

Implementation plan for the digital transformation of the machinery industry

The machinery industry is a basic and strategic industry that provides technical equipment for the development of the national economy, national defense and military industry construction and people's livelihood, with wide industrial coverage, many product types, complex product structure, long industrial chain, and the coexistence of large-scale production and small-batch customization. Accelerating the digital transformation of the machinery industry is not only an inevitable requirement to promote the high-quality development of the industry, but also an important measure to support the digital transformation of all walks of life in the national economy and accelerate the promotion of new industrialization. In order to implement the "Action Plan for Digital Transformation of the Manufacturing Industry" and accelerate the intelligent upgrading of the digital transformation of the machinery industry, this implementation plan is

formulated.

1. General requirements

Guided by Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, thoroughly implement the spirit of the 20th National Congress of the Communist Party of China and the Second and Third Plenary Sessions of the 20th Central Committee of the Communist Party of China, completely, accurately and comprehensively implement the new development concept, and further implement the deployment requirements of the National New Industrialization Promotion Conference. Focus on the needs of enterprise development and industrial transformation and upgrading, adhere to innovative development, safety and controllability, adhere to scenario traction and problem-oriented, develop a number of intelligent equipment, build a number of smart factories, expand a number of smart services, promote the high-end, intelligent and green development of the machinery industry, and provide solid technical equipment guarantee for promoting new industrialization.

By 2027, digital intelligence technology will be widely used in product R&D and design, manufacturing, operation and management, operation and maintenance services, etc., accounting for 50% of enterprises with a maturity level 2 or above in intelligent manufacturing capabilities, and no less than 200 excellent intelligent factories will be built, driving machinery enterprises to develop and design, manufacturing, the digital and intelligent level of supply chain management has been steadily improved; Cultivate a group of system solution providers who understand both the industry and digitalization, and form no less than 200 excellent scenario-based solutions, and significantly increase service capabilities

Strong. By 2030, enterprises above the designated size of the machinery industry will basically complete a round of digital transformation, the upstream and downstream of the industrial chain and supply chain of key enterprises will realize data interconnection, sharing and collaboration, backbone enterprises will deeply apply artificial intelligence technology, and the maturity of intelligent manufacturing capabilities will account for

60% of enterprises at level 2 and above, and no less than 500 excellent intelligent factories will be built. A systematic, safe and controllable product and service supply system has been basically formed, and the level of digital intelligence in the industry has been greatly improved.

2. Key tasks

(1) Intelligent equipment innovation and development actions

1. Carry out research on common technologies and key components. In-depth implementation of industrial base reconstruction

In view of the shortcomings of perception, control, and execution, breakthroughs are made in intelligent perception technologies such as high-speed dynamic perception and feature extraction, as well as intelligent sensors such as low power consumption and high sensitivity speed, acceleration, and displacement. breakthroughs in intelligent control technologies such as independent learning and optimized control strategies, as well as intelligent controllers such as highly reliable and highly integrated programmable controllers and integrated motion controllers; Breakthrough digital actuators and basic components such

as digital hydraulics, precision pneumatics, and electronic transmissions. Accelerate the development of new industrial software, support the softwareization of technical knowledge such as technology, agronomy, and medical technology, and develop a number of industrial apps and clouds

software, cloud-native software, etc., to promote the integration and application of artificial intelligence technologies such as large models and equipment technology.

2.Promote the integration and innovation of the whole

machine. Facing the needs of old equipment transformation in the industrial field, deep

Implement large-scale equipment renewal actions, support enterprises to integrate and apply intelligent components such as perception, control, and execution, and transform and upgrade a number of old, inefficient, and high-energy equipment in service. Facing the needs of national defense and military industry and national strategic needs, implement major scientific and technological projects such as major national science and technology projects and key R&D plans, and break through a number of intelligent equipment such as industrial machine tools, industrial robots, intelligent instrumentation, intelligent testing equipment, safety emergency equipment, and deep mine safety mining equipment. Facing the needs of the people for a better life, develop a number of intelligent agricultural machinery and equipment, medical

equipment, textile machinery, food machinery, energy-saving and environmental protection equipment, service robots and other intelligent livelihood equipment. Facing the global trend of scientific and technological innovation and the needs of future industrial development, accelerate the implementation of major technical equipment research projects, and break through a number of future high-end equipment such as humanoid robots and brain-computer interface products.

