

Path and Countermeasures of Optimizing and Upgrading Livelihood Equipment in China

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Abstract: Livelihood equipment is an important part of high-end equipment. It plays an important role in the development of national economy. China's livelihood equipment lags behind the international advanced level in terms of international competitiveness and comprehensive level. The outbreak of the coronavirus disease 2019 (COVID-19) further exposed the serious shortcomings in China's livelihood equipment concerning medical treatment, food, textile, and the like, as well as the urgent need for optimization and upgrading of the industry. In this paper, livelihood equipment regarding agriculture, food, textile, and medical treatment are studied, which are related to the lifeblood of the national economy. Their development status is reviewed, and the problems and shortcomings of China's livelihood equipment are proposed. The research suggests that intelligent manufacturing should be the major development direction of the livelihood equipment. Specifically, equipment with digital, networked, and intelligent functions should be developed; key components and industrial software should be researched; digital, networked, and intelligent transformation and upgrading of livelihood equipment enterprises should be promoted; and integration with the service industry should be deepened. To ensure and promote the optimization and upgrading of the livelihood equipment in China, the state should make overall plans for supporting policies regarding the livelihood equipment, conduct large-scale technological transformation, build a public platform for technological innovation services for the industry, and strengthen the development and application of domestic equipment and industrial software.

Keywords: livelihood equipment; intelligent manufacturing; optimize and upgrade; agriculture; food; textile; medical treatment

1 Introduction

People's livelihood industries refer to industries that are directly related to people's lives, such as the agricultural, food, textile, healthcare, home appliance, and furniture industries. These industries play a significant role in promoting employment capacity and meeting the growing demand of consumers. Furthermore, they are the main export-oriented industries for earning foreign currency, which plays an important part in the structure of the national economy. People's livelihood industries are a "rigid demand" for the economic development of a country. In the face

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of major emergencies, such as the outbreak of Coronavirus (COVID-19) disease, the country can quickly escape its predicament with strong support from people's livelihood industries, which provide an important foundation for high-quality economic and social development.

Livelihood equipment serves people's livelihood industries and is essential to the high-end equipment system of a country. In China, the development of livelihood equipment has always been key to consumption upgrade, expansion of spaces for consumption, and transformation and upgrade of traditional manufacturing industries. It is of great practical significance to focus on the optimization and upgrade of livelihood equipment and follow a path of high-quality development of the manufacturing industries for achieving a strategic transformation to a world manufacturing power.

In society, people's livelihood industries are sometimes mistaken as sunset industries and livelihood equipment as low-end equipment. Without timely rectification, such misunderstanding could hinder the healthy development of the national industrial system and have a negative impact on the effectiveness of a country's response to major emergencies. To this end, it is meaningful to study strategies for the development of industries and equipment for people's livelihoods in China as this can help to get insights into the current development of industries, obtain a clear view of the path of equipment development, and direct social attention to the development of livelihood equipment. Agriculture, food, textile, and healthcare are four key areas in the lifeblood of the national economy. Livelihood equipment for these areas is closely connected to people's food, clothing, health, and other commodities. Therefore, it is of great significance to conduct research on the optimization and upgrade of equipment for these areas.

2 Status of development of livelihood equipment

2.1 Important foundation for the development of people's livelihood industries

People's livelihood industries strongly support consumption upgrade in China. Livelihood equipment serves people's livelihood industries and provides an important foundation for their development. Over the past 40 years of reform and opening up, China's livelihood equipment has made remarkable progress in promoting people's livelihood industries.

