

Research on Innovation of Cost Control in Intelligent Manufacturing Enterprises

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Abstract: The World Economic Forum pointed out that the fourth generation of industrial revolution technology, as the next generation of economic growth engine, should be fully applied in the manufacturing industry. Intelligent manufacturing is gradually becoming the commanding point of innovation and innovation in manufacturing industry. Cost control is one of the main factors for manufacturing enterprises to improve economic efficiency. Traditional cost control may no longer apply to today's intelligent manufacturing enterprises, or even hinder the development of intelligent manufacturing enterprises. Therefore, it is necessary to innovate the cost control of intelligent manufacturing enterprises. Based on the traditional cost control and the characteristics of intelligent manufacturing enterprises, this paper studies the innovation of cost control in order to improve the competitive advantage of intelligent manufacturing enterprises and promote their economic benefits.

Keywords: Intelligent manufacturing, Manufacturing enterprise, Cost control, Management innovation

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I. Introduction

Manufacturing industry can directly reflect a country's level of productivity development and occupy a dominant position in the national economy. The arrival of the fourth Industrial Revolution ushered in a new era of technological revolution, dominated by artificial intelligence, clean energy, robotics, quantum information technology, virtual reality and biotechnology. Developed countries have introduced a national strategy of "re-industrialization" with advanced manufacturing as the core, such as the "industrial Internet" and the "new generation of robots" of the intelligent manufacturing strategy layout in the United States, Germany's "Industrial 4.0" high-tech strategic plan and the European Union's "2020 growth strategy." Developed countries have made great efforts to develop intelligent manufacturing to ensure their strong position in the world manufacturing industry. China, as a developing country, has creatively proposed "made in China 2025" in order to solve the disadvantages of the development of traditional manufacturing industry and adapt to the trend of global scientific and technological development in the current fierce international competition environment, aiming at changing the situation of "big but not strong" manufacturing industry in China (Gao Qingsong and Li Ting, 2018).

According to the 2016 Global Manufacturing Competitiveness Index published in 2016, as manufacturing industries continue to adopt more advanced and sophisticated products, technology and materials, the traditional manufacturing powers of the 20th century (i.e., the United States, Germany, Japan and the UK) returned to the top 10 of the most competitive countries in 2016. China and the United States manufacturing competition is particularly fierce. It can be seen that with the development of intelligent manufacturing enterprises, the competition of global manufacturing industry is becoming more and more intense. Cost control is one of the eternal topics for the manufacturing industry to enhance its core competitiveness. The method must have changed.

In the new era and new situation, the traditional manufacturing industry relying on manpower development is gradually becoming the past, and the intelligent trend of manufacturing industry is constantly strengthened. At present, the important strategic task of building a manufacturing power is to develop from traditional manufacturing to intelligent manufacturing (Meng Fansheng and Zhao Gang, 2018). In the process of developing from traditional manufacturing to intelligent manufacturing, the cost structure is bound to change. The traditional cost control is no longer suitable for the intelligent manufacturing enterprises. In order to improve the competitiveness of intelligent manufacturing enterprises, it must innovate on cost control. However, when scholars study the development of intelligent manufacturing, most of them focus on the development trend, development system and management of intelligent manufacturing, and few of them involve the innovative research on cost control of intelligent manufacturing enterprises. Therefore, this paper analyzes the

existing problems in the cost control of intelligent manufacturing enterprises and tries to put forward some innovative ideas for the cost control of intelligent manufacturing enterprises.

The remainder of this paper is organized as follows. The second section introduces the literature review of intelligent manufacturing enterprises and cost control. The third section analyzes the existing problems of cost control in intelligent manufacturing enterprises. The fourth section analyzes the problem and puts forward some innovative ideas on cost control of intelligent manufacturing enterprises. The final section draws a final conclusion.

