I. New Generation Information Technology Industry

1.1. Integrated Circuits and Special Equipment

An integrated circuit (IC) refers to a circuit with a specific function formed by integrating a large number of electronic components through semiconductor processing. This roadmap mainly covers IC design, IC manufacturing, IC testing and packaging, key equipment, and materials.

1.1.1. Requirements

The size of the global IC market is projected to grow from approximately US$292 billion to US$328 billion from 2011 to 2015, with a compound annual growth rate (CAGR) of 4%. From 2016 to 2020, it is expected to grow from approximately US$328 billion to US$400 billion, at a CAGR of 4%. From 2021 to 2030, it is expected to grow from approximately US$400 billion to

US$537.5 billion, at a CAGR of 3%.

The size of the Chinese IC market is projected to grow from approximately US$84 billion to US$118 billion from 2011 to 2015, at a CAGR of 12%. From 2016 to 2020, it is expected to grow from approximately US$118 billion to US$173.4 billion, at a CAGR of 8%. From 2021 to 2030, it is expected to grow from approximately US$173.4 billion to US$244.5 billion, at a CAGR of 3.5%.

China's IC market will account for 36% of the global market in 2015, rise to 43.35% in 2020, and then 46% in 2030, becoming the world's largest IC market. The local value of output (本地产值) of Chinese-made integrated circuits is expected to reach US$48.3 billion in 2015, meeting 41% of domestic market demand. This value is expected to reach US$85.1 billion in 2020, meeting 49% of domestic market demand. In 2030, it is expected to reach US$183.7 billion, meeting 75% of domestic market demand.

From the above data, it is clear that meeting domestic market demand and increasing the self-sufficiency of IC products while meeting national security needs and dominating (占领) the market for strategic products have always been the greatest needs and motivations for the development of the IC industry.

1.1.2. Objectives

In the face of the two requirements of national strategy and industrial development, we must focus on the development of the IC design industry, accelerate the development of the IC manufacturing industry, improve the development level of the advanced packaging and testing industry, and make breakthroughs in key IC equipment and materials.

By 2020, the gap between the Chinese IC industry and the advanced level internationally will gradually narrow, industry-wide sales revenue will grow at an average annual rate of over 20%, and the sustainable development capabilities of companies in the industry will be significantly enhanced. IC design technologies in key areas such as mobile smart terminals, network communications, cloud computing, Internet of Things (IoT), and big data will reach leading international levels, and an industrial ecosystem will have begun to take shape. The 16/14nm manufacturing processes will have achieved mass production, packaging and testing technology will have reached the leading levels internationally, key equipment and materials will have entered the international procurement system, and a technologically advanced, secure, and reliable IC industry system will have basically been established.

By 2030, the main links of the IC industry chain will have reached international advanced levels, and a group of enterprises will enter the top rung of international industry, achieving development by leaps and bounds (跨越发展).

1.1.3. Key Points in Development

1. IC Design

   (1) Servers and Desktop CPUs

Single-core and dual-core server and desktop computer CPUs, multi-core server and desktop computer CPUs, and manycore server and desktop computer CPUs

   (2) Embedded CPUs

Low-power high-performance embedded CPUs, low-power multi-core embedded CPUs, and ultra-low-power manycore embedded CPUs

(3)   Memory

Dynamic random-access memory (DRAM) and embedded dynamic random-access memory (eDRAM), flash memory, and three-dimensional flash memory (3D V-NAND Flash)

(4)   FPGAs and Dynamic Reconfigurable Chips

Field programmable gate arrays (FPGAs) and dynamic reconfigurable platforms

(5)   IC Design Methodologies

System-on-chip (SoC) design, electronic system level (ESL) design, and 3D-IC design

2.   IC Manufacturing

(1)   New Devices

High-k (HK)/metal gate and SiGe/SiC stressors, fin field-effect transistors (FinFETs), and quantum devices

(2)   Photolithography Technology

Double exposure, multiple exposure, extreme ultraviolet lithography (EUV), electron beam exposure, 193nm photoresist, and EUV photoresist

(3)   Materials and Complete Set (成套) Technology

65-32nm photomask material and a complete set of technology, and 20-14nm photomask material and a complete set of technology

3.   IC Packaging

(1)   Flip Chip Packaging Technology

Large-area flip chip ball grid array (BGA) packaging

(2)   Multi-chip Packaging

Two-chip packaging, three-dimensional system in package (3D SIP), and multi-component integrated circuit (MCO)

1.1.4.   Major Equipment and Key Materials

1.   Manufacturing Equipment

90-32nm process equipment, 20-14nm process equipment, and 18-inch process equipment

2.   Photolithography Machines

90nm lithography machines, immersion lithography machines, and EUV lithography machines

3.   Manufacturing Materials

65-32nm process materials, 22-14nm process materials, and 12/18-inch silicon wafers

4. Packaging Equipment and Materials

High-end equipment and supporting materials for high-density packaging, and some key equipment and materials for through-silicon via (TSV) manufacturing

1.1.5. Strategic Support and Assurance

1. According to the needs of industrial development, gradually expand the scale of investment funds for the Chinese IC industry or establish phase II and phase III funds.

2. Strengthen the coordination of existing policies and resources, such as: IC research and development special projects, major national science and technology (S&T) projects that support general purpose technology (共性技术) R&D, and national IC industry investment funds that support industrialization. These resources should be better coordinated to combine their forces.

3. Strengthen the cultivation and recruitment of human resources and strengthen support for the construction of microelectronics curricula.

