[J]. Sustainability, 2020, 12(3): 832.

[11] Sun X, Wang X. Modeling and analyzing the impact of the internet of things-based Industry 4.0 on circular economy practices for sustainable development: Evidence from the food processing industry of China[J]. Frontiers in Psychology, 2022, 13: 866361.

[12] Guidat T, Seidel J, Kohl H, et al. A comparison of best practices of public and private support incentives for the remanufacturing industry[J]. Procedia Cirp, 2017, 61: 177-182.

[13] Zhou X, Mei Wei, Helong Yu. Current Status and Research Progress of International Standards for Remanufacturing of Mechanical Products[J]. China Standardization, 2019,3,148-152.

[14] Liao L, Cheng H, Liu Y. United States Standardization System and its references giving for China[J]. Chin. J. Manag, 2013, 10: 1805-1809.