II. Literature Review

What is an intelligent manufacturing enterprise? First, the concept of intelligent manufacturing must be understood. According to p.k.right of New York university and d.a.ourne of Carnegie Mellon university, intelligent manufacturing models the skills and expert knowledge of manufacturing technicians through integrated knowledge engineering, manufacturing software systems, robot vision and machine control to enable intelligent robots to produce in small batches without human intervention (Wang Lei, 2018). Intelligent manufacturing originates from artificial intelligence. It includes intelligent manufacturing technology and intelligent manufacturing system. It is a human-machine integrated intelligent system composed of intelligent machines and human experts. The main features of intelligent manufacturing are information perception, optimal decision-making and executive control (Meng Fansheng and Zhao Gang, 2018). Furthermore, it can be concluded that intelligent manufacturing enterprises are manufacturing enterprises that realize production automation and management intelligence by using advanced intelligent manufacturing technology and intelligent manufacturing system.

Many scholars have studied intelligent manufacturing. Lu tie and Han Na(2015) pointed out that the penetration of virtual network and physical production is the essence of intelligent manufacturing, and that internet technology is the power engine to realize manufacturing intelligence. However, in some developing countries, it is difficult to improve the intelligence level of manufacturing industry due to the lag of software system development. Xiao Jinghua, Mao Yunshi and Xie Kang(2016) also pointed out that the current global research on intelligent manufacturing mainly focuses on the fields of technology and engineering realization, while the economic management theory of intelligent manufacturing is still in its infancy. Especially, it is even weaker in the research on the economic management theory of intelligent manufacturing system in the context of Internet and big data. It leads to the application of traditional cost control methods to intelligent manufacturing enterprises, which leads to a large increase in costs and a lack of competitiveness of manufacturing enterprises.

What is cost control? Cost control is a part of cost management, which is to guarantee the cost within the scope of budget estimation. Cost control calculates, adjusts and supervises various costs and expenses in the production and operation of an enterprise by means of prior control, in-process control and ex-post control. Then it can discover the weak links, tap the internal potential, and find all the methods that can reduce the cost, so as to promote the enterprise to survive, develop and expand in the fierce market competition environment.

The current manufacturing industry is gradually changing to intelligent, service-oriented manufacturing. Mass and small batches of the traditional production model has gradually become a personalized and customized production model. Customers can participate in product design, supervision and command, and it greatly meet customer needs. On the one hand, in the process of intelligent development of manufacturing industry, the cost structure of products has changed greatly(Feng Yuan, 2016). For example, machine depreciation and R & D costs increase. On the other hand, with the continuous expansion of production scale, the traditional extensive cost control mode of manufacturing enterprises has been unable to promote the economic benefits of enterprises. Only by careful cost control, can the goal of cost control be guaranteed(Chen Liwen, 2014). At the same time, time factor(Liang Hongxue and Li Jiamin, 2017) and environment factor(Li Ting and Li Wenxing, 2016) into the cost control of manufacturing enterprises have gradually become an inevitable trend.

III. Analysis of existing problems of cost control in intelligent manufacturing enterprises

Cost control plays a key role in improving the economic benefits and enhancing the core competitiveness of enterprises. With the development of intelligent manufacturing enterprises, the production mode of products has changed, and it gradually change from the production of large quantity and fewer batches to the customized and differentiated production of small quantity and multiple batches (Xu Qianying, 2018). At the same time, the cost structure of intelligent manufacturing enterprises has also changed. The cost of traditional manufacturing enterprises is heavy in materials and workers' wages. After introducing intelligence, large-scale production of machine instead of labor. The amount of materials is more accurate and saving, and labor costs are reduced sharply. On the contrary, the cost of product design, depreciation of machinery and equipment has increased substantially. With the change of production mode and cost structure, the cost control

method of traditional manufacturing enterprises is no longer suitable for the intelligent manufacturing enterprises. In the process of intelligent development, the intelligent manufacturing enterprises ignore the problems existing in the cost control of their own enterprises, which lead to higher product costs and reduce the economic benefits and competitiveness of enterprises. It is mainly manifested in the following aspects.