4. Formulate policies for technology introduction, digestion, and absorption and provide support.

5. Establish a linkage mechanism for intellectual property protection.

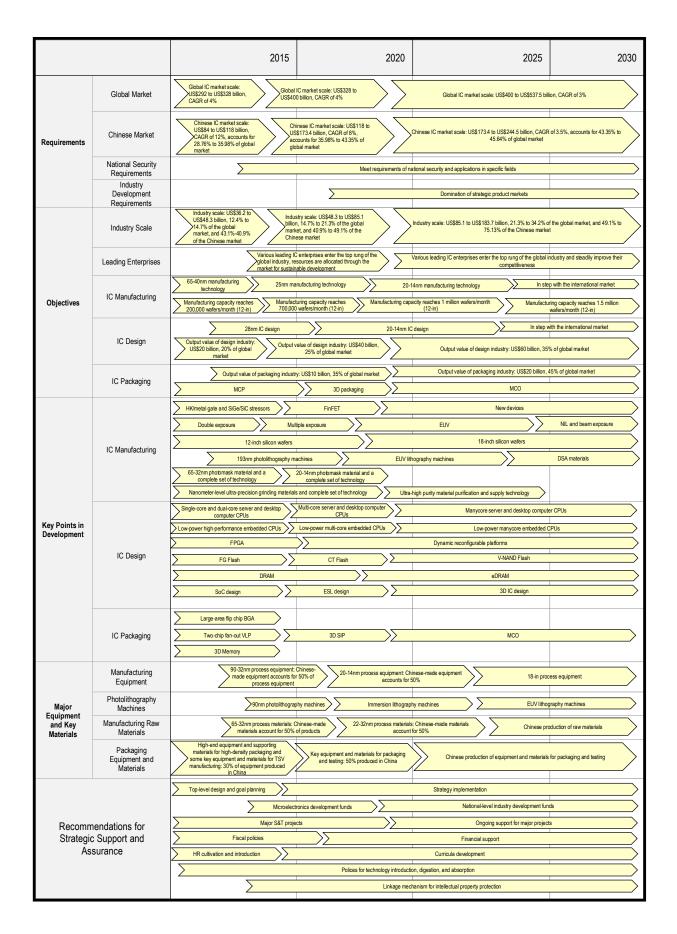|		2015	2020	2025	2030
Requirements	Global Market	Global IC market scale: US$292 to US$328 billion, CAGR of 4%	Global IC market scale: US$328 to US$400 billion, CAGR of 4%	Global IC market scale: US$400 to US$537.5 billion, CAGR of 3%	
	Chinese Market	Chinese IC market scale: US$84 to US$118 billion, CAGR of 12%, accounts for 28.76% to 35.98% of global market	Chinese IC market scale: US$118 to US$173.4 billion, CAGR of 8%, accounts for 35.98% to 43.35% of global market	Chinese IC market scale: US$173.4 to US$244.5 billion, CAGR of 3.5%, accounts for 43.35% to 45.64% of global market	
	National Security Requirements	Meet requirements of national security and applications in specific fields			
	Industry Development Requirements		Domination of strategic product markets		
Objectives	Industry Scale	Industry scale: US$36.2 to US$48.3 billion, 12.4% to 14.7% of the global market, and 43.1%-40.9% of the Chinese market	Industry scale: US$48.3 to US$85.1 billion, 14.7% to 21.3% of the global market, and 40.9% to 49.1% of the Chinese market	Industry scale: US$85.1 to US$183.7 billion, 21.3% to 34.2% of the global market, and 49.1% to 75.13% of the Chinese market	
	Leading Enterprises		Various leading IC enterprises enter the top rung of the global industry, resources are allocated through the market for sustainable development	Various leading IC enterprises enter the top rung of the global industry and steadily improve their competitiveness	
	IC Manufacturing	65-40nm manufacturing technology	25nm manufacturing technology	20-14nm manufacturing technology	In step with the international market
		Manufacturing capacity reaches 200,000 wafers/month (12-in)	Manufacturing capacity reaches 700,000 wafers/month (12-in)	Manufacturing capacity reaches 1 million wafers/month (12-in)	Manufacturing capacity reaches 1.5 million wafers/month (12-in)
	IC Design	28nm IC design		20-14nm IC design	In step with the international market
		Output value of design industry: US$20 billion, 20% of global market	Output value of design industry: US$40 billion, 25% of global market	Output value of design industry: US$60 billion, 35% of global market	
	IC Packaging	Output value of packaging industry: US$10 billion, 35% of global market		Output value of packaging industry: US$20 billion, 45% of global market	
		MCP	3D packaging	MCO	
Key Points in Development	IC Manufacturing	HK/metal gate and SiGe/SiC stressors	FinFET	New devices	
		Double exposure	Multiple exposure	EUV	NIL and beam exposure
		12-inch silicon wafers		18-inch silicon wafers	
		193nm photolithography machines		EUV lithography machines	DSA materials
		65-32nm photomask material and a complete set of technology	20-14nm photomask material and a complete set of technology		
		Nanometer-level ultra-precision grinding materials and complete set of technology		Ultra-high purity material purification and supply technology	
	IC Design	Single-core and dual-core server and desktop computer CPUs	Multi-core server and desktop computer CPUs	Manycore server and desktop computer CPUs	
		Low-power high-performance embedded CPUs	Low-power multi-core embedded CPUs	Low-power manycore embedded CPUs	
		FPGA		Dynamic reconfigurable platforms	
		FG Flash	CT Flash	V-NAND Flash	
		DRAM		eDRAM	
		SoC design	ESL design	3D IC design	
	IC Packaging	Large-area flip chip BGA			
		Two-chip fan-out VLP	3D SIP	MCO	
		3D Memory			
Major Equipment and Key Materials	Manufacturing Equipment	90-32nm process equipment: Chinese-made equipment accounts for 50% of process equipment	20-14nm process equipment: Chinese-made equipment accounts for 50%	18-in process equipment	
	Photolithography Machines		90nm photolithography machines	Immersion lithography machines	EUV lithography machines
	Manufacturing Raw Materials	65-32nm process materials: Chinese-made materials account for 50% of products	22-32nm process materials: Chinese-made materials account for 50%	Chinese production of raw materials	
	Packaging Equipment and Materials	High-end equipment and supporting materials for high-density packaging and some key equipment and materials for TSV manufacturing: 30% of equipment produced in China	Key equipment and materials for packaging and testing: 50% produced in China	Chinese production of equipment and materials for packaging and testing	
Recommendations for Strategic Support and Assurance		Top-level design and goal planning	Strategy implementation		
			Microelectronics development funds	National-level industry development funds	
		Major S&T projects		Ongoing support for major projects	
		Fiscal policies		Financial support	
		HR cultivation and introduction		Curricula development	
		Polices for technology introduction, digestion, and absorption			
		Linkage mechanism for intellectual property protection			

1.2. Information Communication Equipment

The information communication equipment industry refers to systems and devices that use electronic computers and modern communication technologies to obtain, transmit, store, process, and apply information. This roadmap mainly covers wireless mobile communication equipment, new generation network equipment, and high-performance computers and servers (including general-purpose central processing units [CPUs] and storage devices). It does not cover other information communication products and services.

1.2.1. Requirements

With the continuous growth of mobile Internet, Internet+, information consumption, IoT, and other businesses, the integration of informatization (信息化) and industrialization continues to deepen, and the demand for information communication equipment will continue to grow long-term.

(1)　Wireless mobile communication: According to International Telecommunication Union (ITU) statistics, in 2014, the number of mobile users worldwide reached 7 billion, including 2.3 billion mobile broadband users. Annual shipments of mobile terminals were 2.16 billion, annual shipments of machine-to-machine (M2M) terminals were 250 million, and the scale of the market for mobile communication system equipment was about US$40 billion. According to the forecasts of ITU, Gartner, and other institutions: By 2020, the number of mobile users globally will reach 7.2 billion, including 4 billion mobile broadband users. Annual shipments of mobile terminals will reach 3.2 billion, and annual shipments of M2M terminals will reach 2.4 billion. The mobile communication systems and equipment market will reach US$52 billion. By 2025, the number of global mobile users will reach 7.5 billion, including 5.5 billion mobile broadband users. Annual shipments of mobile terminals will reach 4.2 billion, and annual shipments of M2M terminals will reach 6 billion. The mobile communication system equipment market will reach US$64 billion.

(2)　New generation networks: In 2014, the global optical communication equipment market was worth US$14.1 billion, and the router and switch market was worth US$15.3 billion. According to the estimates by Gartner and the China Academy of Information and Communications Technology (CAICT): By 2020, the global optical communication equipment market will reach US$18.2 billion, and the router and switch market will reach US$23.6 billion. By 2025, the global optical communication equipment market will reach US$22.7 billion, and the router and switch market will reach US$33.8 billion.

(3)　High-performance computers and servers: In 2014, the global high-performance computer market was worth US$11 billion, and global server shipments reached 9.2 million units per year. According to forecasts by the IDC and other institutions: By 2020, the global high-performance computer market will reach US$16.5 billion, and global server shipments will reach 12 million units. By 2025, annual global server shipments will exceed 15 million units.

1.2.2. Objectives

1- Objectives for 2020

The information communication equipment industry's technology and industrial

capabilities will rank among the top in the world, forming a relatively complete industrial system and innovation system.

(1)   Wireless mobile communication: China will become one of the leaders in the standards, technology, and industry for fifth-generation mobile communication (5G). The wireless mobile communication system equipment industry will maintain its status as one of the best in the world, and the mobile terminal industry will become one of the world leaders. Chinese-made (throughout, we are not including Taiwan companies) mobile communication system equipment, mobile terminals, and mobile terminal chips will account for 75%, 75%, and 35%, respectively, of the Chinese market and 35%, 25%, and 15%, respectively, of the global market.