3. Accelerate the promotion and application of intelligent equipment.

Build a number of pilot verification platforms around the project

The engineering and industrialization needs of key products in the industry, such as machine tools, agricultural machinery and equipment, medical equipment, safety emergency equipment, intelligent mining equipment, and mechanical basic parts, support leading enterprises and scientific research institutes in the industry to build a test and verification environment that integrates virtual and real. Accelerate the promotion and application of the first (set) of equipment, establish a digital intelligent monitoring system for the whole application process, and ensure that the risks of the

application process are controllable. For typical scenarios such as human-machine collaborative operation, online intelligent detection, and intelligent warehousing, a number of low-cost, reusable system solutions will be created by industry to accelerate the penetration and popularization of intelligent equipment and system solutions in small and medium-sized enterprises. Compile application promotion catalogs such as industrial machine tools, robots, and instrumentation, and organize and carry out "robots."

+" application action, "industrial machine tool +" production and demand docking of hundreds of enterprises, intelligent manufacturing into the park and other activities to promote the large-scale application of intelligent equipment in automobiles, electronic information, aerospace, rail transit, clean energy, agriculture, construction and other fields.

Column 1 Intelligent equipment

innovation and development project

1 Industrial machine tools

Facing the transformation and upgrading needs of strategic emerging industries and traditional industries such as new energy vehicles, new energy equipment, aerospace, etc., we will focus on the development of CNC vertical/horizontal/gantry (five-axis) machining centers, CNC lathes and turning centers, casting equipment, forging equipment, additive manufacturing equipment, etc. Promote the industrial interconnection communication protocol (NC-Link) of CNC machine tools, promote the deep integration of a new generation of information technology and industrial machine tool technology, and develop intelligent industrial machine tools.

2 Industrial robots

Focus on the development of high-precision heavy-duty robots, skilled operation robots, and special environment operation robots, build a number of industrial robots and core components pilot verification platforms, and promote the

application of a number of high-end industrial robots such as large-load welding robots, explosion-proof spraying robots, and human-machine collaborative robots in key fields such as automobiles, ships, rail transit, and aerospace.

3 instrumentation

Focus on the development of high-resolution spectrometers, mass spectrometers, chromatographs, ultra-wideband high-resolution digital storage oscilloscopes and other scientific research instruments, intelligent testing equipment such as surface quality testing of complex components, non-destructive testing of internal defects, online measurement of assembly parameters, special instruments and instruments in the fields of environmental monitoring, navigation and mapping, geological exploration, nuclear and nuclear radiation measurement, as well as key components such as high-end detectors and sensors, high-end signal generation and radiation source components, and precision analysis and separation and control components. Industry atlas libraries and software such as instrumentation basic software and databases.

4 Intelligent control equipment

Focus on the development of a number of distributed intelligent control systems, adaptive flexible control systems, real-time resource scheduling and control integrated edge controllers, drive and control integrated motion controllers, high performance and high reliability

Column 1 Intelligent equipment
<p>innovation and development project</p> <p>Intelligent control equipment such as embedded control systems and highly integrated programmable logic controllers promote the deep integration of artificial intelligence and real-time control technology.</p> <p>5 Intelligent logistics equipment</p> <p>Focus on the development of high-speed and heavy-duty stackers, high-speed intelligent sorters, intelligent multi-layer multi-directional shuttles, intelligent high-density storage shuttle boards, high-parameter intelligent three-dimensional warehouses, high-speed and large-capacity conveying and sorting complete sets of equipment, workshop logistics intelligent complete sets of complete equipment, etc.</p> <p>6 Medical equipment</p> <p>Focus on the development of a new generation of intelligent monitoring systems, intelligent rehabilitation training equipment based on brain-computer interfaces, intelligent prosthetics and other innovative medical equipment, build a number of intelligent medical equipment pilot verification platforms, and promote the application of a number of advanced and applicable medical equipment such as intelligent medical imaging-assisted diagnosis systems, intelligent surgical robots, and intelligent meridian traditional Chinese medicine diagnosis systems.</p> <p>7 Pharmaceutical equipment</p>

Focus on the development of high-performance cell culture

tanks and ancillary systems, protein separation and purification equipment, high-standard preparation equipment, micro-reaction continuous synthesis and oral preparation continuous manufacturing equipment, complex preparation production and testing equipment, etc., and continue to promote breakthroughs and applications such as high-end sensors and new bioreactors.