Management personnel lack the ability to respond and the design and procurement costs increase

The prior control mainly includes product design, processing technology, material procurement, production organization and so on. On the one hand, the cost of product design increases. In the past, people pursued popular fashion, and the traditional mass production method could meet the needs of people. However, with the continuous development of the world's diversification process, people prefer personalized, differentiated and customized products, such as limited edition cosmetics, customized jewelry and so on. In order to meet the individual needs of consumers and seize the market as soon as possible in a competitive environment, intelligent manufacturing enterprises use new technologies and develop new products constantly. While design, R & D costs increase, it also leads to shorter product life cycles. Managers of enterprises need to respond quickly to changes in the market, bring time into cost control and invest more cost to shorten the time of product design so that the product can be listed as soon as possible (Liang Hongxue and Li Jiamin, 2017). On the other hand, material purchase cost is higher. The managers of intelligent manufacturing enterprises have a strong awareness of cost control, and they believe that the realization of production automation can reduce the cost of material consumption in the production process to a certain extent. However, most employees in the enterprise think that cost control is only the responsibility of the finance department. Because of lack of cost control consciousness, purchasing personnel tend to ignore the cost in the process of material purchase.

Intelligent equipment updates quickly and operating costs increase

The in-process control includes the consumption of materials, labor and energy, transportation between processes, workshop and other management departments and so on. Most of the traditional manufacturing enterprises produce products manually, which may lead to waste of materials. Because the quantity of materials is not accurate enough. But now, the machine mass production has replaced the previous manual manufacturing. The control of material consumption is more accurate and economical. However, labor costs and depreciation costs are increasing. On the one hand, labor costs increase. Intelligent manufacturing enterprises introduce new production technologies in the process of product production. Traditional artificial manufacturing plants have gradually disappeared, and automatic machine equipment production plants appear. Although the number of employees has decreased, the comprehensive quality of employees needs to be improved. The use of automation equipment for production requires high-quality employees with professional knowledge and skills, and the wages of workers are higher than before. The upgrading of equipment also requires the training of employees' skills, and the enterprise needs to pay more staff training costs. In addition, machinery and equipment will inevitably lead to greater noise pollution. As employees stay in the factory for a long time and suffer from the impact of noise, the enterprise must pay certain compensation fees. On the other hand, the cost of workshop and other management departments increase greatly. Most of the workshops of traditional manufacturing enterprises use low-distribution equipment and mainly rely on labor to produce products. However, intelligent manufacturing enterprises have introduced automatic equipment, and the upgrading speed of equipment is often relatively fast. Therefore, the depreciation cost of equipment greatly increases, and the cost of workshop management will also increase accordingly.

The market competition is intense, the marketing service cost increases and the environmental protection cost is on the high side

Post-action control mainly includes product promotion, transportation outside the factory and after-sale service. First, the cost of product promotion increases. In the fierce market competition environment, all kinds of customized new products are springing up like mushrooms. In order to make products sell as soon as possible, intelligent manufacturing enterprises have to adopt a variety of novel ways to promote products. The overwhelming advertisement, various festival's discount activity, gives the gift activity and so on fills each big shopping mall and the online shopping platform. The product promotion cost increases greatly. Second, the cost of after-sales service increases. In the current fierce competitive market, people have gradually accepted the business philosophy of taking consumers as the center. Marketing services play a huge role in enterprises, while intelligent manufacturing enterprises often tend to ignore the control of service cost (Liu Qi, 2015). From traditional manufacturing enterprises to intelligent manufacturing enterprises, the transformation from mass production to personalized customized production has been realized. Consumers can participate more in the design, production and sales of products. In the process of after-sales use, the enterprises further increase the service cost. They get real-time feedback from consumers to deliver information and help them deal with after-sales problems. It is conducive to improving consumer satisfaction (Wang Lei, 2018). Finally, environmental