(2)   New-generation networks: Chinese-made optical communication equipment will continue to maintain the largest share of the international market, with its international market share expected to reach 50%. The international market share of Chinese-made routers and switches is expected to reach 20%.

(3)   High-performance computers and servers: The international market share of Chinese-made high-performance computers and servers is expected to reach 30%, and the Chinese market share is expected to exceed 60%. The overall performance indicators of Chinese-made high-end servers will be comparable to advanced international products and they will be widely used in key fields in China such as the finance, telecommunications, and smart city sectors. Chinese-made high-performance computers will continue to maintain a leading position internationally. Brand-name servers using Chinese-made CPUs will be used for industrial applications.

2-   **Objectives for 2025**

(1)   The information communication equipment industry system will be more complete, its innovation capabilities and overall strength will be significantly enhanced, and the comprehensive strength of the Chinese industry will place China among the top powers in the world in this field.

(2)   Wireless mobile communication: The Chinese mobile communication system equipment, mobile terminals, and mobile terminal chip industries will have all entered the first rank in the global market. Chinese-made mobile communication system equipment, mobile terminals, and mobile terminal chips will account for 80%, 80%, and 40%, respectively, of the Chinese market and 40%, 45%, and 20%, respectively, of the global market. Chinese-made mobile communication testing instruments will take a dominant position in the Chinese market and achieve breakthroughs in the international market.

(3)   New generation networks: The international market share of Chinese-made optical communication equipment is expected to reach 60%. Breakthroughs will be achieved in the local production of the key components of optical communication equipment. The Chinese router and switch industry will have entered the first rank of the global market, with an international market share that is expected to reach 25%.

(4)　High-performance computers and servers: The international market share of Chinese-made high-performance computers and servers is expected to reach 40%, and the Chinese market share is expected to exceed 80%. Specifically, the Chinese market share of Chinese-made high-end servers is expected to exceed 50%, and the domestic market share of brand-name servers using Chinese-made CPUs is expected to exceed 30%.

1.2.3.　Key Points in Development

1-　Key Products

(1)　Wireless mobile communication: 5G key technology comprehensive verification platform, 5G mobile communication system equipment (including 5G base stations, 5G core network equipment, and 5G industrial private networks), 5G mobile communication instrumentation (including comprehensive 5G terminal testers and 5G protocol conformance testers), 5G mobile terminals (including consumer 5G terminals, industrial 5G terminals, and M2M terminals), key 5G chips (including 5G baseband chips, 5G radio frequency [RF] chips, and 5G system-on-chips [SoC] chips), and key 5G components (such as 5G high-frequency communication devices).

(2)　New generation networks: High-speed and large-capacity optical transmission equipment (400G/1Tbps), high-speed optical access equipment (10G/100Gbps), optical switching equipment (100Tbps optoelectronic hybrid switching equipment), core routers (single interface: 400G, switching capacity: 100T), large-capacity switches (1Tbps) supporting software-defined networks (SDN), all-optical switching equipment, silicon-based optical transceiver chips (100G/400G/1Tbps), analog-to-digital and digital-to-analog conversion (ADC/DAC) (at least 64Gb/s), digital signal processor (DSP) chips, optical transport network (OTN) chips (Nx100G/Nx400G), optical line terminal (OLT) chips (100G/400G/1T), WDM-passive optical network (WDM-PON) chips, wavelength selective switches (WSS), network processors (400G/1T and above), and other key components.

(3)　High-performance computers and servers: General-purpose CPUs, high-end servers (over 10,000 cores), mass storage devices (dozens of exabytes), high-performance computers (exascale computing), converged architecture cloud data centers for cloud computing and big data, cross-regional, multi-dimensional and multi-type integrated cloud storage equipment, and high-performance computers and high-end servers based on Chinese-made CPUs.

2-　Key Technologies

(1)　Wireless mobile communications: Large-scale antenna array technology (supporting peak rates of dozens of Gbps), ultra-dense networking technology (link density greater than 106/km2, traffic density greater than dozens of Tbps/km2), new multiple access technology, high frequency band communication technology (above 6GHz), inter-terminal communication technology (including vehicle telematics [车联网] technology), new core network architecture technology (supporting SDN and network function virtualization [NFV]), 5G enhanced technology (100Gbps, user-centric and highly aware access network and core network), and other key technologies.

(2) New generation network technologies: High-capacity optical switching technology (100Tbps optoelectronic hybrid switching technology), high-speed route switching technology (100Tbps route switching technology), network management and control technology (including: NFV and SDN), network measurement and perception technology, high-speed optical transmission technology (single port 400Gbps/1Tbps), large-capacity all-optical switching technology, network equipment key component technology (including: optical transceiver technology, high-speed switching chip technology, and large-capacity packet switching chip technology supporting NFV), silicon photonics and optoelectronic integrated chip technology, wavelength selective switching (WSS) optical cross-connect technology, ultra-large-capacity long-distance optical communication technology and undersea communication technology, (Wavelength Division Multiplexing-Passive Optical Network (WDM-PON) device technology, and other key technologies.

(3) High-performance computers and servers, including: High-performance, low power consumption, high stability, and high reliability chip technology, ten-thousand-core processor high-speed interconnection technology, board-level optical interconnection technology, large-port processor high-speed interconnection technology, large-capacity non-volatile storage technology, reconfigurable computing technology, in-memory computing and streaming data processing, and other big data processing platform technologies, multi-dimensional and heterogeneous big data fusion platform technology, business-aware dynamic hardware resource adjustment technology, quantum computing technology, artificial intelligence (AI) technology, and other key technologies.

1.2.4. Application Demonstration Projects

1- 5G Mobile Communications Technology Innovation and Application Projects

In order for China to achieve global leadership in 5G wireless mobile communication technology, standards, industries, services, and applications as well as to achieve the application and integration of 5G technology in public networks, private networks, national defense, and other markets, joint efforts are required on the part of leading units for 5G standards, 5G equipment manufacturers, telecom operators, application units, and other organizations.

By 2020, deploy 5G innovation demonstration networks and start 5G commercial services, apply China's independently developed 5G technology advantages and system capabilities, support 10Gbps peak rates, increase spectrum efficiency by more than a factor of three, implement end-to-end transmission tests of 1ms and 5Tbps/km2 or more flow density (流量密度), and test and verify 5G RF, baseband, and other core chips and terminals, test instruments, and system equipment.

In 2020, China will begin to deploy a demonstration network for integrated space, ground, sea, and air, comprehensively apply the research achievements in the field of 5G and other ground and satellite mobile communication technologies, realize ultra-long-distance broadband communications over thousands to tens of thousands of kilometers, and provide an informatization foundation for the implementation of the "Belt and Road"[1] strategy and the

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[1] Translator's note: The "Belt and Road" （"一带一路"）refers to the Silk Road Economic Belt and the 21st Century Maritime Silk Road.

"maritime superpower" (海洋强国) strategy.

2- New Generation Network Innovation and Application Demonstration Projects

We recommend that a new generation optical communication demonstration network be deployed before 2020. Support distances of more than 1,000 kilometers (such as Beijing to Wuhan) with optical transmission network (OTN) equipment supporting 400G/1T/4T/10Tbps interfaces, parallel access to at least 96 wavelengths, and two-way communication capacity of at least 96Tbps. The network should be implemented jointly by mainstream equipment vendors and operators undertaking core technology research and development, with commercial verification of new generation network equipment, and testing of key hardware and software protocols.