For example, after years of development, textile equipment has witnessed significant improvement in terms of research and development (R&D), innovation, technological applications, and human-centered design. Great advancements have also been achieved in high-end textile equipment, high-quality spare parts, and sets of technologies and equipment for high-performance fibers. The rapid development of textile equipment has promoted the growth of the textile industry. In the early days of reform and opening up, the colors of clothes of the Chinese people were limited to black, gray, and blue. Cloth coupons (for buying limited goods) were only withdrawn from circulation in 1983. Nowadays, China's annual fiber consumption per capita exceeds 20 kg, which reaches the level of consumption of moderately developed countries [1]. According to the data from the National Bureau of Statistics of China, China's chemical fiber output in 2018 was approximately 5.011×10^7 t, accounting for more than 80% of the world's total output [2]. China is also the world's largest producer in the printing and dyeing industry. 60% of the total output of printed and dyed textiles is produced by China [3]. Thanks to the development of textile equipment, it has been diversely applied in the textile industry, which offers more opportunities for the development of all kinds of textiles and clothing and increases the competitiveness of products.

2.2 Significance to high-end equipment

High-end equipment refers to equipment with high technical content, high added value, and a core position in the industrial chain. In people's livelihood industries, increasing requirements for the diversity of products and applications and the safety of materials have given rise to the increasing demand for the high performance of key equipment. In particular, a new round of revolution in science and technology has promoted the development of digital, network, and intelligent livelihood equipment, making them gradually an important part of high-end equipment.

For instance, medical equipment has been greatly improved by the deep integration of high-end equipment with the new generation of information technology and advanced manufacturing technology. Examples of high-end medical imaging equipment include 3T superconducting magnetic resonance imaging (MRI) systems, 128-slice computed tomography (CT) scanners, positron emission tomography/CT (PET-CT) scanners, high-end 196-channel color ultrasound systems, equipment for digital subtraction angiography (DSA), and endoscopic ultrasonography (EUS) devices. Some key technologies have also been applied to food equipment, such as efficient heat exchange

without accumulation of coke, physical sterilization with electromagnetic heating/ultrasound/electron-beam/intense pulsed light (IPL), filtration for in-line sterilization of heat-sensitive materials, high-speed aseptic filling, seamless cleaning in place (CIP) and sterilization in place (SIP), and sterility testing of the whole unit. Examples of food equipment include high-end equipment for high-speed aseptic filling of food, high-speed sealing machinery for ultra-thin metal cans, equipment for high-pressure and homogeneous crushing, machinery for ultra-high-pressure (UHP) food processing, and equipment for the processing of whole grains. Furthermore, unmanned driving, automatic operation, automatic monitoring, and other technologies have been gradually applied to agricultural equipment for farming and harvesting in order to develop multi-functional and intelligent equipment with high efficiency, high precision, and high flexibility. There is also a tendency to develop sets of green, intelligent, and information-based equipment for processing, storage, and transportation of agricultural products, as well as for protected horticulture and breeding. In the textile industry, there are a wide variety of products and models of textile machines for spinning, weaving, printing and dyeing, chemical fiber processing, and other processes.

2.3 Direction of industrial upgrade in developed countries

The majority of developed countries worldwide have been increasing their investment in scientific research on livelihood equipment, and they attach great importance to the patent rights of equipment. For instance, a company's investment in scientific research on food equipment accounts for 8% to 12% of the company's turnover, which tends to increase year by year [4]. Major developed countries have seen development of livelihood equipment in several areas.

The United States is the world's leading country in terms of agricultural equipment. It has paid great attention to the R&D of equipment for the efficient use of agricultural resources and sustainable development. Leading machinery enterprises provide a large number of machines, fertilizing equipment, airplanes, and other types of advanced equipment for agricultural production, which promote the development of agricultural productivity by leaps and bounds and make the agricultural industry an important export-oriented industry.

Germany values the strategic transformation and upgrade of the textile industry at the national level and lists it as a key area of the fourth industrial revolution (i.e., Industry 4.0). In the future TEX-project, key areas for development include future textile factories, digital manufacturing process, flexible production equipment, precision textile machinery, and advanced sewing equipment.

Furthermore, major developed countries have applied big data, Internet of Things, artificial intelligence (AI), and other types of new-generation information technologies to livelihood equipment in different scenarios. For example, the United States attempts to improve the efficiency of agricultural production by applying technology in satellite communication, remote sensing, and AI to agricultural equipment. Major spinning machinery enterprises worldwide have introduced individual spindle monitoring systems for spinning as well as feeding monitoring systems for coarse yarn coiling. Spinning mills can achieve unattended monitoring of equipment at night by using big data to collect, analyze, and process data centrally.

