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Research on the Development of the Industrial Internet in the Post-Epidemic Era

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Abstract: After the outbreak era, the world's industrial power economy faces great pressure, industrial Internet as the "Internet +" and advanced manufacturing depth fusion product, for overall epidemic prevention and control and industrial development provides important support, has gradually become the core of the fourth global industry revolution, has become an important gripper to relieve the downward pressure of the global economy. This article through the in-depth analysis of the US NNMI network plan, combined with the current situation of China's industrial Internet development, suggested that the future industrial Internet development focus on the research and development process, research and development as the core integration of industry, academia and local government related resources, unified construction of a national industrial Internet.

1. Introduction

Manufacturing for any country's economic development and national security is a pivotal role, it can not only bring national high-paying manufacturing jobs, but also can increase the demand of the entire supply chain, based on invention, research and new ideas of novel products or technology can continue to drive economic growth, at the same time for national defense, security institutions continue to provide reliable products and equipment. In the United States, for example, manufacturing plays an important role in the US economy, accounting for only 12% of US GDP, but two-thirds of private companies, two-thirds of national developers, the vast majority of patents granted, and most U. S. exports are closely related to manufacturing.

In the manufacturing industry, the high-end manufacturing industry is generally in the high-end link of the manufacturing value chain, with the characteristics of technology, knowledge-intensive, high added value, good growth, strong key, and great driving force. The core is the new methods to manufacture existing products, and to use new technologies to create new products. For example, a manufacturing position can support 1.6 jobs outside of manufacturing, while a high-end manufacturing

position can drive five additional [1,2] jobs across the country.

Industrial Internet (Industrial Internet) is a new generation of information and communication technology and industrial economy depth fusion of new infrastructure, application mode and industrial ecology, through people, machine, things, system, comprehensive connection, is the Internet of things, big data, artificial intelligence and other emerging digital technology and industrial depth fusion products, build up the whole industry chain, the whole value chain of new manufacturing and service system, for industrial and industrial digital, network, intelligent development provides the way, is the important cornerstone of the fourth industrial revolution.

At present, it is in the critical period of the fourth industrial Revolution, and it is a critical period of fierce competition among the global industrial powers. The United States launched an ambitious NNMI network plan to rebuild the world's leading complete industrial system; Industry 4.0 full ecological network jointly built by Germany and France; Japan, Smart Society 5.0 based on "connected industry"; and Britain revitalized the dream of industrial power with superior technological and financial power through the industrial Internet. China's Internet application base in the field of people's livelihood and Huawei breakthroughs in 5G and other technological fields have led the world, enabling Chinese industry to compete on the same stage for the first time on the stage of global industry. The Party and the country attach great importance to the development of China's industrial Internet, The State Council to seize the commanding heights of a new round of industrial revolution issued the "on deepening the" Internet + advanced manufacturing "development of industrial Internet guidance", set off the construction wave of industrial Internet in full swing.

This paper focuses on the relatively successful analysis of the American NNMI network abroad, aiming to provide some useful suggestions for the future development of China's industrial Internet.

2. US NNMI Network research and analysis

2.1 Overview of the US NNMI Network

National Network for Manufacturing Innovation (NNMI), the innovation network plan proposed by Obama in his fiscal year 2013 budget and officially disclosed in March 2012, is an important step in the implementation of the "reindustrialization" strategy. It is planned to build a regional manufacturing Innovation Research Institute (IMI) to build a unified NNMI network.

By 2017, the US Department of Defense had funded 8 Innovation Institutes (IMI), Energy funded 5 Innovation Institutes, and Commerce funded 1 Innovation Institute, with a total of 14 [3] s. The Innovation Institute was originally founded to become a regional industry-university-research hub, working with US federal institutions to invest in emerging potential technologies and break down the gap between applied research and product development. For example, Detroit's Light Modern Metal Manufacturing Innovation Institute is led by the Edison Welding Institute, including 34 companies, 9 universities and laboratories, and 17 other organizations; Chicago's Digital Manufacturing and Design Innovation Institute, led by the Supercomputing Center Laboratory at the University of Illinois, includes 41 companies, 23 universities and laboratories, and nine other organizations, [4]. Therefore, as of 2016, the NNMI has 830 members, two-thirds of which are manufacturers, and about 341 small businesses, or 33%, 177 universities and research institutions, or 21%; and 105 federal, state, and local government agencies and non-profit organizations, or 13% [3].

The overall architecture of NNMI is shown in the figure below. The bottom layer mainly includes three parts: 1, Product design (including process design), which is the core of manufacturing innovation;

2, the platform for supporting technologies for manufacturing innovation; 3, quality management, personnel training, evaluation and promotion. As shown Fig 1.