We recommend that a new controllable and reliable demonstration network be constructed before 2020. The network scale should be no less than 20 cities, the backbone switching capacity should reach 100Gbps per port while supporting software definition, and the control plane should support the networking of 500 backbone-level routers and 50,000 metro-level routers. The delay between data control planes should be less than 50ms, and no less than 4,096 virtual networks with differentiated service quality guarantees should be operated in parallel. This project should promote the widespread application of related systems in the fields of telecommunications, broadcasting, power, finance, industry, and national defense.

3- Secure and Reliable National Collaborative Software and Hardware Production Innovation Project

We recommend building a new generation high-performance computer and server, basic software, and field application test bed based on domestically-made CPUs with independent intellectual property rights. This project should apply new generation high-performance computers, high-end servers and storage devices, and basic software (operating systems, databases, and middleware) with independent intellectual property rights (IPR). It should support the technological innovation and application demonstration of high-end servers and storage devices based on Chinese-made processors.

We recommend this project promote national production of software and hardware solutions in at least three key application areas, such as finance, telecommunications, and smart cities. By 2020, the share of Chinese-made servers in the financial and telecommunications industries will reach 75%, and the share of Chinese-made basic software will reach 50%. By 2025, the share of Chinese-made servers in the financial and telecommunications industries will reach 90%, and the share of Chinese-made basic software will reach 75%.

1.2.5. Strategic Support and Assurance

1- Intellectual property: In line with the national intellectual property strategy, we recommended that China actively promote achievements in intellectual property in the Chinese information communication field, continue to optimize the intellectual property business and legal environment, strengthen intellectual property protection and operations, and promote the international application of independent intellectual property rights.

2- Government and industry market resources: Continue to cultivate and optimize the market space of China's information communication equipment industry and continue to

support existing major projects. We recommend that China encourage the strengthening of collaboration between upstream and downstream enterprises in the production chain, between enterprises and governments, and between industry and markets.

3- Spectrum planning and allocation: We recommend that 5G spectrum planning take into account the spectrum requirements of mobile communications, radio and television, satellite, and military-civil fusion (军民融合) so as to maximize the value of spectrum utilization and achieve the integrated development of related industries.

4- Going global (走出去): Implement the major "Belt and Road" strategy, explore new models of "going global" with "capital + industry" and "construction + operation services." We recommend that China establish an inter-ministerial coordination mechanism and set up a special fund for "going global" to encourage China's information communication equipment industry to "go global" and to encourage the creation of an information silk road (信息丝绸之路).

		2020	2025
Requirements	Wireless Mobile Communication	Requirements due to the growth of mobile Internet, Internet+, information consumption, and IoT businesses	Requirements for the promotion of in-depth integration between new generation information technology and the manufacturing industry
		7.2 billion global mobile users, including 4 billion mobile broadband users; mobile terminal shipments of 3.2 billion units, M2M terminal shipments of 2.4 billion units, and mobile communication system equipment market worth US$52 billion	7.5 billion global mobile users, including 5.5 billion mobile broadband users; mobile terminal shipments of 4.2 billion units, M2M terminal shipments of 6 billion units, and mobile communication system equipment market worth US$64 billion
	New generation Networks	Global optical communication equipment market: US$18.2 billion, router and switch market: US$23.6 billion	Global optical communication equipment market: US$22.7 billion, router and switch market: US$33.8 billion
	High-performance Computers and Servers	Global high-performance computer market: US$16.5 billion, global server shipments: 1.2 million units per year	Global server shipments exceed 15 million units
Objectives	Wireless Mobile Communication	China becomes a leader in 5G international standards and the 5G industry	Chinese-made mobile communication system equipment, mobile terminals, and mobile terminal chips account for 80%, 80%, and 40% of the Chinese market and 40%, 45%, and 20% of the global market
		Chinese-made mobile communication system equipment, mobile terminals, and mobile terminal chips account for 75%, 75%, and 35% of the Chinese market and 35%, 25%, and 15% of the global market	Chinese mobile communication test instruments lead the Chinese market and achieve breakthroughs in the international market
	New Generation Networks	Chinese-made optical communication equipment maintains its lead in the international market with a share of more than 50%	International market share of Chinese-made optical communication equipment exceeds 60%
			Achieve breakthroughs in the domestic production of communication equipment key components
		Chinese-made routers and switches account for 20% of the global market	Domestic routers and switches account for 25% of the global market, making China a world leader in these fields
	High-performance Computers and Servers	Domestic market share of Chinese-made high-performance computers and servers exceeds 60%, international market share reaches 30%	Domestic market share of Chinese-made high-performance computers and servers exceeds 80%, international market share reaches 40%
		Overall performance indicators of high-end servers are comparable to similar products in the United States, large-scale applications in key areas such as telecommunications and smart cities	International market share of Chinese-made high-performance servers exceeds 50%
		Industrialized applications using brand-name servers with Chinese-made CPUs	Brand-name servers using Chinese-made CPUs account for over 30% of the Chinese market
Key Products	Wireless Mobile Communication	5G key technology comprehensive platform	
		5G testing instruments	
		5G system equipment (pre-commercial)	5G system equipment (commercial)
		5G key chips and devices (pre-commercial)	5G key chips and devices (commercial)
		5G testing terminals	
			5G terminals (commercial)
			Industrial 5G private network equipment, industrial 5G private network terminals
			5G M2M terminals
			5G high-frequency communication devices
	New generation Networks	High-speed large-capacity optical transmission equipment (400G/1T optical transmission equipment)	
		High-speed optical access equipment (10G/100Gbps)	
		Optoelectronic hybrid switching equipment	All-optical switching equipment
		Core routers (single interface: 400G, switching capacity: 100T)	
		Large-capacity switches supporting SSDN (1Tbps)	
			Silicon-based optical transceiver chips (100G/400G/1T) and ADC/DAC (64Gb/s)
			DSP chips, OTN chips, OLT chips, WDM-PON chips
			Wavelength selective switches (WSSs)
		Network processor (400G)	Network processor (1T)

