Analysis on the Development of Chinese Intelligent Manufacturing System Integrators

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Abstract: Intelligent manufacturing integrators are an important force to promote the digital transformation of manufacturing enterprises, and play an important role in improving production efficiency and quality, reducing costs, improving competitiveness, etc., and their service capability affects the development process of intelligent manufacturing to a certain extent. With the development of intelligent manufacturing, the team of integrators continues to grow, and there are some aspects to be optimized. This paper studies the overall development of China's suppliers in the past ten years from the aspects of market size and specialization based on the relevant open data, analyzes the internal and external weakness existing in the development of suppliers according to the current stage, and puts forward relevant suggestions on supplier cultivation.

Keywords: Intelligent Manufacturing; Manufacturing Industry; System Integrators; System Integration Solutions; Integrator Cultivation

1. Introduction

Manufacturing is the foundation of a country, and an important part of the real economy. Intelligent manufacturing represents the main direction of high-quality development of my country's manufacturing industry. It is necessary to firmly promote industrial transformation and upgrading, strengthen independent innovation, develop high-end manufacturing and intelligent manufacturing, and promote manufacturing industry and the real economy. Since 2012, the Central has attached great importance to the development of the real economy. The comprehensive strength of manufacturing industry has reached a new level, new breakthroughs have been made in innovation in key areas, and new steps have been taken in the optimization of industrial structure [1,2].

As the core force of the supply side of intelligent manufacturing, intelligent manufacturing system integrators are practitioners of the development of intelligent manufacturing, inheritors of manufacturing knowledge, and promoters of high-end, intelligent, and green development of manufacturing. To a certain extent, it determines the development process of my country's intelligent manufacturing. Since 2015, under favorable conditions such as government policy guidance at all levels, market demand pull and effective promotion of new technology breakthroughs, the integrators have continued to grow, achieving rapid growth in quantity and steady improvement in quality [3,4].

2. Overall Development of Integrators

2.1 The Market Size of System Integration Solutions is Growing Rapidly

According to incomplete statistics, the average annual compound growth rate of the system integration solutions market in the past six years has reached 9.5%. In 2022, the operating income will exceed 680 billion. The output of industrial robots will increase from 72,000 units (sets) in 2016 to 443,000 units (sets) in 2022, with a compound annual growth rate of 35.4%. The industrial software market size has grown from 126.14 billion yuan in 2016 to 240.7 billion yuan in 2022, with an average annual compound growth rate of 11.4%. Under the traction of national and local smart manufacturing policies, the trend of solution standardization and modularization is obvious, the supply capacity of smart manufacturing is continuously enhanced, and the overall development trend is good [5].

2.2 Preliminary Meet the Digital Transformation Requirement of Chinese Manufacturing Enterprises

According to incomplete statistics, the manufacturing industry served by integrators has covered more than 90% of the secondary categories of manufacturing, and the solutions can cover more than 50 typical scenarios in the production and manufacturing activities of enterprises, which can initially support manufacturing The digital transformation tasks of enterprises. Local governments are actively promoting the construction of digital workshops and smart factories, and have cultivated more than 1,700 domestic leading high-level digital workshops/smart factories. Integrators have played an important role and become an important force to promote the transformation and upgrading of the industry.

2.3 The Degree of Specialization and Innovation Ability Improved Greatly

Integrators focus on scene empowerment, provide overall/partial solutions for typical industries such as automobiles, textiles, and refining and chemical industries, and form vertical software specialized in industrial scenarios of specific industries in the fields of aerospace, intelligent networked vehicles, and petrochemicals; The solution integrates innovative technologies and manufacturing process improvement concepts, and uses artificial intelligence deep learning, digital twin technology, etc. to raise the company's quality improvement, cost reduction and efficiency increase to a new level; integrators joint enterprises, universities and research institutes collaborate through industry-university-research institutes Innovate, carry out technology, process, equipment and software innovation, and make breakthroughs in key areas of high-end sensors, controllers and some high-end intelligent manufacturing equipment.

2.4 The Basic Construction of Intelligent Manufacturing Service Network has been Formed

In 2016, the Intelligent Manufacturing System Integrator Consortium was established. It takes integrators' cultivation as the core, promotes the matching of supply and demand as the main line, and takes the application and promotion of advanced experience and typical practices as the starting point, giving full play to the role of "building a platform, promoting integration, and building an ecology", and absorbing more than a thousand smart manufacturing services Institutions have established 21 local alliances and 9 industry alliances, leading to the formation of more than 6,000 integrators, and building a point-line-surface integration of "general alliance + local alliance + industry alliance + service organization" service network. By gathering resources such as intelligent manufacturing policy system, innovation system, supply system, application system and support system, we will promote the innovation and development of intelligent manufacturing in regions and industries.

3. Direction in Improvement Process of Integrators

3.1 Enhancing Core Competencies

In recent years, China has alleviated the weak manufacturing base to a certain extent by promoting the reengineering of its industrial base. But there is still room for improvement in some industrial basic processes, important component production processes, and other aspects. There are external reasons for the proliferation of anti-globalization, and there are also internal reasons for insufficient accumulation in the field of basic processes. Many integrators conduct secondary development based on mature software and hardware architectures. Not only is full controllability not guaranteed, but it is also easy for multiple integrators to form solutions based on the same technology base, and they can only compete in the market by lowering prices. Even undertake projects beyond the scope of capacity, disrupting market order [6].