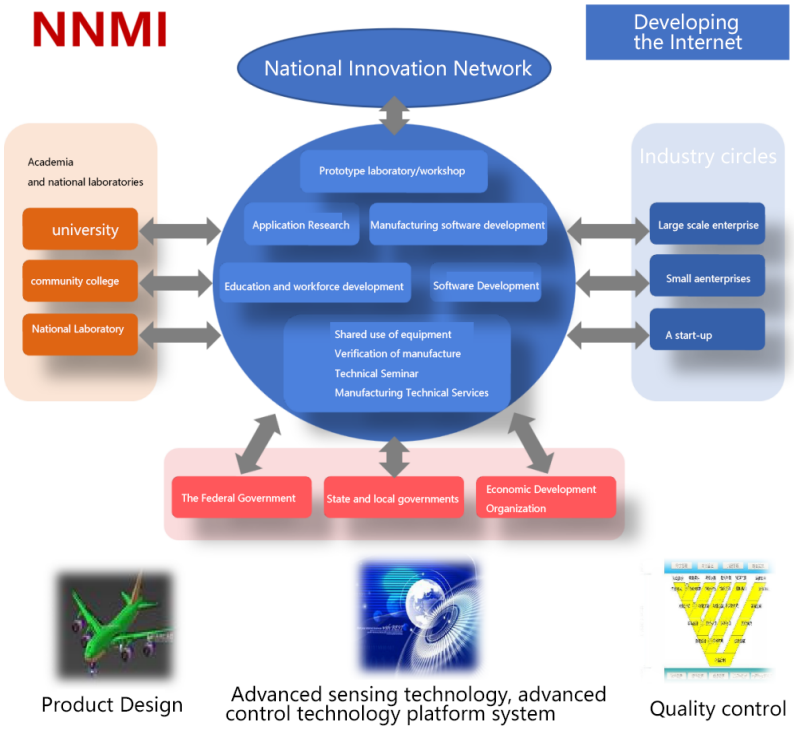

Figure 1: American NNMI network architecture diagram

"Advanced" is defined as "advanced technology", "advanced industry" "" and "advanced management". Its mission is to "connect people, ideas and technologies with the industrial Internet" to solve advanced manufacturing challenges related to industry, thus enhance industrial competitiveness and economic growth, and strengthen national security in the United States.

NNMI's vision is to keep the US ahead in global industry to: 1) provide a rich innovation environment for advanced manufacturing; 2) make transformative manufacturing technology flourish in the US; 3) promote public and private sector investment in advanced manufacturing infrastructure; 4) promote rapid scale and market expansion of advanced manufacturing; 5) provide leadership and innovative talent operation management mechanisms [5].

The United States wants to through the industrial enterprises, academia and the corresponding government forces together, rebuild solid advanced manufacturing capacity, RAMI bill has been authorized to establish and convene composed of individual manufacturing national industrial Internet network, in order to enhance their influence, to further strengthen the global influence and competitiveness of the United States. American academia includes universities, community colleges, and national laboratories, American industry includes all large, medium and start-up enterprises in the United States, and the American government includes federal government, state and local governments, and economic development organizations.

In the proposed NNMI, organizations in the network can share best practices at work; identify and address gaps in the US manufacturing technology base; identify common interests and activities that help train the next generation of skilled workers; share information about newly developed technologies and processes; and leverage manufacturing areas with expertise in other sectors. Throughout its development,

the network can also receive continuous guidance to U. S. government agencies, such as the Department of Energy, Defense, Commerce, Education, Agriculture, NASA, the US Administration, the Federal Aviation Administration, the Food and Drug Administration, and the National Science Foundation.

NNMI focuses on strengthening network construction from three aspects: first, cross-IMI collaboration. The IMI are required to work together as much as possible to share resources, best practices, and research and development outcomes, while funding and membership models, annual reports, and related projections are open to each other. Second, the common IMI management policy. NNMI enables efficient network operations through developing common management policies, including promoting the policies for interaction with SMEs, promoting intra-network synergy and activity policies, and sharing service policies such as shared human resource management. In addition, NNMI has established common policies for maintaining intellectual property rights, collaborative research, operations, accounting, marketing, and branding; third, for uniformly connecting to advanced manufacturing portals. Each IMI has its own website, but also needs to join and link to the advanced manufacturing portal simultaneously.

2.2 Analysis of the US NNMI network

The summary of industrial Internet development ideas in the United States is the unified network of "R and D + manufacturing" in the whole United States, that is, the establishment of research and development network, manufacturing network and the deep integration of research and development network and manufacturing network.

The fourth industrial revolution transformation technology, such as robots and the Internet of Things, makes unmanned factories a reality. At the core of the traditional manufacturing industry, cheap manufacturing workers are no longer the main body of the future industrial manufacturing industry, and robots represented by high technology are the main body force of the future industrial manufacturing industry. After the labor cost disadvantage of low-end workers is solved, the United States has the foundation to restructure the industrial manufacturing industry.