		2020	2025
Key Technology	High-performance Computers and Servers	General-purpose CPUs	
			High-performance computers with Chinese-made CPUs
		High-end servers (over 10,000 cores)	
		High-performance (exascale)	
		High-end servers with Chinese-made CPUs	
		Converged cloud storage equipment	
		Mass storage devices (dozens of exabytes)	
		Converged architecture cloud data centers	
	Wireless Mobile Communication	Large-scale antenna array technology, ultra-dense networking technology, terminal pass-through technology, new multiple access technology, high-band communication technology, and new core network architecture technology	5G enhanced technology (100Gbps, user-centric)
	New generation Networks	High-speed optical transmission technology (single port: 400Gbps)	High-speed optical transmission technology (single port: 1Tbps)
		Large-capacity switching technology	All-optical switching technology
		High-speed route switching technology (100Tbps route switching)	
		Network management and control technology (NFV and SDN technology)	
		Network measurement and perception technology	
		Network equipment key component technology	
		Silicon photonics and optoelectronic integrated chip technology	
		WSS optical cross-connect technology	
		Ultra-large-capacity long-distance optical communication technology and undersea communication technology	
		WDM-PON device technology	
	High-performance Computers and Servers	High-performance, low power consumption, high stability, and high reliability chip technology	
		10,000-core processor high-speed interconnection technology	
		Large-port processor high-speed interconnection technology	
		Board-level optical interconnection technology	
		Reconfigurable computing technology	
		In-memory computing and streaming data processing and other big data processing platform technologies	Large-capacity non-volatile storage technology
		Multi-dimensional and heterogeneous big data integration platform technology	
		Business-aware dynamic hardware resource adjustment technology	
		AI technology	
Application Demonstration Projects	5G Mobile Communications Technology Innovation and Application Projects	The 5G innovation demonstration network supports 10Gbps peak rates, increases spectrum efficiency by more than a factor of three, and implement end-to-end transmission tests of 1ms and 5Tbps/km2 or more Flow density	
	New generation Network Innovation and Application Demonstration Projects	The new generation optical communication demonstration network supports distances of more than 1,000 kilometers with 400G/1T/4T/10Tbps interfaces, parallel access to at least 96 wavelengths, and two-way communication capacity of at least 96Tbps	
		New controllable and reliable demonstration network with no less than 20 cities, a single port speed of 100Gbps, and no less than 4,096 virtual networks	
	Secure and Reliable National Collaborative Software and Hardware Production Innovation Project	Build a test bed for new generation high-performance computer servers, basic software, and field applications based on Chinese-made CPUs with independent intellectual property rights	
		Promote Chinese-made software and hardware solutions in at least three key application areas, such as finance, telecommunications, and smart cities	
Recommendations for Strategic Support and Assurance	Intellectual Property	In line with the national intellectual property strategy, we recommended that China actively promote achievements in intellectual property in the Chinese information communication field, continue to optimize the intellectual property business and legal environment, strengthen intellectual property protection and operations, and promote the international application of independent intellectual property rights	
	Government and Industry Market Resources	Continue to cultivate and optimize the market space of China's information communication equipment industry and continue to support existing major projects. We recommend that China encourage the strengthening of collaboration between upstream and downstream enterprises in the production chain, between enterprises and governments, and between industry markets	
	Spectrum Planning and Allocation	5G spectrum planning takes into account the spectrum requirements of mobile communications, radio and television, satellite, and military-civil fusion so as to maximize the value of spectrum utilization and achieve the integrated development of related industries	
	Going Global	Implement the major "Belt and Road" strategy, explore new models of "going global" with "capital + industry" and "construction + operation services," establish an inter-ministerial coordination mechanism, set up a special fund for "going global", promote the going global by China's information communication equipment industry, and create an information silk road	

1.3. Operating Systems and Industrial Software

Operating systems and industrial software are the cornerstones of the digitalized, networkized (网络化), and intelligentized (智能化) manufacturing industry and the core elements of the new round of industrial revolution. The development of real-time industrial operating systems and high-end embedded manufacturing systems, basic industrial software such as industrial big data platforms and core manufacturing software, industrial application software for key fields such as advanced rail transit equipment, electric power equipment, agricultural equipment, high-end CNC machines and robots, aerospace equipment, marine engineering equipment, and high-tech vessels is of great significance for developing Chinese independently controllable (自主可控) industries and domains.

1.3.1. Requirements

The new generation S&T revolution and industrial transformation is characterized by digitalization, networkization, and intelligentization. Its core approach is to deeply integrate new generation information technology (IT) such as cloud computing, IoT, and big data with modern manufacturing to promote industrial transformation and upgrading. In response to the current situation where developed countries control the core technologies of traditional operating systems and industrial software and dominate the discourse surrounding international industrial competition, we must rely on China's strategically competitiveness as a "manufacturing power" ("制造大国") and advantageous industries, use China's global leadership in the Internet ecosystem and applications, and firmly grasp the historical opportunities provided by the new technological revolution and industrial transformation in order to realize autonomous control of operating systems and promote the restructuring and development by leaps and bounds of industrial software in combination with new generation IT.

1.3.2. Objectives

By 2020, make breakthroughs in some key core technologies, basically form Chinese industrial software technology standards and ecosystems, and seize a share of over 30% in the lower-end market. **Focusing** on the improvement of production efficiency and service-oriented manufacturing, the application penetration rate (普及率) of autonomous **"cloud" + "terminal" industrial big data platforms** in key industries should **exceed** 40%.

By 2025, make breakthroughs in most core technologies and form independently controllable operating systems, industrial software, and corresponding systems of standards. The market share of independent industrial software should exceed 50%. The application penetration rate of **"Internet+" smart industrial clouds** in key industries should **exceed** 60%. Form an industrial Internet based on intelligentized interconnected products and independent industrial software.

1.3.3. Key Points in Development

1- **Key Products**

(1) Industrial Operation Systems and Their Application Software

Link up the achievements of major special projects such as "core electronic components,

high-end general-use chips, and foundational software products" （"核高基"）to build a customizable industrial basic software platform. Facing the requirements of digitalized products and intelligent complete sets of equipment, focus on the development of high-security and high-reliability real-time industrial operating systems to achieve adaptation to mainstream control equipment, CPUs, and bus protocols. On this basis, research and develop a set of embedded software interfaces, configuration languages, and integrated development environments and form evaluation standards and specifications for the safety, reliability, and performance of embedded operating systems. Develop high-end embedded manufacturing systems and promote and apply them in important key fields such as advanced rail transit equipment, electric power equipment, and agricultural equipment.

(2)   "Cloud" + "Terminal" Industrial Big Data Platforms

Oriented toward terminal and cloud data exchange and integration and intelligent collaboration, develop an embedded data management platform and real-time data intelligent processing system on the device side and develop an industrial data processing software stack for industrial data collection, storage, query, analysis, mining, and application with massive processing capabilities on the cloud. Build an industrial big data platform covering the entire product lifecycle and all manufacturing business activities and support the integration and unified access of internal and external data, structured and unstructured data, synchronous and asynchronous data, dynamic and static data, equipment and business data, and real-time and historical data to achieve "data-driven" operations.

(3)   Smart Industrial Clouds and Core Manufacturing Software

Research and develop "Internet+" intelligent industrial cloud system architecture and a system of standards, and build an industrial resource library (including knowledge bases, model libraries, part libraries, process libraries, and standard libraries.) Oriented toward the "Internet+" manufacturing ecosystem, refactor core manufacturing software such as product lifecycle management software (CAD/CAE/CAPP/CAM/PLM), enterprise resource planning (ERP) software, supply chain management (SCM) software, and customer relationship management (CRM) software to form a new industrial cloud component library. Develop a data-driven component combination engine, develop intelligentized software and a collaborative management and control platform for industrial energy management, build an "Internet+" intelligent industrial cloud platform, promote the Internetization (互联网化) of industrial enterprises, and form an industrial application ecosystem for the entire industry and across industries.

(4)   Industrial Application Software for Key Areas

Oriented toward key industrial fields such as advanced rail transit equipment, electric power equipment, agricultural equipment, high-end CNC machines and robots, aerospace equipment, marine engineering, and high-tech vessels, develop industry application software covering the entire lifecycle from design and development, to manufacturing, to product services, focus on breakthroughs in key technologies such as product innovation and R&D, intelligent control and analysis optimization, and equipment intelligent services, and develop independent industrial application software systems.

2-   **Key Technologies**

(1) "End-to-end" industrial software security technology: Research security technologies from terminals to the cloud, such as control system security, hardware security, network communication security, system security, data security, and information and system intrinsic security (信息与系统安全本质安全). Research and develop security standards, verification technologies, and certification systems for secure and highly reliable industrial software systems.

(2) **Industrial basic resource libraries and standardization technology:** Focus on building an industrial basic resource library interface standardization system that is compatible with autonomous industrial software. Study the classification standards of industrial basic resource libraries and lay out an architecture and ecosystem of industrial basic resource libraries adapted to the characteristics of China's manufacturing environment. Research standardized evaluation and certification systems for industrial basic resource libraries.