8 Agricultural machinery and equipment

Focus on the development of high-horsepower intelligent tractors, large-feed grain combine harvesters, large-scale high-speed precision seeders, self-propelled wide boom sprayers, manure returning machines, side deep fertilizer spreaders, water, fertilizer and medicine integration equipment, facility horticultural equipment, facility aquaculture equipment, large-scale breeding equipment and other high-end intelligent agricultural machinery and equipment, as well as hilly and mountain tractors, light sugarcane harvesters, mountain corn harvesters and other intelligent agricultural machinery suitable for hilly and mountainous areas. Carry out in-depth unmanned agricultural operation experiments, build unmanned agricultural operation pilot areas, and explore new paths for the integration of intelligent agricultural machinery and smart agriculture.

9 Rail transit equipment

Focus on the development of a number of intelligent rail transit equipment such as "Fuxing" intelligent EMUs, new energy locomotives, smart subways and urban trains, and maglev transportation equipment, and continue to promote intelligent

equipment and smart services

Column 1 Intelligent equipment

innovation and development project

business, smart urban rail and other technology upgrades, forming and improving the "product +" and "system +" full life cycle service system solutions.

10 Safety emergency equipment

Facing the needs of improving the intrinsic safety level of key industries such as manufacturing, mining, hazardous chemicals, industry and trade, energy, transportation, housing and construction, as well as the needs of natural disaster prevention and emergency rescue and disposal such as floods, droughts, typhoons, forest and grassland fires, geological disasters, and earthquakes, we will focus on the development of monitoring and early warning equipment, emergency communication equipment, special safety production equipment and facilities, safety materials and products, personal protective equipment, rescue and disposal equipment, fire fighting equipment, emergency support equipment, etc., and promote equipment to be intelligent, lightweight, Standardization development.

11 Mining equipment

Focus on the development of intelligent fast excavation equipment, hard rock cutting and tunneling equipment, intelligent drilling equipment, intelligent working face fully mechanized mining equipment, unmanned intelligent drilling and blasting equipment, thin coal seam and thin vein intelligent mining equipment, intelligent shoveling and transportation equipment, intelligent tailings filling equipment, large-scale

intelligent mining and stripping equipment for open-pit mines, intelligent special operation robots, new mining unmanned vehicles and other core equipment. Accelerate the research and development and application of core components, sensors, key control units and operating systems of mining intelligent equipment.

12 Construction machinery

Focus on the development of high-end and green construction machinery for intelligent operation scenarios and unmanned operation systems, continue to promote the breakthrough application of intelligent load management technology, dynamic stability control technology, adaptive operation assistance technology, active safety technology and energy management technology, and continuously improve the accuracy of autonomous identification and the stability of autonomous operation of intelligent construction machinery.

(2) Intelligent manufacturing expansion and popularization action

4. Accelerate the digital and intelligent transformation of enterprises. Carry out digital transformation and transformation actions, implement a number of "intelligent transformation and digital transformation networking" transformation projects, and promote the renewal and "dumbness" of old equipment

Equipment transformation, support enterprises to implement software and hardware integration transformation, promote the comprehensive interconnection of production equipment and information systems, promote digital integration and application innovation, and improve the level of digital lean management of enterprises. Carry out smart factory gradient cultivation actions, support enterprises with good digital foundation to carry out intelligent upgrades around typical scenarios such as digital R&D and design, flexible configuration of production lines,

Column 2 Smart factory
<p>1 Basic smart factory</p> <p>Carry out digital networking basic capacity building, deploy necessary intelligent manufacturing equipment, industrial software and systems around typical scenarios of intelligent manufacturing, realize real-time collection of core data, automation of key production processes, informatization of production and operation management, and carry out point-like intelligent exploration.</p> <p>2 Advanced smart factory</p> <p>Improve digital network integration capabilities, widely deploy intelligent manufacturing equipment, industrial software and systems for typical scenarios of intelligent manufacturing, intelligent warehousing, equipment operation and</p>

maintenance, and supply chain elastic control, accelerate the integration and application of digital intelligence technologies such as artificial intelligence, explore future manufacturing models, and promote innovation in business models and enterprise forms. Organize industry institutions to study and sort out typical scenarios of intelligent manufacturing and industry characteristic scenarios, as well as element reference guidelines, to provide reference for enterprise transformation. Implement special actions for digital empowerment of small and medium-sized enterprises, support enterprises to implement digital "micro-transformation" with low investment and quick results, such as equipment automation transformation, data collection, and cloud platform based on their own needs, and consolidate the digital foundation.