2.4 Strong support in the event of emergencies

Livelihood equipment provides basic material support for people in preventing and responding to emergencies. In the face of major emergencies, advanced and reliable livelihood equipment, as well as a resilient and flexible industrial chain for people's livelihood, can effectively provide the basic daily necessities of people. They lay an important foundation for improving the emergency response capability and risk resistance of the whole society, ensuring the safety of people's lives and property, and safeguarding the national public security.

For example, at the start of the COVID-19 epidemic, there was a serious shortage of medical supplies in China, which made it more difficult for the healthcare system to cope with the epidemic. However, in a very short time, medical equipment manufacturers made rapid adjustments to the situation and produced medical equipment at full capacity such as face masks, protective clothing, testing reagents, ventilators, and heart-lung machines. The production of medical equipment provided strong material support for a large number of medical staff to assist Wuhan in the fight against COVID-19. The turnaround time of test results has been reduced from 2–3 days to 30 minutes. A number of domestic CT machines were quickly installed and operated in Huoshenshan Hospital, Leishenshan Hospital, and mobile cabin hospitals. The ventilators produced could fully meet the clinical needs during the outbreak, both in quality and quantity, and they were also exported to countries in need.

Textile equipment plays a unique role in supporting and protecting people in various major emergencies such as virus prevention and control, flood prevention, earthquake relief, and fire rescue. For medical treatment, textile

equipment provides basic support for the production of face masks and medical protective clothing, and it lays an important foundation for alleviating the shortage of supplies for infection prevention and control during the epidemic. In terms of infrastructure construction, textile equipment contributes to the production of geotextiles that play an important role in flood prevention and rescue. For disaster rescue (e.g., earthquake and fire relief), textile equipment can be used to produce a large number of industrial textiles such as tents, rescue and escape ropes (or rigging), and special protective clothing.

3 Current development of livelihood equipment

3.1 World-leading textile equipment

China has a wide variety of textile equipment and a complete textile industry chain. The sales of textile machinery products account for about 50% of the global sales. The domestic market share of domestic textile equipment has reached 80%. The localization rate of key basic parts of high-end equipment has exceeded 50%. Since 2015, China's exports of textile machinery have exceeded its imports, and its exports rank among the highest in the world [5]. A group of medium-sized textile machinery enterprises in China can produce machinery for spinning, printing, and dyeing up to the international advanced standard. In addition, China occupies a world-leading position in intelligent production and automation of production by using robots in production lines on a large scale.

3.2 A wide gap in food equipment

European countries, the United States, and Japan hold a leading position in the global food equipment market. Germany has the highest level of automation of production for food processing and top innovation capability in the world. Its food service equipment occupies 70% of the European food service equipment market and 30% of the global food service equipment export market. In the United States, food service equipment is highly integrated with information technology and is generally controlled with integrated electromechanic technology. The majority of Japanese food service machines are small- and medium-sized single machines that are high-precision, easy to install and operate, and highly automated [6].

In China, equipment for food processing and handling can meet the basic production needs of the domestic food industry, though trade deficits have not been fundamentally resolved. There is still a wide gap between Chinese food service equipment and international advanced equipment in terms of technology. Specifically, Chinese food service equipment tends to have a low level of automation. There are more single-machine products than complete sets of equipment and high-tech and high value-added products. The majority of equipment is for primary processing, and there is less equipment for deep processing. There are many general-purpose models, but there are few models for special requirements and special material processing.