(3) **Embedded operating system technology:** Targeting the security mechanisms and credibility mechanisms of real-time embedded operating systems, research and develop real-time scheduling algorithms that meet the requirements of highly secure and reliable embedded operating systems. Research adaptation technology that adapts operating systems to heterogeneous underlying layers, complex equipment, and their fieldbus protocols. Research the unified design, development, testing, and release technology for model-driven control programs.

(4) **Intelligentized terminal-end technology:** Research small-capacity embedded database systems as well as data caching, data synchronization, and data exchange technologies. Accelerate research on terminal environment semantic modeling technology as well as new and intelligentized terminal technology, such as real-time dynamic data collection, frequency conversion transmission, visual understanding, stand-alone intelligent analysis and control, and regional collaboration.

(5) **Industrial big data management and analysis technology:** Research and develop key technologies such as real-time collection of industrial data, high-throughput storage, data compression, data indexing, query optimization, and data caching. Research key technologies related to data quality inspection and restoration under the spatiotemporal correlation and mechanism model. Research integration technology for real-time data from front-end equipment and relational data from back-end information systems. Make breakthroughs in industrial big data parallel analysis and processing technology, mechanism model modeling technology, knowledge reasoning technology, and simulation models.

(6) **Data-driven component combination technology:** Research industry vertical application software component set development and the key technology related to component information integration platforms. Research rapid response within the industry and between enterprises driven by the analysis of information elements such as manufacturing resource data, enterprise data, industry data, and Internet data and research the dynamic integration and optimization of resource utilization efficiency.

1.3.4. Application Demonstration Projects

1- **Application Demonstrations of "Industrial Operating Systems and Their Application Software:"** Apply embedded operating systems and application software in the

aerospace, military, shipping, energy, chemical engineering, and other safety-critical fields.

2- **Application Demonstrations of "Industrial Big Data Platforms:"** Select leading enterprises and production chains in the process and discrete manufacturing fields to carry out application demonstrations of "industrial big data platforms."

3- **Application Demonstrations of "Smart Industrial Clouds and Core Manufacturing Software" in Key Fields:** Link up with the strategically competitive and advantageous industries deployed by "Made in China 2025," consider group enterprises and small and medium-sized enterprises, develop industry application software, and carry out multi-level industry-wide and cross-industry application demonstrations.
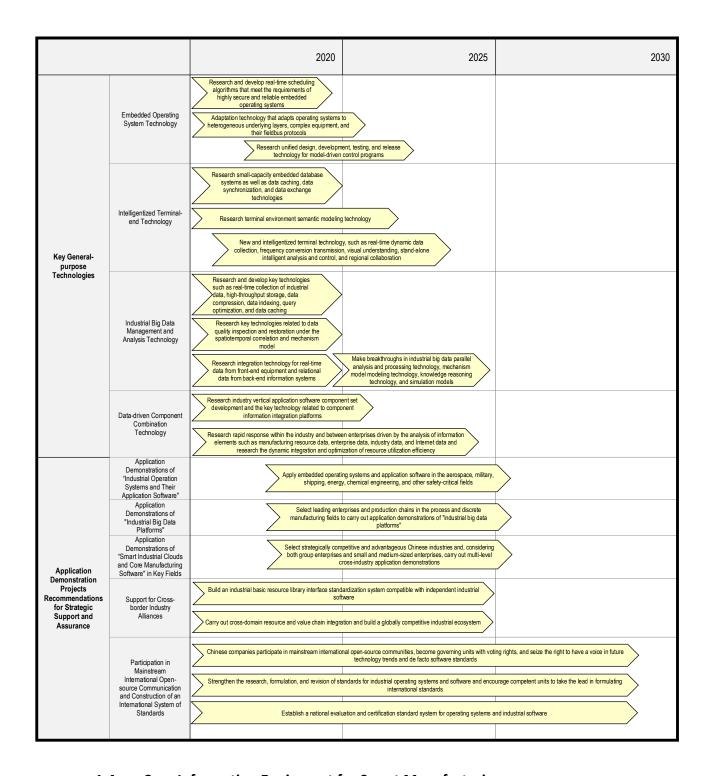
1.3.5. Strategic Support and Assurance

1- **Support for Cross-Border Industry Alliances**

With manufacturing companies as the primary entities, encourage related companies to join the industrial application cloud platform ecosystem, carry out cross-domain resource and value chain integration, and build a globally competitive industrial ecosystem.

2- **Construct Standard Systems**

Encourage Chinese companies to participate in mainstream international open-source communities and become governing units with voting rights. Strengthen the formulation and revision of standards for industrial operating systems and software and encourage competent units to take the lead in formulating international standards. Establish a national evaluation and certification standard system for operating systems and industrial software.

	2020	2025	2030
Requirements	Deeply integrate new generation IT such as cloud computing, IoT, and big data with modern manufacturing to promote industrial transformations and upgrades		
	Respond to the status quo where developed countries control the core technologies of traditional operating systems and industrial software and dominate the discourse surrounding international industrial competition		
	Use China's global leadership in the Internet ecosystem and applications, firmly grasp the historical opportunities provided by the new industrial revolution, and promote development by leaps and bounds in independent data processing systems and industrial software in order to overtake competitors (弯道超车)		
Objectives — Industrial Internet Based on Intelligentized Interconnected Products and Autonomous Industrial Software	Basically form Chinese industrial software technology standards and ecosystems	Make breakthroughs in most core technologies and form independently controllable operating systems, industrial software, and corresponding systems of standards	
	China's share in the lower-end market exceeds 30%	China's share in the independent industrial software market exceeds 50%	
Key Products — Industrial Operation Systems and Their Application Software	Form evaluation standards and specifications for the safety, reliability, and performance of embedded operating systems		
	"Keep pace" with developments in international industry, link up the achievements of major special projects such as "core electronic components, high-end general-use chips, and foundational software products" and build a customizable industrial basic software platform	Facing the requirements of digitalized products and intelligent complete sets of equipment, focus on the development of high-security and high-reliability real-time industrial operating systems	
	Achieve adaptation to mainstream control equipment, CPUs, and bus protocols and, on this basis, research and develop a set of embedded software interfaces, configuration languages, and integrated development environments	Promotion and application in important key fields	
"Cloud" + "Terminal" Industrial Big Data Platforms	Stand "shoulder-to-shoulder" with the most advanced players in the international industry, focus on terminal and cloud data exchange and integration and intelligent collaboration, and develop an embedded data management platform and real-time data intelligent processing system on the device side		
	Develop an industrial data processing software stack for industrial data collection, storage, query, analysis, mining, and application with massive processing capabilities on the cloud	Build an industrial big data platform that covers the full lifecycle of products and all manufacturing business activities	
	Support the integration and unified access of internal and external data, structured and unstructured data, synchronous and asynchronous data, dynamic and static data, equipment and business data, and real-time and historical data to achieve "data-driven" operations		
Smart Industrial Clouds and Core Manufacturing Software	"Lead" the direction of international industry and research and develop "Internet+" intelligent industrial cloud system architecture and a system of standards	Build an industrial resource library (including knowledge bases, model libraries, part libraries, process libraries, and standard libraries)	
	Face toward the "Internet+" manufacturing ecosystem, refactor core manufacturing software such as product lifecycle management software (CAD/CAE/CAPP/CAM/PLM), ERP software, SCM software, and CRM software, and form a new industrial app component library		
	Develop a data-driven component combination engine, develop intelligentized software and a collaborative management and control platform for industrial energy management, build an "Internet+" intelligent industrial cloud platform, and promote the Internetization of industrial enterprises	Form an industrial application ecosystem for the entire industry and across industries	
Industrial Application Software for Key Areas	Develop industry application software covering the entire lifecycle for key fields	Make breakthroughs in intelligent industrial application software for product innovation and R&D, intelligent control and analysis optimization, and equipment intelligent services	
Industrial Basic Resource Libraries and Standardization Technology	Build an industrial basic resource library interface standardization system compatible with autonomous industrial software	Research classification standards for industrial basic resource libraries	
		Research standardized evaluation and certification systems for industrial basic resource libraries	
		Lay out an architecture and ecosystem of industrial basic resource libraries adapted to the characteristics of China's manufacturing environment	
"End-to-End" Industrial Software Security Technology	Research control system security, hardware security, network communication security, system security, data security, information and system intrinsic security, and other technologies		
	Develop security standards, verification technologies, and certification systems for secure and highly reliable industrial software systems		