Column 2 Smart factory
<p>Comprehensive optimization of the whole link promotes multi-scenario system-level intelligent applications.</p> <p>04 Pilot-level smart factory</p> <p>Promote the deep integration of digital intelligence technologies such as new generation artificial intelligence and the whole manufacturing process, achieve breakthroughs in the</p>

5.Coordinate to promote chain digital transformation.

Carry out the construction of smart supply chain and support

Key enterprises in key industries such as industrial machine tools, construction machinery, agricultural machinery and equipment, rail transit equipment, medical equipment, mining equipment, and energy-saving and environmental protection equipment have built supply chain collaboration platforms to promote data interconnection, trusted information interaction, and flexible allocation of resources. Support the collaborative transformation of the upstream and downstream of the supply chain, encourage leading enterprises to jointly formulate collaborative technology transformation plans with upstream and downstream, and carry out digital collaborative transformation such as collaborative design of complex

equipment networks, distributed collaborative manufacturing of multiple factories, and collaborative management of upstream and downstream of the industrial chain. Support backbone enterprises to carry out capacity sharing, open data interfaces, and use standards to drive the upstream and downstream of the industrial chain and supply chain to popularize intelligent manufacturing equipment, advanced manufacturing technology, excellent management concepts, etc., and drive the chain transformation of small and medium-sized enterprises.

6. Guide the overall digital transformation of the region. Carry out the construction of high-standard digital parks

Smooth the data chain, innovation chain, industrial chain, and supply chain in the park, and explore the overall improvement path of the park's digitalization. Encourage equipment industry clusters and parks to focus on common needs, build shared processing centers, casting centers, coating centers, surface treatment centers, testing centers, etc., and explore new models and new formats such as regional collaborative design, collaborative production, and collaborative services.

Carry out urban pilots for new technological transformation of manufacturing industries and digital transformation of small and medium-sized enterprises

Encourage localities, high-tech development zones, economic and technological development zones, equipment industry cluster core bearing parks and other leading industries, organize and carry out the construction of digital transformation pilot projects, cultivate a number of common scenarios, and guide enterprises to "follow the example". Build a number of regional and industry digital transformation promotion centers to provide public services such as assessment and diagnosis, pilot verification, and talent training for the digital transformation of enterprises.

(3) Smart service expansion and improvement actions

7.Improve equipment service functions. Guide

enterprises to focus on the personalized needs of users, improve product data acquisition, interconnection, human-computer interaction, assisted decision-making, and independent execution

Smart service function. Encourage key enterprises in key industries such as industrial machine tools, construction machinery, agricultural machinery and equipment, rail transit equipment, medical equipment, mining equipment, and pharmaceutical equipment to build a number of intelligent operation and maintenance

management platforms, and carry out intelligent operation and maintenance services such as remote fault diagnosis, operation parameter optimization, operation trajectory tracking, predictive maintenance, and shared deployment. Support capable equipment manufacturing enterprises to expand or transform from equipment suppliers to system solution providers, and provide high-level, professional, and one-stop integration services for the digital transformation needs of industry users.

8.Cultivate smart service scenarios. Apply intelligent rail transit equipment and intelligent port installation

Equipment, intelligent logistics equipment, etc., to create smart transportation scenarios such as smart highways, smart railways, smart urban railways, smart ports, smart waterways, smart logistics, and smart hubs. Carry out in-depth unmanned agricultural operation experiments and accelerate the construction of unmanned agricultural operation pilot areas. Promote the application of intelligent power and cultivation management and harvesting equipment, facility horticultural equipment, animal husbandry and

aquaculture equipment, etc., and cultivate smart agricultural scenarios such as smart farms, smart ranches, smart fishing farms, and slaughtering and processing. Carry out the promotion and application of high-end medical equipment and push