3.3 A big gap in medical equipment

In 2018, the global medical devices market size was valued at around 442.8 billion US dollars, of which the United States held approximately 147.9 billion US dollars [7]. China held about 70 billion US dollars, accounting for about 1/7 share of the total global market [8]. There is a big gap between Chinese medical equipment and advanced foreign medical equipment. China relies on imported high-performance medical equipment. For example, most of the medical imaging equipment for hospitals at or above the county level in China is still foreign. Nevertheless, in recent years, China has gradually developed a number of high-performance medical equipment items that have reached or approached the international advanced standard, such as ultrasound equipment, fully automated biochemistry analyzers, CT scanners, superconducting MRI systems, other high-end medical imaging equipment, and deep brain stimulation (DBS) devices. Chinese equipment is becoming competitive in the domestic market against foreign products. Some equipment produced domestically is very competitive in the domestic market and can replace imported foreign machines, such as fully automated biochemistry analyzers, ultrasound equipment, DBS machines, and coronary stents. Overall, China's medical equipment industry can meet people's basic healthcare needs, but there is still a lot of room for improvement in high-performance medical equipment.

3.4 A huge gap in agricultural equipment

While China is a large manufacturer and consumer of agricultural equipment, it is currently not a world manufacturing power. Compared with world-leading countries such as the United States and Germany, there is a huge gap between China and those countries in terms of the overall industrial level, technological innovation

capability, and enterprise competitiveness in the international market [9]. Regarding the scale of agricultural equipment, the total number of agricultural machinery companies in China exceeded 8000 in 2018, of which more than 2300 were at least medium-sized. Though China accounts for around 30% of the global manufacturing output [10], its value-added rate and profit rate of products are only 1/10 of the global rates at the international leading level. In terms of the technology used in agricultural equipment, the technical performance and reliability of Chinese agricultural equipment are still not up to the international advanced standard. There are still shortcomings in core techniques, high-performance parts and components, major equipment supply, and independent innovation, which do not meet the requirements of high-quality and high-efficiency agricultural mechanization and development.

4 Issues in development of livelihood equipment

Based on the analysis of the current development of livelihood equipment, there is a significant difference in the international competitiveness and overall performance of livelihood equipment between China and developed countries. In particular, the limitations in the development of livelihood equipment in China are likely to be observed in the event of emergencies. Key technologies, parts and components mainly rely on imports, and the quality and reliability of products still need to be improved urgently. Lack of original innovations and insufficient investment in R&D are still stumbling blocks to the development of livelihood equipment, which have seriously affected the optimization and upgrade of livelihood equipment in China.

4.1 Over-reliance on imports of key technologies, parts and components

(1) In terms of agricultural equipment, a large proportion of high-end machines are imported, such as tractors boasting over 200 horsepower, large harvesters, 6-row cotton pickers, and sugarcane combine harvesters. Key components in some systems and machines also rely on imports, such as the electro-hydraulic control system, baler knotters, and picking fingers of cotton pickers.

(2) Regarding food service equipment, most of the key raw materials, key parts, and high-precision servo systems are imported. The accuracy and stability of technology and equipment for food safety are still far from the international advanced standard. High-end precision measuring equipment for laboratory use also needs to be imported from abroad.

(3) When it comes to textile equipment, core technologies for core components, equipment integration, and information management software are not yet fully mastered, so key functional components are mainly imported. The COVID-19 pandemic has caused a sharp surge in the worldwide demand for manufacturing equipment for face masks and protective clothing, as well as a severe shortage in melt-blown nonwoven fabric, which is the key filter material for protective coverings. Nevertheless, there is still a certain gap in the speed of manufacturing of sets of equipment for the production of melt-blown nonwovens, the production capacity of a single line, and core parts and components (such as the die head for melt-blown nonwovens) between Chinese textile equipment and advanced equipment of developed countries.

(4) Key components of medical equipment also rely heavily on imports such as superconducting magnets, CT tubes, transducers, detectors, optical components, vascular stents, and artificial components for bones and joints. The COVID-19 epidemic has led to a surge in demand for healthcare robots, AI-powered consultation systems, and systems for AI-assisted CT imaging analysis to support healthcare services.

4.2 Improvement of product quality and reliability

The quality of Chinese agricultural equipment is generally not high. The reliability index of agricultural machinery is only about 50% of that of foreign agricultural machinery. The working efficiency of domestic machinery and the utilization rate of water and fertilizers are only about 70% of the working efficiency of foreign machinery and the utilization rate of developed countries. The energy consumption level is 30% higher than the foreign advanced level, and the production loss rate in manufacturing is about 20% higher than the foreign advanced standard [11].