costs have risen dramatically. Manufacturing enterprises are the main body of environmental pollution. The intelligent development of manufacturing enterprises not only brings convenience but also aggravates the pollution to the environment. However, the scope of environmental cost control in many enterprises is not precise, and they often adopt the way of end treatment. They not pay attention to the environmental cost that exists outside the enterprise. For example, environmentalists give up buying the products that pollute the environment, and the national policies attack the products that pollute the environment. The environmental cost is relatively high under this kind of treatment(Li Ting, 2016).

IV. Innovative ideas of cost control in intelligent manufacturing enterprises

Establish the incentive and restraint mechanism to improve the participation of all members

The managers of intelligent manufacturing enterprises often have strong awareness of cost control. They find the problems in cost control and solve them in time. However, many employees are perfunctory. Due to the high degree of connection between the cost control work and each member of the intelligent manufacturing enterprise, the enterprise should improve the cost control awareness of all employees before carrying out cost control (Chen Yanqing, 2017). However, raising the awareness of total cost control will not be achieved overnight. At the present stage, the effective method that the enterprise can do is to use the incentive and restraint mechanism to improve the participation of all members. For example, everyone will have their own unique opinions on a certain product. In terms of product design, it does not have to rely on professional designers. Companies can organize design contests and reward the winners. Then the professional staff refers to excellent design ideas to design new products. It may reduce the cost of product design. For another example, in the process of material procurement, enterprise managers can adopt the methods of centralized procurement, joint procurement, and establishing good long-term cooperative relationship with suppliers to work out the cost range. Purchasing personnel who purchase within this scope are rewarded if they can ensure quality and save costs within the scope. It can reduce the cost of material procurement. The internal personnel of the enterprise should clearly realize that cost control is not only the responsibility of the finance department. The production process of the product includes three stages of purchasing, producing and marketing, which involves all the departments in the enterprise. Each department should communicate and cooperate with each other while performing its duties, and participate in cost control.

Build the dynamic deployment platform of production facilities based on the characteristics of products

Organizational cost is often neglected in the traditional cost control. The organizational structure, process operation and function planning of an enterprise will remain stable within a certain period of time. However, the individual and diversified requirements of customers make intelligent manufacturing enterprises have to use a more flexible organization to make each unit highly coordinated and coordinated. Therefore, intelligent manufacturing enterprises can set up a dynamic deployment platform for production facilities to interact with the production process of the enterprise. Enterprises can deploy production plans, dynamically configure resources and optimize production facilities according to different requirements of customers. While satisfying the individual needs of customers, it also reduces the organization cost, improves the utilization rate of the production equipment and the economic benefit of the enterprise.

Adopt the strategic control mode of environmental cost to reduce environmental cost

Intelligent manufacturing enterprises usually adopt the way of terminal governance, but the cost is often the highest, which is not conducive to the cost control of enterprises. Environmental costs can be divided into control costs and damage costs. Cost control refers to the cost that occurs beforehand. It is the cost that the enterprise expends in advance to reduce environmental pollution. Damage cost is the cost in the event and the cost after the event. The sum of control costs and damage costs is environmental costs. Theoretically speaking, when the level of enterprise pollution control rises, the cost of control increases, and the cost of damage decreases. However, in the model of strategic control of environmental cost, they can decrease simultaneously. Damage costs could even be reduced to zero, and it can achieve zero emissions and minimize the environmental cost of business (Li Ting, 2016). The strategic control of environmental cost requires intelligent manufacturing enterprises to adopt the method of strategic cost control when evaluating environmental cost accounting, analyze the relevant factors affecting environmental pollution, and take preventive measures to control environmental pollution before it, such as choose renewable materials when purchasing, use environment-friendly intelligent equipment and conduct clean production when producing, choose non-toxic and harmless packaging materials and reduce packaging waste when selling and so on. At the same time of utilizing resources efficiently and reducing waste discharge, the balanced role of ecosystem can be obtained, the contents of environment and economic benefit of enterprises are improved, and the development mode of ecological economy is set up step by step.