The integration and application of artificial intelligence and medical equipment will create smart medical scenarios such as medical image assisted interpretation and remote consultation, and promote the research and development and application of medical emergency robots, intelligent ambulances and other equipment. Carry out pilot projects of intelligent construction and smart mines, and apply engineering surveying drones, construction robots, construction equipment integration platforms, as well as intelligent excavators, mining trucks, drilling rigs, special robots, etc., to create intelligent construction scenarios such as intelligent surveying and mapping, intelligent production of building parts and components, and human-machine collaborative construction operations. Promote the application of safety emergency equipment such as emergency robots, intelligent fire trucks, and rescue equipment, select a number of typical cases, and build a safety emergency base.

9. Tap the value of equipment data. Carry out data governance throughout the life cycle of equipment and improve it

Data governance systems such as intelligent equipment

data collection, secure storage, knowledge visualization, and standardized utilization form controllable, trustworthy, and traceable high-quality data resources. Implement the development of trusted data space, build a number of trusted data spaces around construction machinery, rail transit equipment, agricultural machinery and equipment, medical equipment, mining equipment and other industries, and explore and cultivate new models and new formats such as data-driven industrial cooperation and collaborative innovation. Accelerate the value of equipment life cycle data, encourage data trading institutions to focus on equipment life cycle data, explore equipment data circulation and trading models, and promote the construction of intelligent equipment data service ecology.

(4) Strengthen the consolidation of basic support

10.Improve the digital transformation standard

system. Facing the needs of intelligent upgrading of the digital transformation of the machinery industry, promote the construction of standard systems and clarify intelligent manufacturing standards in key areas

Quasi-key construction direction. Accelerate the development of standards, focusing on intelligent equipment, intelligent manufacturing, smart services, etc., for equipment digital intelligence functions, intelligent scenarios, and new technologies

Promote the development of standards in the direction of integration and evaluation system. Strengthen the publicity and application of standards, guide enterprises to carry out the construction of typical digital transformation scenarios with standards, and

support the construction of "standard groups" that coordinate and support national standards, industry standards, group standards and enterprise standards. Continue to promote the pilot application of intelligent manufacturing standards, encourage enterprises to build a number of intelligent "mother factories", solidify and standardize the development experience of digital transformation and intelligent upgrading.

Column 3 Digital Transformation Standard Improvement Project

1 Standard system construction

The "Guidelines for the Construction of the National Intelligent Manufacturing Standard System" will be revised on a rolling basis, and key standards for digital transformation and intelligent upgrading such as intelligent equipment, intelligent manufacturing, and smart services will be studied and proposed.

2 Key standard development

For intelligent equipment, we will focus on developing

product data collection interfaces, interconnection communication protocols, data dictionaries, human-computer interaction, process knowledge bases and other standards. For intelligent manufacturing, focus on the development of intelligent scenario standards such as design and manufacturing integration, reconfigurable flexible production, and lean digital management, as well as new technology integration and application standards such as digital twin equipment, industrial artificial intelligence, and industrial data circulation. For smart services, focus on developing standards such as data-driven services, model-as-a-service, and intelligent operation and maintenance services. Improve standards such as intelligent manufacturing capability maturity evaluation.

3 Standard application promotion

Promote the application of mature standards such as machine vision online detection, digital design of smart factories, remote operation and maintenance, and predictive maintenance in the machinery industry, carry out the construction and summary of "standard groups" for digital transformation for typical scenarios, and promote the promotion of successful experiences in small and medium-sized enterprises.

11.Promote the construction of digital infrastructure.

Increase the supply of high-performance intelligent computing and target many Typical industry applications such as equipment collaborative operation, equipment operation optimization, and remote

operation and maintenance of equipment promote the **coordinated development of "cloud-edge-end"** computing power. Support the construction of artificial intelligence infrastructure in the industry, and lay out a number of artificial intelligence open platforms and high-quality industry data for subdivided industries

New infrastructure such as big data centers and basic components. Explore the establishment of a data circulation and traceability system for the whole life cycle of intelligent equipment in key industries. Support industry enterprises to carry out internal and external network transformation, flexibly deploy new network infrastructure such as 5G industry virtual private networks, industrial optical networks, industrial Ethernet, and Beidou navigation according to their own needs, and support data interconnection throughout the entire life cycle of equipment, the whole process of production and manufacturing, and the whole link of the supply chain.