The current development of textile equipment is mainly limited by industrial technology and methods of manufacturing. As the techniques and quality management of domestic textile equipment are not very advanced in the processes of manufacturing, assembly, heat treatment, and surface treatment, the stability of equipment is also not high. In addition, some components of textile equipment are of poor quality, which reduces the reliability of domestic textile equipment. Compared with similar foreign equipment, the performance of food service equipment has low production capacity and high energy consumption, and the difference is even greater in the performance of

large-scale complete sets of equipment.

4.3 Lack of original innovations

The development of livelihood equipment in China lacks both independent and integrated innovations, and insufficient attention is given to research on the basic and common key technologies. China's over-reliance on foreign advanced technologies directly affects the improvement of the overall technical level of people's livelihood industries. Specifically, there is a lack of specific advanced design, technology, and platforms for livelihood equipment. Researchers are less competent in developing systematic technical equipment and efficient and reliable intelligent equipment through modeling or simulations. There is a big gap in the integration of process design of the whole production line between domestic and foreign advanced equipment.

4.4 Lack of investment in R&D

The development of livelihood equipment in China has been limited by low R&D investment and its incomplete technical systems. Taking agricultural equipment as an example, enterprises in this area are generally small sized and make low investment in R&D. According to statistics, only less than 5% of the agricultural machinery enterprises established R&D departments, and less than 1% had relatively complete technical systems. Less than 2% of the investments are for R&D [12]. Based on the stories of foreign food service companies, a company can be very competitive if its investment in R&D reaches 5%. In contrast, the average investment of Chinese enterprises in R&D is less than 1%. National R&D funds only account for 0.3% to 0.4% of sales revenue, while only 3.4%–4% employees of an enterprise are R&D personnel [12].

5 Path to optimizing and upgrading livelihood equipment

Currently, new-generation intelligent manufacturing is powered by both AI and advanced manufacturing technology, and it has become the core driving force of a new round of the industrial revolution. The new-generation intelligent manufacturing has caused significant and profound changes in the concept of development and manufacturing model of the manufacturing industry, which will reshape technical systems, production models, key elements of development, and value chains in the manufacturing industry. Based on previous responses to emergencies (such as public health emergencies or natural disasters), the important tasks to develop livelihood equipment are speeding up the development of core technologies, improving the intelligent functions of livelihood equipment, and achieving the automated control of equipment. Intelligent manufacturing should currently be the key focus to steadily promote the optimization and upgrade of livelihood equipment and the development of mid- to high-end equipment.

5.1 Promoting R&D of equipment with digital, network, and intelligent functions: increasing the quality and added value of equipment

Enterprises are encouraged to increase investments in R&D of new equipment and develop and produce high-tech and high-end equipment that can meet the requirements for major emergencies, consumption upgrade, and cross-sectoral equipment for emerging industries. The approach can gradually transform the advantages of China's livelihood equipment in scale (quantity) to advantages in value (quality).

(1) In terms of agricultural equipment, it is suggested to focus on intelligent agricultural equipment for farming, harvesting, and management and intelligent equipment and facilities for breeding and agricultural product processing. In addition, it is advised to promote the application of the Internet of Things, big data, the Internet, and the fifth generation of mobile network telecommunications (i.e., 5G) technology in agricultural production and agricultural machine operations, so as to develop a new generation of intelligent agricultural equipment and achieve intelligent operations, remote control, and maintenance of agricultural equipment.

(2) For the development of food service equipment, it is important to develop and improve high-end equipment for food processing and handling, which is a weakness of China's food service equipment. It is suggested to develop unmanned services by using intelligent robots and establish an intelligent, digital, and automated complete production line that offers zero-contact, zero-cross-infection, highly reliable, and 24/7 online services.