Advanced R & D leads the industry, which will make NNMI's research and development institutions, namely the R & D network, become the power source of NNMI, which is also defined as the pillar and cornerstone of the NNMI program. Manufacturing network construction is a jigsaw puzzle that the US NNMI must build to make up for the significant shortcomings of the American industry. However, no matter how efficient the manufacturing industry is, the research and development industry provides competitive new product design for manufacturing, and it is also a bunch of unattended machines. That's why NNMI defines the R & D network as the pillar of NNMI.

R & d network established, in the United States has a global unique foundation, is also defined by NNMI as the pillar of NNMI, Boeing, Loma, GE and a large number of global industrial research and development giants and the global leading academia for NNMI pillar research and development institutions that laid the advantages of other industrial power in the world. It is an indisputable fact that the US is leading in global technology and one of the three core forces (technology, military and dollar). The cross-industry alliance of the giants of the American industry and the giants, coupled with the deep alliance of the world's leading American academia, will explode with unpredictable research and development innovation power, so the NNMI innovation organization research and development network will become the absolute pillar of NNMI.

NNMI is a unified network with the deep integration of r & D networks and manufacturing networks. The natural close integration requirements of digital design and digital manufacturing further contribute to the formation of NNMI unified network. The future of the American industrial Internet construction,

such as NNMI, manufacturing deep digital integration, and research and development and manufacturing deep digital integration, whether politically active or technically forced, will facilitate the future independent cycle of the American industry. At the same time, the significant features of the American NNMI program are the emphasis on the strong alliance of American academia and American industry, including the world's leading academic community in the United States supporting the industry through NNMI, and the real economy of American industry driving the continuous progress of the academic community through NNMI. It can be predicted that NNMI will become a global example of the combination of "research and learning", accurately integrate the academic circle with technological achievements and the industry with new product research and development, promote the transformation of scientific and technological achievements and industry-driven scientific and technological innovation from the independent behavior of enterprises to the national height, and complement each other and deeply integrate.

3. Analysis of China's Industrial Internet Current Situation

At present, China has made preliminary progress in industrial Internet construction, promoted a batch of vertical industry and segmentation of industrial Internet products, small and medium-sized technology, enterprises are gradually join the industrial Internet platform, the overall development trend of flowers development pattern, not only the local government and industry alliance actively promote the development of industrial Internet platform, industrial Internet is favored in the capital market, become a popular investment field.

The market segmentation analysis of China's top 40 industrial Internet positioning layout in 2019, and the results are shown in the following figure 2: [6-7]:

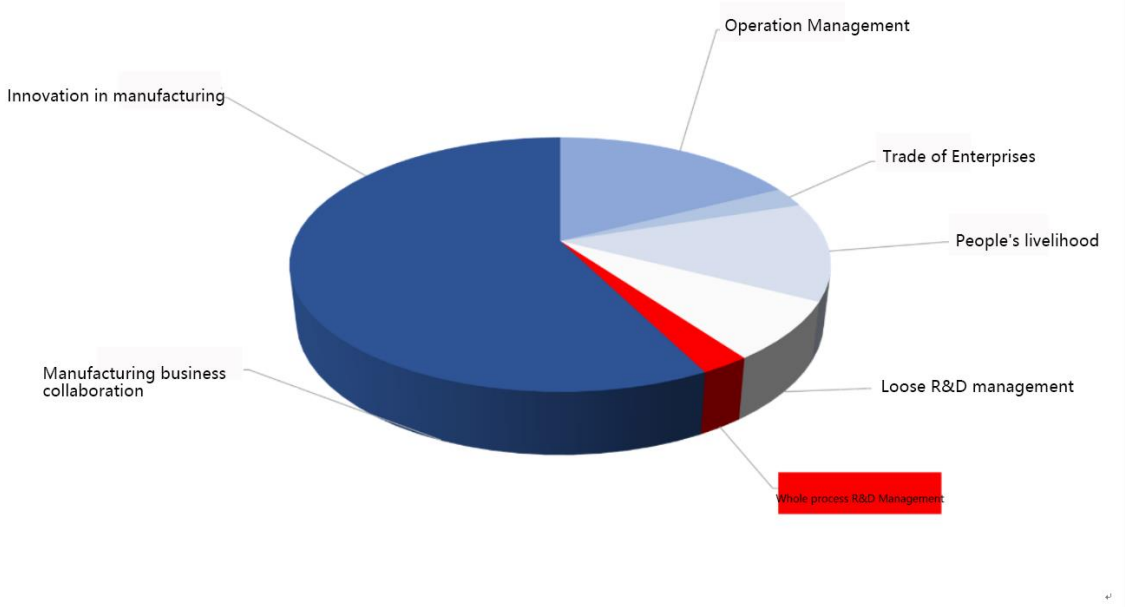

Figure 2: Positioning and layout of China's top 40 Industrial Internet in 2019

There are 5 industrial Internet construction companies focusing on the field of people's livelihood, which are: China Telecom-Tianyi Cloud, China Mobile (OneNET), Baidu Cloud (Tiangong Internet of

Things platform), Tencent (Wood Nebula), Ali Cloud (Ali Cloud-Ali supET).