12.Strengthen network and data security governance.

Implement industrial Internet security
classification

Promote enterprises to implement the "Measures for the Classification and Classification of Industrial Internet Security"

The "Guidelines for Network Security Protection of Industrial Control Systems" requires that all aspects of work such as independent grading, hierarchical protection, compliance evaluation, and security

rectification be carried out, and key enterprises should be guided to strengthen the construction of network security monitoring methods, strengthen the security protection of important industrial control systems, and improve the comprehensive guarantee ability of network security. Promote the development of standards and specifications such as important data identification in key subdivided industries, guide enterprises to carry out important data identification and catalog filing, implement hierarchical protection, risk assessment, monitoring and emergency response requirements, apply data security technology products, strengthen data security guarantees, and improve protection capabilities.

3. Organization and implementation

(1) Strengthen organizational coordination.

Strengthen departmental coordination to jointly promote the digital transformation of the machinery industry technology research, equipment innovation, promotion and application, standard development, talent training, etc. Strengthen cooperation between the central and local governments, encourage local governments and parks to introduce supporting policies, guide the

agglomeration of various social resources, and form a systematic promotion work pattern. Give full play to the role of the Intelligent Manufacturing Expert Advisory Committee and relevant universities, scientific research institutions, and professional think tanks to carry out forward-looking and strategic research on major issues in the digital transformation of the machinery industry. Encourage industry organizations to play the role of bridges and strengthen policy publicity, industry monitoring, and decision-making support

Support and enterprise services.

(2) Improve public services. Support existing national industrial metrology and testing centers, standard test and verification platforms and service institutions to improve professional service capabilities such as inspection and testing, quality certification, measurement and testing, consulting and planning, and safety assessment, and vigorously carry out "one-stop" services for quality infrastructure. Enhance the capabilities of carriers such as the national intelligent manufacturing data resource public service platform, encourage local governments to build a number of regional and industry public service platforms, and provide public welfare services such as assessment and diagnosis, benchmarking cases, and supply and demand docking for the digital transformation of the industry. Improve the index system of intelligent manufacturing capability maturity and performance evaluation, and encourage local machinery enterprises above designated size to widely carry out self-assessment of intelligent manufacturing capability maturity and digital level.

(3) Strengthen talent training. Carry out a thorough

survey of the demand for key professional and technical talents in the digital transformation of the machinery industry, and promote the construction of an information database of key talents and experts.

Support the construction of national excellent engineer practice bases, deeply implement the knowledge update project of professional and technical personnel and the training action of "skills illuminate the future", accelerate the cultivation of digital technology engineers, promote the evaluation of outstanding engineers' capabilities, and focus on cultivating urgently needed talents for the digital transformation of the machinery industry. Facing advanced manufacturing technology, product innovation, intelligent manufacturing systems and other directions, we will strengthen the inheritance of process technology and accelerate the training of craftsmen, skilled craftsmen, and high-skilled talents in big countries.

(4) Deepen international cooperation. Strengthen exchanges with relevant countries, regions and international organizations, and carry out cooperation in digital transformation technologies, standards,

talents, etc. Rely on the Belt and Road Initiative, the BRICS cooperation mechanism, and the Regional Comprehensive Economic Partnership Agreement

(RCEP), etc., giving full play to the International Intelligent Manufacturing Alliance and IEC intelligent manufacturing system

The role of the China Special Committee of the Committee, the BRICS Innovation Base, the BRICS Intelligent Manufacturing and Robotics Working Group and other institutions to promote the "going out" of intelligent equipment, supporting services, and related standards. Support multinational enterprises to build high-level smart factories and R&D centers in China, and jointly build a resilient global production network.

List of typical scenarios

Focus on the characteristics of the machinery industry, sort out typical scenarios such as R&D and design, manufacturing, operation and management, operation and maintenance services, and supply chain management. Adhere to the principle of problem-oriented and urgent use first, and take the scene as the starting point to promote the digital transformation and intelligent upgrading of the machinery industry.