In 2021, China's investment intensity in science and technology has reached 2.4% of GDP, while the United States is 2.79%, Northern Europe like Norway, Finland, Sweden is 3.2%, Japan and Germany is 3.4%, South Korea is 4.5%, which means that we still have potential. In terms of the absolute amount of investment, China is currently second only to the United States, but its use in basic research and development and original innovation accounts for only 6.2% of the total investment, while developed countries are 15%-20%. For a long time, Chinese industries

are mostly in the middle and low end of the global value chain, with excess low-end products and insufficient high-end products. For example, electronic information, high-end equipment manufacturing, aviation and Marine engines, intelligent instrumentation, medicine and medical equipment and so on. Among them, most of the key equipment materials such as high-end chips and semiconductors rely on imports [7].

3.2 Focus on System Integration Solutions for Small and Medium-sized Enterprises

Small and medium-sized enterprises are the new force of national economic and social development, the number of small and medium-sized industrial enterprises accounts for more than 90% of the total number of industrial enterprises in China. By the end of 2022, the number of small and medium-sized enterprises in my country has exceeded 50 million. Accelerating the development of small and medium-sized enterprises will help improve the stability and competitiveness of the industrial chain and supply chain. Promoted by the government and driven by policies, they have generally recognized that the transformation of enterprises with digitalization, networking and intelligence is the main means and urgent need to improve the competitiveness of enterprises, and enterprises are increasingly willing to implement smart manufacturing. However, restricted by capital, technology, talent and experience, the vast majority of smes are still in a wait-and-see state.

Small and medium-sized enterprises are facing "lack of technology, lack of talent, lack of funds" and other problems, and they mostly carry out intelligent manufacturing transformation and upgrading with the progress of their own production technology as the goal, lack of contact with the industrial Internet platform, upstream and downstream enterprises, most of the established data system exists within the enterprise, lack of circulation ability in the industrial chain. To solve this problem, we need to formulate targeted and operational measures. At present, although integrators serve a wide range of industries, they are not deep enough in subdivided fields. Few are familiar with the development characteristics, business processes, and key processes of subdivided fields. Due to the rapid update and iteration of intelligent manufacturing technology and enterprise needs, integrators cannot provide standardized and low-cost solutions, or cannot quickly locate integrators with corresponding capabilities, which restricts the development progress of small and medium-sized enterprises to a certain extent [8].

3.3 Strengthen Support Integrators from All Sectors of Society

Integrators are a new type of professional service organization, and currently there is a lot of room for improvement in terms of capital, technology, and talents needed to support the development of integrators. In terms of financial support for the development of the real economy, supply chain finance can support the influx of industrial manufacturing, which is still a common problem. Financial institutions use Internet technology in combination with offline supply chain scenarios to provide less financial services for upstream and downstream enterprises in the intelligent manufacturing industry chain. They need to be guided to provide suppliers with more credit financing, non-credit financing, insurance services, trade financial services and other innovative financial services chain capital turnover, reduce financing costs, and alleviate financing pressure. In terms of integrators' project implementation, the intelligent transformation of enterprises requires a large amount of capital investment, and it is difficult to support the project to completion only by prepayment and progress payment. There are also delays in capital payment and Pay-in Constructions; In terms of talents, in 2020, the demand for talents in the field of intelligent manufacturing in China was 7.5 million, while the gap was 3 million; The talent gap is expected to reach 4.5 million by 2025. Intelligent transformation involves all aspects of research and development, production and sales, and requires compound talents who understand both intelligent manufacturing systems and the industry, business and process. The core concern of suppliers is enterprise survival and profit, and the talent training is willing but insufficient. Therefore, it is necessary for scientific research institutions and universities to strengthen joint innovation with integrators, input new technologies to them for achievement

transformation, and transport outstanding talents. [9].

4. Suggestions for Cultivation of Integrators

4.1 Classification and Grading Assessment

Since 2016, some localities have attached great importance to integrator cultivation and built a local integrator resource pool. However, due to differences in conceptual understanding of the types of services provided by integrators, and the selection criteria are customized by each locality, there is no uniform standard, which is not conducive to the continuous development of cultivation work. Therefore, it is necessary to establish a set of classification and grading system that is agreed and recognized in stakeholders, divide the different gradients that are clearly hierarchical and connected with each other, and conduct a scientific and effective evaluation of the service categories and service capabilities provided by integrators accordingly, so as to make the overall work of supplier cultivation more systematic and standardized.