There are 11 industrial Internet companies based on the industry and oriented to enterprise manufacturing business collaboration, namely: Industrial Fulian Foxconn-BEACON9 (communication system), Xugong Information-Hanyun (heavy Machinery), Qiming Cloud QMAC (automobile), China Ship Internet-Navigation Zhiyun (ship), Puao-ProudThink (ship), Midea Group-M. The loT (furniture), Petrochemical Yingke-ProMACE (petrochemical), Huaneng Group-Aldustry (energy), Shanghai Electric-Xingyun Zhihui (electrical), Oriental Guoxin-Cloudiip (steel), China Power Internet-China Power Cloud Network BachOS (electronic glass, SMT).

Provide platform support for manufacturing innovation, for enterprise manufacturing business industrial Internet has 12, respectively are: root interconnection-root cloud, and time-HiaCloud, Zoomlion-ZValleyOS, research technology-WISE-PaaS, cloud technology-NeuSeer, soft technology-Honeycomb, sea-OctoloT, the east wisdom, you information-Thingswise, intelligent-NewTonLOT, intelligent cloud-iSESOL.

There are 7 industrial Internet companies with enterprise operation management and production management as the core, namely: China Overseas Innovation-Sea Innovation Cloud, Yonyou Network-Yonyou Jingzhi, Baoxin Software-Baoxin Cloud, China Service Industrial Internet Platform, Kingdee Group-Yundi Wisdom, Aerospace Cloud Network-INDICS, Langkun Technology-Langkun Suchang.

With enterprise trade as the core of 1: Ali Cloud (Ali Cloud-Ali supET).

The industrial Internet focusing on research and development management or highlighting research and development management only accounts for 4 in the top 40, which are Haier-COSMOPLAT, Yundao Intelligent manufacturing-Simdroid, witty cloud-witty cloud, Suo-zhong industry.

From the above 2019 China's industrial Internet top 40 positioning layout analysis, for industrial manufacturing business of industrial Internet has 23, and for enterprise research and development of industrial Internet is only 4. Therefore, although now China's industrial Internet development is now blossoming, but most of the focus is on the manufacturing process, focusing on the research and development process of the industrial Internet is less.

In April 2020, China Industrial Internet Industry Alliance officially released the "China Industrial Internet System Architecture 2.0". Most of this architecture, which guides the future construction of China's industrial Internet, is also centered around the construction of intelligent manufacturing plants, and R & D collaboration has not become the core part of the whole architecture design as in the United States.

American advanced manufacturing strategy in the industrial Internet, the planning is worth our reference, its NNMI system plans to build 45 manufacturing innovation research institutes. IMI for different areas, and according to the local resources and technology basis will each IMI in different regions, help each region to form characteristics of different industry innovation highland, and by strengthening the IMI network construction maximum spillover effect, avoid the repeated competition, also fully integrate existing resources and mobilize the enthusiasm of local governments, form strategic synergy to maximize the strategic as a whole, integration and leading role.

4. Summary and development recommendations

In general, the global industrial Internet platform is in a critical period of uncertain pattern, the window period of scale expansion, and the opportunity period to seize the dominant power. China has a complete industrial system, an innovation-led Internet ecology, and a huge professional talent team, which contains the super-large industrial Internet application market demand, and has the foundation and advantages of

accelerating the construction of an industrial Internet platform. At the same time, under the background of the continuous development of science and technology, there is no doubt that the r & D industry has replaced the manufacturing industry as the core pillar of modern industry. Therefore, China should give full play to the advantages of the system and mechanism, fully mobilize the resources of all parties, break through the core shortcomings of a number of platforms, promote the continuous improvement of technology and industry in the rapid iteration with large-scale application, and build an internationally competitive industrial Internet platform facing research and development.

According to the analysis of NNMI network in the United States, some strategies of its development ideas are worth our reference. The following development of China's industrial Internet can focus on the following points:

(1) With research and development as the core, through the construction of regional research and development highland, the integration of surrounding industrial, academia and government resources;

(2) Through the industrial Internet, we can connect large, small and medium-sized technology enterprises, and even start-ups, universities, research institutes, and the government, forming a smooth technology chain and capital chain;

(3) Unified construction of a national industrial Internet, so that all information and resources are interconnected and shared, to realize the optimal allocation of resources.

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