1. Typical scenario: product digital R&D and design

Pain points: There are many types of mechanical products, complex structures, and there are pain points in the design process, such as inconsistent product data sources, poor consistency, low management efficiency, and difficulty in multi-professional and multi-disciplinary collaboration .

Transformation goal: digital product research and development and design.

Implementation and requirements: Apply computer-aided design and simulation analysis

(CAD&CAE), product data management (PDM), product life cycle management (PLM).) and other systems,

establish product standard parts library and general parts library, realize the efficient call of design tools for standard parts and general parts, and improve the work efficiency of designers. Build a multi-party shared digital design platform, and form a multi-party collaborative design model driven by task flow, data flow as the core, and digital design objects as the carrier. Use professional software to carry out virtual tests and simulation optimization of structural strength, fatigue failure, life, etc. , to improve the quality and efficiency of product design.

2. Typical scenario: process digital design

Pain points: Traditional mechanical process design methods are difficult to ensure the uniqueness and timeliness of transmission from product data to process data, and some processing and assembly process designs are still there

Relying on the experience of technicians, resulting in poor product manufacturability.

Transformation goal: digital process design.

Implementation method and requirements:

Establish a process knowledge base and model library, integrate various process models such as machining, casting, forging, welding, and heat treatment to realize the design process data

Real-time calls. Build computer-aided process planning (CAPP) and other systems to realize process digital design and iterative optimization.

Apply product lifecycle management (PLM) and other software, integrate 3D process design tools, open up product research and development, process design, production operation and other link data, and comprehensively evaluate and improve the processability, assembly and maintainability of product and process design in a timely manner.

3. Typical scenario: Data-driven product research and development

Pain points: Mechanical product R&D and design mainly rely on manual experience, which is difficult to meet the needs of rapid product development, complex structure design, and personalized user

design.

Transformation goal: Achieve generative product design based on data and knowledge.

Implementation method and requirements: build a generative design platform and face the product Rapid R&D, complex structure design, user personalized design and other requirements, integrate multi-dimensional data such as demand, design, production, and use, and quickly generate the most effective shape structure and material formula according to the defined design variables and constraints, and continuously iterate and optimize iteratively, so as to realize data-driven R&D design and continuous optimization of product form, function and performance , greatly improve design efficiency, and expand cognitive boundaries.

4. Typical scenario: intelligent production scheduling

Pain points: Mechanical products have complex structures, many parts, and most of them are single-piece small-batch production, production process management is difficult, traditional production scheduling methods mainly rely on manual labor, production efficiency is low, and it is difficult to optimize the utilization of production resources.

Transformation goals: dynamic optimization of production plans and efficient allocation of resources.

Implementation method and requirements: Apply enterprise resource management system (ERP), production execution system (MES) and other information management systems to monitor production capital in real time

Source, equipment status and process flow to ensure accurate basic data and real-time on-site feedback for scheduling and scheduling. Deploy advanced planning and scheduling systems (APS), apply multi-constraint scheduling modeling, multi-objective scheduling optimization and other technologies to achieve scheduling optimization and dynamic resource scheduling under multi-objective constraints and multi-disturbance conditions such as orders, production capacity, resources, and delivery dates, shorten product production cycles, and improve production efficiency and resource utilization.

5. Typical scenario: flexible configuration of production line

Pain points: There are a wide variety of mechanical products and strong demand for customization, and the

traditional rigid production line lacks flexible configuration capabilities, making it difficult to quickly respond to changes in the market and orders, and cannot adapt to the mixed production requirements of different products.

Transformation goal: multi-product mixed line production and rapid line changeover, agile response to market demand.

Realization methods and requirements: apply high-end CNC machine tools, intelligent welding equipment, industrial robots, flexible tooling fixtures, intelligent logistics equipment and other intelligent equipment Combined with enterprise resource management system (ERP), production execution system (MES) and other information management systems, a modular flexible and reconfigurable production line is built, so that the production line can achieve rapid line change and on-demand configuration according to changes in orders, working conditions, inventory, etc., to meet the rapid and low-cost production needs of multiple varieties and small batches of mechanical products.

6. Typical scenario: human-machine collaborative operation

Pain points: complex mechanical product structure,
traditional production mode resource collaborative
efficiency

low and high operational safety risks, restricting the improvement of production efficiency.