	2020	2025	2030
Key General-purpose Technologies — Embedded Operating System Technology	Research and develop real-time scheduling algorithms that meet the requirements of highly secure and reliable embedded operating systems Adaptation technology that adapts operating systems to heterogeneous underlying layers, complex equipment, and their fieldbus protocols Research unified design, development, testing, and release technology for model-driven control programs		
Intelligentized Terminal-end Technology	Research small-capacity embedded database systems as well as data caching, data synchronization, and data exchange technologies Research terminal environment semantic modeling technology New and intelligentized terminal technology, such as real-time dynamic data collection, frequency conversion transmission, visual understanding, stand-alone intelligent analysis and control, and regional collaboration		
Industrial Big Data Management and Analysis Technology	Research and develop key technologies such as real-time collection of industrial data, high-throughput storage, data compression, data indexing, query optimization, and data caching Research key technologies related to data quality inspection and restoration under the spatiotemporal correlation and mechanism model Research integration technology for real-time data from front-end equipment and relational data from back-end information systems	Make breakthroughs in industrial big data parallel analysis and processing technology, mechanism model modeling technology, knowledge reasoning technology, and simulation models	
Data-driven Component Combination Technology	Research industry vertical application software component set development and the key technology related to component information integration platforms Research rapid response within the industry and between enterprises driven by the analysis of information elements such as manufacturing resource data, enterprise data, industry data, and Internet data and research the dynamic integration and optimization of resource utilization efficiency		
Application Demonstration Projects Recommendations for Strategic Support and Assurance — Application Demonstrations of "Industrial Operation Systems and Their Application Software"		Apply embedded operating systems and application software in the aerospace, military, shipping, energy, chemical engineering, and other safety-critical fields	
Application Demonstrations of "Industrial Big Data Platforms"		Select leading enterprises and production chains in the process and discrete manufacturing fields to carry out application demonstrations of "industrial big data platforms"	
Application Demonstrations of "Smart Industrial Clouds and Core Manufacturing Software" in Key Fields		Select strategically competitive and advantageous Chinese industries and, considering both group enterprises and small and medium-sized enterprises, carry out multi-level cross-industry application demonstrations	
Support for Cross-border Industry Alliances	Build an industrial basic resource library interface standardization system compatible with independent industrial software Carry out cross-domain resource and value chain integration and build a globally competitive industrial ecosystem		
Participation in Mainstream International Open-source Communication and Construction of an International System of Standards	Chinese companies participate in mainstream international open-source communities, become governing units with voting rights, and seize the right to have a voice in future technology trends and de facto software standards Strengthen the research, formulation, and revision of standards for industrial operating systems and software and encourage competent units to take the lead in formulating international standards Establish a national evaluation and certification standard system for operating systems and industrial software		

1.4. Core Information Equipment for Smart Manufacturing

Core information equipment for smart manufacturing is the key basic equipment for information acquisition, real-time communication and dynamic interaction, and decision-making analysis and control throughout all stages of the manufacturing process.

Core information equipment for smart manufacturing mainly includes basic

communication equipment for smart manufacturing, smart manufacturing control systems, new industrial sensors, manufacturing IoT equipment, instrumentation and testing equipment, and manufacturing information security products.

1.4.1. Requirements

The world is embarking on a new round of industrial revolution centered on smart manufacturing, and China's manufacturing industry is also accelerating its transformation to smart manufacturing.

In the next five years, the upgrading and transformation of China's smart production facilities and digital workshops and factories will be further accelerated, and the manufacturing industry's demand for core information equipment for smart manufacturing will also increase substantially. The scale of China's core information equipment for the smart manufacturing market is expected to continue to grow at a rate of about 30%.

1.4.2. Objectives

By 2020, a system of standards for core information equipment for smart manufacturing will be basically constructed and breakthroughs will have been achieved for a batch of core and key technologies in the field of core information equipment for smart industry. As a result, Chinese-made basic communication equipment for smart manufacturing, industrial control equipment, industrial sensors, intelligent instrumentation and testing equipment, manufacturing IoT equipment, and industrial information security products will be used on a large scale in China. The domestic market share of Chinese-made products will exceed 40% in this field. China will have cultivated more than five relevant companies that generate annual revenues in excess of RMB10 billion.

By 2025, China will have built an autonomously controllable, secure, and reliable core information equipment for a smart manufacturing industry ecosystem and a technological innovation system featuring advanced performance. Chinese-made core information equipment for smart manufacturing will occupy a leading position in the domestic market, with a domestic market share of 60%. The overall technical level of such products will have reached advanced levels internationally.

1.4.3. Key Points in Development

1- Key Products

(1) Basic Communication Equipment for Smart Manufacturing

Develop high-speed industrial switches that support IPv6 with high reliability, high capacity, high speed, and high quality, high-speed industrial wireless routers and repeaters, industrial-grade low-power long-distance and near-field communication equipment, fast wireless ad hoc network industrial communication equipment, industrial protocol converters and gateways, industrial communication consistency testing equipment, and other industrial communication network infrastructure equipment suitable for harsh industrial environments. Build a high-speed, secure, and reliable industrial communication network for smart manufacturing and lay a foundation for the interconnection of manufacturing information.

(2)   Smart Manufacturing Control System

Develop and support distributed control systems (DCS), programmable logic controllers (PLC), programmable automation controllers (PAC), embedded control systems, and supervisory control and data acquisition (SCADA) systems with fieldbus communication functions to improve the independently secure and controllable (自主安全可控) factor of and level of smart manufacturing.

(3)   New Industrial Sensors

Develop intelligent low-power, high-precision, and high-reliability photoelectric sensors with data storage and processing, automatic compensation, and communication functions, intelligent proximity sensors, high-resolution vision sensors, high-precision flow sensors, onboard inertial navigation sensors (INS), DOMAIN controllers for vehicles, and other new industrial sensors as well as high-precision detectors for analytical instruments to meet requirements for ubiquitous information collection in typical industries and fields.

(4)   Manufacturing IoT Equipment

Vigorously develop RFID chips and read-write equipment, portable and handheld industrial smart terminals, industrial IoT gateways, and industrial wearable devices and achieve the interconnection and comprehensive management of people, equipment, environments, and materials.

(5)   Intelligent Instrumentation and Testing Equipment

Develop online component analyzers, online non-destructive testing devices, online high-precision 3D digital ultrasonic flaw detectors, and online high-precision non-contact geometric accuracy testing equipment to achieve quality information collection and quality traceability in the smart manufacturing process.