Firstly, through the classification and grading of suppliers, it can help integrators to understand the current development situation, clarify their own ability positioning, see the gaps and shortcomings, and clarify the direction of efforts. Secondly, promote integrators, user enterprises, governments at all levels and other relevant parts to reach a consensus, help government departments at all levels to fully grasp the level of local and industrial intelligent manufacturing supply capacity, conduct scientific research and judgment and classified policies, and put forward references or suggestions for the industry's self-regulation model to create a healthy, orderly and standardized development of the ecological environment. Thirdly, the catalogue is sorted out according to different dimensions such as industry attributes, geographical distribution and service capabilities, to provide reference for the demand matching of intelligent manufacturing in different regions and industries into the park, supply and demand docking and other activities, and to provide reference for small and medium-sized enterprises to propel intelligent transformation, so that they can select appropriate integrators.

4.2 Gradient Cultivation

We need both leading integrators with international competitiveness and comprehensive strength, as well as professional integrators who are deeply rooted in the industry and flexible and innovative. On the one hand, China has a large number of small and medium-sized enterprises, and helping them grow rapidly at different stages of development requires different types of integrators to provide services. It is necessary to guide some integrators to develop towards specialization and specialization, focus on casting expertise, and develop standardized and precise solutions suitable for small and medium-sized enterprises in segmented industries, forming a two-way collaborative gradient development ecosystem between supply and demand. On the other hand, although China is moving from a "manufacturing powerhouse" to an "intelligent manufacturing powerhouse", improving core competencies is still a long-term and arduous task. To guide integrators to enhance their independent innovation capabilities, especially to accelerate technological breakthroughs, cultivate suppliers with international technological leadership and control over key nodes in the industrial chain, and form a competitive advantage in the international market [10].

On the basis of integrators classification and grading, we carry out gradient cultivation and put forward systematic requirements for cultivation management. The gradient cultivation work is mainly based on internal causes and supplemented by external causes, and the core is to rely on enterprises to continuously enhance the internal driving force, the government and social forces to optimize the development environment and strengthen service support, and jointly form a joint force for cultivation. To carry out the gradient cultivation of integrators, it is not only to identify a group of excellent suppliers, but to accurately focus on the innovation potential and development prospects of integrators, according to the specific conditions of the enterprise's product, technology, management, mode, and so on, to cultivate the new momentum of enterprise development and growth, and give play to the enterprise's own advantages.

4.3 Select and Recommend Service Mode and Excellent Solutions

In recent years, Zhejiang, which is characterized by private enterprises, small and medium-sized enterprises and block economy, has become a pioneer, and enterprises and the government have joined hands to obtain certain experience, and these experiences and models have become the scope and gradually spread to all parts of the country. Formed a "Xinchang mode" to support the digital transformation of small and medium-sized bearing enterprises, that is, "project cooperation, technology research, talent training" trinity college enterprise collaboration mechanism, "one-to-one" and "point-to-point" training mode, gathered and coordinated multidisciplinary research team, applied technology research and development team, industry technology center, enterprise senior engineer expert team, As well as multi-party research and development subjects such as professional degree graduates, a new situation of multi-party, multi-layer and diversified high-tech industry innovation has been formed. It has formed a "Lanxi model" to support the digital transformation of small and medium-sized textile enterprises, and cultivated a number of integrators that provide "lightweight and low-cost" intelligent manufacturing equipment, industrial software and system solutions for small and medium-sized enterprises.

The Intelligent Manufacturing System Integration Consortium implements the deployment of intelligent manufacturing work and sets a good example in selecting excellent solutions. They carry out supply and demand matching activities every year on industrial robots, control systems and other fields, to promote the development of intelligent equipment, industrial software and other intelligent manufacturing emerging industries; Carry out supply-demand docking activities for textile, construction, automobile and other industries, effectively solve the problem of information asymmetry between supply and demand, and promote the implementation of projects; Carry out capital docking activities for integrators, invite capital institutions to provide financing services for integrators with technology and potential.

In addition, relevant industry associations and sub-alliances can develop solutions for typical scenarios of subdivided industries based on the catalog, and carry out the compilation of industry application implementation guidelines based on the maturity of intelligent manufacturing capabilities and typical scenarios. Localities, industry organizations, leading enterprises, etc. can carry out activities such as experience exchange, supply and demand docking, and joint promotion. Relying on authoritative media and service networks to tell the beneficial experience of intelligent manufacturing development in all directions, from multiple angles, and in multiple forms, and publicize and promote the "Chinese solution" of intelligent manufacturing.

5. Conclusion

The Intelligent Manufacturing Development Plan proposes to accelerate the cultivation of system integrators, promote standardized development, provide professional, high-level, one-stop integrated services, and the goal of cultivating more than 150 intelligent manufacturing system integratorts with high professional level and strong service ability by 2025.

Integrators need independent research and development in technology, break through the bottleneck of assembly and software technology, and pay attention to the core technology in the entire ecological chain; In terms of adaptability, the organization and management should be promoted to adapt to the management changes brought by information technology; On the intelligent road, it is necessary to introduce system engineering and top-level design, so as to realize the deep integration of manufacturing technology, information technology and organizational management. In the key stage of promoting intelligent manufacturing, suppliers should do a good job in the role of development, practice and inheritance, and strive to make up for weaknesses, clear their own development goals, and constantly improve innovation capabilities, take advantage of the new round of technological revolution and industrial transformation, and promote high-level Self-reliance.

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