Transformation goal: efficient collaboration between man and machine in the production and assembly of complex equipment. **Implementation method and requirements:** deployment of high-end CNC machine tools, industrial robots, etc

Intelligent equipment such as intelligent detection, intelligent assembly, and intelligent logistics should be used to build human-machine collaborative operation units and control systems, and technologies such as intelligent interaction, autonomous planning, risk perception and safety protection should be applied to realize efficient human-machine collaboration in processes such as product processing, quality inspection, complex assembly, sorting, logistics and distribution, and significantly improve production efficiency and operational safety. With the help of AR/VR, speech recognition and other technologies, innovate the human-computer collaborative interaction mode to realize the collaborative optimization of production organization and operations, and further improve the efficiency of operations.

7. Typical scenario: online intelligent detection

Pain points: The quality inspection of mechanical product production process mainly relies on manual labor, with low detection efficiency, large human error, and difficulty in achieving full life cycle traceability of product quality.

Transformation goal: online accurate and rapid quality detection and whole-process traceability.

Implementation method and requirements: Deploy intelligent inspection systems in key processes such as machining, welding, painting, and assembly, and apply optical inspection, machine vision, and other inspections

Combined with artificial intelligence technologies such as machine learning and big data analysis, the quality analysis model is developed to realize online real-time detection, independent judgment and closed-loop disposal of quality, and improve the efficiency and accuracy of detection. Build a quality traceability system, integrate system data such as quality management, production execution, and equipment management, and realize the digital management of quality inspection and the integration and sharing of data in the whole process.

8. Typical scenario: Intelligent O&M of equipment

Pain points:Traditional equipment operation and maintenance mainly rely on manual labor, and the operation and maintenance cost is high

It is time-consuming, labor-intensive, and difficult to respond quickly to user needs.

Transformation goals: intelligent remote operation and maintenance, predictive maintenance and unmanned construction. **Implementation method and**

requirements: Deploy data acquisition equipment on mechanical products

5G, AR/VR, image acquisition and other technologies are applied to realize remote and automatic collection of product operation data. Build a remote operation and maintenance system, combine the history of equipment operation and real-time data, build a fault diagnosis model, realize long-distance monitoring, fault diagnosis and value-added services based on operation data, and significantly improve the added value of products. Build a digital twin model of the equipment, synchronize the operation status of the equipment in real time, deeply mine the value of the operation data, and provide customers with active services.

9. Typical scenario: network collaborative manufacturing

Pain points: The structure of mechanical products is complex, design and manufacturing require multi-party

collaboration, and there are information islands in the upstream and downstream of the traditional design and manufacturing model, and the collaboration efficiency is low, making it difficult to achieve optimal utilization of resources and rapid response.

Transformation goal: efficient collaboration within the enterprise and upstream and downstream of the industrial chain.

Implementation method and requirements: Build a collaborative design platform, establish a virtual prototype system covering multiple disciplines and disciplines, and realize cross-specialty, multi-discipline, and cross-region Domain collaborative design. Establish a network collaborative manufacturing platform to integrate system data such as factory planning and scheduling, manufacturing execution, etc., to achieve cross-enterprise and cross-regional production collaboration and optimization of manufacturing resource allocation. Establish a product life cycle service collaboration platform, integrate the whole chain data of multiple factories from user needs to recycling and reuse with the product as the main line, and realize cross-regional service collaboration based on data analysis.

10. Typical scenario: Supply chain elastic control

Pain points: the structure of mechanical products is complex, the industrial chain and supply chain are long, and there is supply

Pain points such as slow chain response speed, high procurement cost, weak anti-risk ability, and low resource allocation efficiency.

Transformation goal: efficient supply chain management and dynamic risk early warning and disposal.

Implementation methods and requirements:

Establish a supply chain collaboration platform, open up the upstream and downstream production, warehousing, logistics and other links of the supply chain, and carry out supply chain planning coordination

Real-time monitoring of supply chain purchase orders and delivery logistics dynamics. Establish a supply chain risk early warning and flexible management and control system, collect and analyze upstream and downstream data of the supply chain, apply digital evaluation models to carry out refined management of suppliers, and apply supply chain risk identification and dynamic response models to monitor potential risks online, accurately identify , warn in advance and quickly deal with potential risks, and improve the resilience and safety level of the supply chain.