(3) In terms of the R&D of textile equipment, it is advised to focus on intelligent machines for continuous yarn manufacturing, CNC (computer numerical control) weaving machines, CNC equipment for manufacturing nonwovens, intelligent knitting equipment, and intelligent garment production lines. Researchers may carry out

further research on the intelligent management of the complete set of equipment for the production of melt-blown nonwovens, digital monitoring of manufacturing status, retrospective analysis of data about the whole manufacturing process, and intelligent slitting of melt-blown nonwoven fabric.

(4) For the development of medical equipment, it is recommended to focus on the development of intelligent robots for healthcare, AI-powered consultation systems, AI-assisted CT imaging systems based on big data, intelligent diagnosis systems, equipment for medical additive manufacturing, digital medical imaging equipment, virtual reality surgical simulations, and other equipment with new medical technologies.

5.2 Promoting transformation and upgrade of livelihood equipment enterprises

According to the actual situation, relevant enterprises in different regions can develop livelihood equipment with digital, network, and intelligent functions and reshape the technical system, production modes, and value chains for livelihood equipment.

During the transformation and upgrade of livelihood equipment, it is crucial that relevant enterprises first lay a good foundation for quality control, lean production, process optimization, and data accumulation. Then, enterprises may design adaptive schemes for the development of digital and intelligent production units and gradually build digital production lines, digital workshops, and digital factories.

5.3 Deepening integration of livelihood equipment and service industries

In order to promote the deep integration of livelihood equipment and service industries, enterprises may actively explore new areas through cross-sectoral integration. Product design may shift from product-centered to user-centered. It is suggested that enterprises could develop new models and new businesses for further development, such as large-scale customized production, cloud platform, shared manufacturing, and remote operations and maintenance. Based on the application of big data and the construction of flexible production lines, enterprises can establish systems to manage organizational innovations and transform the cost competition between enterprises to service competition that strives for meeting the individual needs of users.

It is also encouraged to actively explore the development of the platform economy and support the establishment of livelihood equipment enterprises or participate in the platform economy to seek more opportunities for development. Furthermore, it is important to support livelihood equipment enterprises to build user-centered production and management models and achieve organizational restructuring, business process re-engineering, business model innovation, and design and manufacturing of new products. Taking medical equipment as an example, it is suggested to focus on system development and platform construction that integrate advanced technologies with medical equipment, such as 5G-based medical big data, AI-powered diagnosis systems, and the integration of clinical big data with equipment operation and quality assurance, as well as the R&D of intelligent technology of rehabilitation and healthcare equipment, auxiliary equipment, and training equipment.

5.4 R&D of key parts, components and industrial software

The R&D of key components and industrial software can focus on the urgent needs of intelligent manufacturing and break the weak links in the industry to promote the independent R&D and industrialization of intelligent key components and industrial software and establish a more resilient and safer industrial chain for people's livelihood.

(1) In terms of agricultural equipment, further research could focus more on soil, animals and plants, environmental perception, basic control theories, and key generic technologies to improve the performance of control systems. Researchers can also study technologies, materials, and components related to the physiology and growth of animals and plants as well as environmental information perception. In addition, research could also be conducted on the precise control of sowing, water, fertilizers, medicine, light, and heat as well as technology and systems for precision feeding. Researchers can also construct an intelligent control technology system for the whole life cycle of animals and plants and promote the transformation of agricultural production from groups to individuals and from total control to intelligent precision production regulated by variables.

(2) The R&D of food service equipment mainly focus on the development of food contact materials and recyclable packaging materials, such as high-performance polymer hollow-fiber membranes, food-grade special steels, rubber materials, and special plastics. It is advised to focus on the development of programming logic controllers (PLCs), material (or liquid) level sensors, the control units of micro-flow sensors, ultra-high pressure valves and cylinders, high-efficiency servos, reducers, capping machines, and relevant industrial software.

(3) The R&D of textile equipment should give priority to the development of new textile materials and key

technical components of high-end textiles, such as key components for emergencies and public safety, infrastructure construction, marine engineering, and health projects. The focus of R&D is on products for the application of high-performance fibers, production equipment, operating systems, and industrial software, such as high-specification carbon fiber products (e.g., T1200, M60J), high-strength and high-modulus polyethylene products with strength above 40 cN/dtex, and high-specification aramid fibers (e.g., K129, K149, and KM-2).