(6)   Manufacturing Information Security Products

Focus on the development of industrial control system firewalls and gatekeepers, backup systems for disaster tolerance, active defense systems, vulnerability scanning tools, wireless security detection tools, and intrusion detection equipment and improve the information security assurance capabilities of smart manufacturing.

2-   **Key Technologies**

(1) Manufacturing Information Interconnection Standards and Interface Technology

Formulate technical standards for the interconnection of manufacturing information, focusing on the research and formulation of technical standards and specifications for intelligent equipment and digitalized workshops and factories. Research interface technology for manufacturing information interconnection, provide an overall framework for protocol interoperability between equipment and between equipment and systems, define the service interfaces for protocol interoperability, and support the interconnection and collaboration of equipment with heterogeneous protocols.

(2)   Core Technology for Industrial Sensors

Research sensor wireless communication technology, sensor signal processing technology, sensor reliability design and test technology, and sensor precision manufacturing and detection technology.

(3) AI Technology

Research key technologies such as knowledge engineering, situational awareness, pattern recognition, autonomous decision-making, autonomous execution, and visualization to improve the level of intelligentization of core information equipment for smart manufacturing.

(4) Augmented Reality Technology

Research three-dimensional space RFID registration and positioning technology and three-dimensional space modeling, search, display, and interaction technology for industrial IoT information.

1.4.4. Strategic Support and Assurance

1- **Formulate Standards for Core Information Equipment for Smart Manufacturing**

Accelerate the formulation of a smart manufacturing standardization system and research and formulate manufacturing information interconnection and cybersecurity standards. Focus on supporting the formulation of technical standards and specifications for intelligent equipment, digitalized workshops and factories, and other fields.

2- **Establish a National-Level Joint Laboratory for Core Information Equipment for Smart Manufacturing**

Support relevant units in jointly preparing for the establishment of a national laboratory for core information equipment for smart manufacturing, strengthen the R&D of key technologies and products of core information equipment for smart manufacturing, and form specialized solutions for smart manufacturing.

		2020	2025	2030
Requirements		New generation industrial revolution centered on intelligent manufacturing releases huge market demand		
		Meet the strategic needs for the in-depth integration of informatization and industrialization in China and the creation of a manufacturing superpower		
		Market demand grows by over 30% annually	Market demand grows by over 25% annually	Market demand grows by over 20% annually
Objectives		Established a system of standards for core information equipment for smart manufacturing	Build an autonomous, controllable, secure and reliable core information equipment for smart manufacturing industry ecosystem and technological innovation system featuring advanced performance	Achieve full local production of core information technology equipment in key industries and significantly increase the international market share of such equipment; the manufacturing industry has comprehensively improved its inteligentization, networkization, serviceization (服务化), security, and controllability.
		Breakthroughs in a batch of key technologies of core information equipment for smart manufacturing		
		The domestic market share of basic communication equipment for smart manufacturing, intelligent manufacturing equipment, sensor devices, intelligent instrumentation equipment, industrial information security products, and manufacturing IoT equipment reaches 40%; cultivate more than 5 relevant companies with annual revenues of more than RMB10 billion	Chinese-made core information equipment for smart manufacturing will occupy a leading position in the domestic market, with a domestic market share of 60%	
Key Products	Basic Communication Equipment for Smart Manufacturing	Significantly improve the performance of Chinese-made high-speed industrial switches supporting IPv6	Implement promotion and application in the manufacturing field	
		Achieve mass production and application of high-speed industrial wireless routers and repeaters with bandwidths above 500M	Achieve mass production and application of high-speed industrial wireless routers and repeaters with bandwidths above 2G	
		Achieve mass production of industrial-grade low-power long-distance and near-field communication equipment	Widely applied in digitalized workshops	
		Achieve mass production of fast wireless ad hoc network industrial communication equipment	Widely applied in digitalized workshops and factories	
		Support industrial multi-protocol converters and gateways to achieve mass production and application		
		The local production rate of industrial communication consistency testing equipment reaches 50%	The local production rate of industrial communication consistency testing equipment reaches 80%	
	Smart Manufacturing Control System	Highly reliable, anti-intrusion DCSs with fieldbus communication functions have a market share of over 50%	Promote the use of highly reliable, anti-intrusion DCSs with information security functions	
		Independent Chinese brands of PLCs account for 10% of the market	PLCs of autonomous brands account for 20% of the market	
		Lower-end embedded control systems are applied in various manufacturing fields	Higher-end embedded control systems are extensively applied in intelligent equipment, with replacement of imports with Chinese-made products basically achieved in key industries	
		PACs and SCADA systems of autonomous brands account for 20% of the domestic market	Autonomous control systems, such as PAC and SCADA systems, reach a domestic market share of 30%	
	New Industrial Sensors	Intelligent photoelectric sensors, intelligent proximity sensors, lower-end vision sensors, MEMS sensors and chips, and optical fiber sensors have a market share of 20%	Intelligent photoelectric sensors and intelligent proximity sensors have a market share of 40% and are widely used in intelligent products and digitalized workshops and factories	
			Possess autonomous design and manufacturing capabilities for high-end smart sensors, high-resolution vision sensors, and high-end MEMS sensors and chips and achieve industrialization	
		Achieve mass production onboard INSs and DOMAIN controllers for vehicles	Widely applied in the vehicle telematics field	
	Manufacturing IoT Equipment	Achieve large-scale mass production and application of RFID chips, read-write equipment, and portable and hand-held industrial smart terminals	Widely applied in the digitalized workshop and factory field	
		Achieve productization of industrial wearable devices	Achieve the large-scale application of industrial wearable devices in the fields of R&D, design, manufacturing, and equipment maintenance	
	Instrumentation	The intelligent instrumentation market share reaches 25%	The intelligent instrumentation market share reaches 35%	
		Domestic market share of online component analysis instruments reaches 20%	Domestic market share of online component analysis instruments reaches 40%	
		Achieve autonomous R&D and use of online non-destructive testing, non-contact geometric accuracy testing, and high-precision three-dimensional testing	Achieve industrialization of high-end non-destructive testing equipment, high-precision geometric testing equipment, and high-precision three-dimensional	
	Manufacturing Information Security Products	Significantly improve the performance of industrial control system firewalls and gatekeepers	Domestic market share reaches 50%	
		Autonomy rate of backup systems for disaster recovery reaches 40%	Autonomy rate of backup systems for disaster recovery reaches 60%	
		Achieve the large-scale application of active defense systems, vulnerability scanning tools, wireless security detection tools, and intrusion detection equipment	Establish security systems for industrial information systems in cloud computing, IoT, and big data environments	

		2020	2025	2030
Key General-purpose Technologies	Manufacturing Information Interconnection Standards and Interface Technology	Formulate technical standards for the interconnection of manufacturing information Focus on the research and formulation of technical standards and specifications for intelligent equipment, digitalized workshops, and digitalized factories Research interface technology for manufacturing information interconnection, provide an overall framework for protocol interoperability between equipment and between equipment and systems, and define the service interfaces for protocol interoperability		
	Core Technology for Industrial Sensors	Sensor wireless communication technology and sensor signal processing technology Sensor reliability design and test technology and sensor precision manufacturing and detection technology		
	AI Technology	Knowledge engineering, situational awareness, and pattern recognition technology Autonomous decision-making, autonomous execution, and visualization technology		
	Augmented Reality Technology	Three-dimensional space RFID registration and positioning technology Three-dimensional space modeling, search, display, and interaction technology industrial IoT information		
Recommendations for Strategic Support and Assurance		Formulate Standards for Core Information Equipment for Smart Manufacturing Establish a National-Level Joint Laboratory for Core Information Equipment for Smart Manufacturing		