Integration of lean production and target cost method to achieve dynamic cost management

Intelligent cost management requires that the cost information can reflect the data of all stages of the whole production process and provide scientific and objective and sufficient decision basis for the intelligent manufacturing industry. Therefore, the cost management of intelligent manufacturing industry can not choose traditional cost accounting methods such as ABC activity-based costing method(Xu Qianying, 2018). Now we can combine lean production, network information and target cost method to realize dynamic cost management. Lean production, as a production process Optimization method, stems from Toyota's approach to manufacturing, which is based on the idea of producing what is needed on demand. It pursues zero inventory, quick reaction, harmonious unification of internal and external environment and humanism. Lean production with flexible characteristics is in line with the characteristics of small batch production of current intelligent manufacturing enterprises. It is the ideological route followed by enterprise management decisions and the method to guide specific work (Pan Yuxiang and Qi Ershi, 2018). An important part of lean production is lean cost management, which combines the lean thinking of enterprises and cost management activities. It is intelligent manufacturing itself (Feng Qiaogen, 2016). As a means of obtaining dynamic real-time information, IT makes full use of information technology, develops and uses information resources, and promotes information exchange and knowledge sharing. Intelligent manufacturing enterprises can use information to monitor and control cost dynamics in real time. It can improve its economic benefit. As the core of cost control, the goal of target cost method is to design the cost of product in the development and design stage of the product life cycle, and to realize cost control at the source, rather than trying to reduce the cost in the manufacturing process. Manufacturing enterprises should collect and study relevant information in the market before designing their products, analyze the actual prices and customer groups of similar products in a comprehensive and systematic way and accurately locate new products and related market prices. The actual target cost of the product is obtained by subtracting the market price from the expected profit. Objective costing emphasizes the sustainability of cost reduction. Intelligent manufacturing enterprises integrate should lean production, informatization and target cost method. They should design target cost and use information system to real-time monitor and reflect cost information in the process of fine production. It can realize dynamic cost management and strictly control product cost.

Speeding up the Development of Software system and constructing Cloud Accounting platform

In the process of intelligent development, manufacturing enterprises make full use of hardware facilities to replace manual production, but they ignore the development of software system. Cloud accounting as a high efficiency, low cost, easy to update and maintain, easy to cooperate with the external information system accounting information model, can provide effective technical support for the cost control of enterprises under the era of big data. The advantage of cloud accounting in big data era lies in perfecting the enterprise cost control system, strengthening the key control point of enterprise cost and shortening the period of enterprise cost calculation(Chen Ping and Zhang Lu, 2015). Based on cloud accounting platform, we can obtain, screen and mine, process, analyze and use all kinds of data related to cost, and we can provide more accurate, timely and comprehensive information for management. Ensure more accurate, timely and effective cost control in production and operation.

V. Conclusion

In the new era of advocating "intelligent manufacturing", the manufacturing industry, as the main body of the national economy, has joined the ranks of "intelligent manufacturing" one after another. Enterprises fully meet the personalized and customized needs of customers and strive to occupy a place in the competitive market environment. While studying how to speed up the intelligent manufacturing enterprises, scholars can not ignore that the cost structure of manufacturing enterprises has changed greatly in the process of transition from traditional manufacturing to intelligent manufacturing, which will inevitably lead to the change of cost control methods. With the development of the fourth industrial revolution, intelligent manufacturing enterprises should combine their own characteristics and take into account the use of intelligent hardware equipment and software systems. They should innovate on cost control, and improve the economic benefits of enterprises. This way is conducive to the continuous development and expansion of enterprises in the fierce market competition environment.

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