(4) Regarding the R&D of medical equipment, it is suggested to deepen research on core parts, components, and software systems in equipment for medical imaging, clinical examinations, and advanced treatment. In terms of biomedical materials and products, it is necessary to enhance the application and development of basic materials, techniques, and processing machinery and software.

6 Countermeasures and suggestions

6.1 Overall planning of policies to support the development of livelihood equipment

In recent years, China has put increasing effort into policies fostering livelihood equipment, and great progress has been made in people's livelihood industries. Despite the progress, there is still much room for development in China's R&D of technologies, key techniques, and equipment in related fields in comparison with those up to the international advanced standard. In addition, China still lacks precise policy guidance and strong support for R&D of livelihood equipment. In light of this, it is recommended to integrate policies for the development of livelihood equipment in the agricultural, food, textile, and healthcare industries. It is important to emphasize the urgent need for common development and reflect the characteristics of individual development, so as to establish a set of optimal policies for livelihood equipment. In addition, technological innovations and production for R&D are also encouraged in order to promote the cross-industry and cross-sectoral application and integration of new materials, high-end components, advanced manufacturing, and other high-end technologies for livelihood equipment.

6.2 Initiation of a new round of technological transformation on a larger scale

Technological transformation is a direct and essential path to industrial upgrade. Livelihood equipment has a wide range of applications in areas such as agriculture, food, textile, and healthcare. Therefore, these areas are conducive to technological transformation. It is important to first organize and summarize the gains and losses in technological transformation at all levels to seek the direction and focus for a new round of technological transformation. In the new round of technological transformation, it is advised to optimize the policy guidance at all levels and provide necessary resources to utilize the functions of the government and the market. Furthermore, it is also important to pay attention to the efficiency and scale of technological transformation funds. Financial departments at all levels may set up special funds for technological transformation and attach importance to the transformation and upgrade of enterprises for livelihood equipment. Relevant enterprises are encouraged to increase investment in technological transformation and carefully identify the direction of development for sound market returns and profit expectations. It is important to improve the independent control of equipment and technology, so as to effectively upgrade technological equipment and improve the core competitiveness of the enterprise.

6.3 Establishment of public platforms for technological innovations in the industry

To highlight key points, improve efficiency, and ensure wide applications, it is recommended to focus on the construction of public service platforms for technological innovations related to livelihood equipment. It is suggested to coordinate and integrate scientific and technological resources in the industry and seek breakthroughs in key common technologies in the industry and core techniques for large-scale equipment, so as to achieve positive Industry–University–Research (IUR) collaboration. Furthermore, it is recommended to establish a work platform for quality supervision, inspection, and standardization for livelihood equipment and to support the construction of platforms for industrial information services, so as to solve the current issues in the livelihood equipment industry, such as lack of technical communication among departments, fund overlap, and difficulties in the industrial application of livelihood equipment. In addition, it is also suggested to provide an operating mechanism adapted to the standardized development of livelihood equipment and to form a standard development system with enterprises as the main body, intermediary services as a bridge, and IUR collaboration. It is also meaningful to construct a technical standard system that is market-oriented and has a key focus and a reasonable structure.

6.4 Promoting R&D and application of domestic equipment and industrial software

It is recommended to introduce preferential policies for promoting the R&D and application of domestic livelihood equipment, key components, and industrial software. It is also advised to formulate policies that encourage the use of domestic livelihood equipment in agriculture, food processing, textile and clothing enterprises, and healthcare services to promote the continuous innovation of livelihood equipment in practice. In addition, it is suggested to consider the needs of users in the R&D of new products and to improve technical skills as well as product quality and reliability. It is encouraged to establish an independent and controllable industrial chain for people's livelihood industries in China and train a team of system integrators to build an industrial system with a virtuous circle of continuous innovation in livelihood products and services and continuous optimization and upgrade of livelihood equipment, in order to support the healthy and orderly development of people's livelihood industries in China.

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