Research on Optimization of Manufacturing Resource Allocation in China from the Perspective of Economics

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Abstract. Manufacturing industry is the material basis of national economy and the main body of industrialization. Highly developed manufacturing industry is a necessary condition for industrialization and an important symbol of a country's comprehensive competitiveness. The inter-manufacturing effect emphasizes the static resource allocation between manufacturing industries, while the entry and exit of manufacturing industries emphasize the process of dynamic resource allocation between manufacturing industries. The previous literature on environmental regulation paid more attention to the influence of environmental regulation on the technological progress of manufacturing industry, and the research on the resource allocation effect of environmental regulation was insufficient, and even less on the dynamic resource allocation effect of manufacturing industry. In this regard, this paper optimizes the allocation of manufacturing resources in China from the perspective of economics, and the rapid economic growth will also provide opportunities for the leap-forward development of productive forces. Under the condition of not affecting the current production plan and production state, the manufacturing industry can optimize the use of idle resources of its own manufacturing units and integrate the superior resources of external manufacturing units to manufacture complex products that meet the requirements of users with faster speed, better quality and lower cost, so as to win the market.

Keywords: Economics, China's manufacturing industry, Resource allocation optimization

1. Introduction

With the continuous integration of high-tech and manufacturing technologies represented by computer technology, network technology, communication technology, software engineering, database technology, information technology and artificial intelligence, distributed computing environment, and open system architecture, modern manufacturing industry is undergoing profound changes. Modern advanced manufacturing models are showing a trend of networking, informatization, integration, intelligence, flexibility, and agility. The manufacturing industry is the material foundation of the national economy and the main body of industrialization. A highly developed manufacturing industry is a necessary condition for achieving industrialization and an important symbol of a country's comprehensive competitiveness [1]. The inter manufacturing effect emphasizes the static resource allocation between manufacturing industries, while the entry and exit of manufacturing emphasize the dynamic resource allocation process between manufacturing industries. Previous literature on environmental regulation has focused more on the impact of environmental regulation on technological progress in the manufacturing industry, with relatively insufficient research on the resource allocation effects of environmental regulation, and even less research on the dynamic resource allocation effects in the manufacturing industry [2-3]. In this regard, this article optimizes the allocation of resources in China's manufacturing industry from an economic perspective, and the rapid economic growth will also provide opportunities for leapfrog development of productivity. At present, China has formed a huge industrial production capacity, especially in the manufacturing industry. 'Made in China' has become one of the most important global economic phenomena. The differential impact on the entry and exit of different productivity manufacturing industries clearly demonstrates the dynamic resource allocation process of resource flow from low productivity manufacturing to high productivity manufacturing, enriching and expanding the research on the mechanism of resource allocation effects in economics manufacturing industry [4]. In the field of economics, pursuing the maximization of one's own interests is anyone's choice. Any decision

made based on subjective will in order to achieve "maximization" is called "rational" behavior. However, in reality, the situation is complex and ever-changing, and there is the fact of information asymmetry, which makes it difficult for participants in economic activities to make rational decisions. Enable the manufacturing industry to optimize the utilization of idle resources in its own manufacturing units, integrate advantageous resources from external manufacturing units, and manufacture complex products that meet user requirements at a faster speed, better quality, and lower cost without affecting the current production plan and production status, thus enabling the manufacturing industry to win the market[5].

2. Analysis on Resource Allocation of Manufacturing Industry in China

2.1. Demand for optimal allocation of manufacturing resources

After years of construction, China's aero-engine industry has a certain foundation in terms of digital collaborative manufacturing in different places. For example, AVIC I has built Jinhang Network and AVIC II has built Xinghang Network. In this way, major domestic aero-engine design institutes, specialized manufacturing enterprises and some universities are connected through these industry network platforms, laying a foundation for collaborative manufacturing in different places in the industry [6]. With the increase of the number of enterprises, the competition among enterprises is intensified, and the profit space of enterprises is gradually compressed until it disappears. Some enterprises will choose to move out to avoid losses, and the concentration trend of enterprises will be reversed. Therefore, the new generation of information technology industry departments create and transmit information, and the spatial distribution of information affects the spatial distribution of enterprises and indirectly determines the profitability of micro-subjects, while the formation and development of manufacturing agglomeration is actually closely related to the profitability of micro-subjects. However, at present, there is no software system for optimizing the allocation of resources to support collaborative manufacturing in different places in the domestic engine industry, which makes the allocation of manufacturing tasks and the allocation of manufacturing resources seem to be blind and based on experience, with low efficiency [7]. Then the enterprise will enter the research and development technology into the production process without interrupting the original production process of the enterprise. However, if we carry out market innovation, input innovation and organizational innovation, we need to make adjustments in this process. Generally, manufacturing enterprises will carry out technological innovation as well as other aspects of innovation. Therefore, in order to improve the development and production efficiency of key components of aero-engines, the manufacturing resources distributed in scientific research institutes and main engine plants all over the country are rationally optimized and allocated through network technology, and extensive cooperation is carried out by using their resource advantages and technical advantages [8].

2.2. Analysis of Manufacturing Resource Allocation Characteristics

The manufacturing task object targeted is the manufacturing and processing stage of complex parts, which can be as large as representing the processing of the entire part or as small as representing the processing configuration of a certain process. The ultimate goal of the manufacturing unit in a network environment is to form a processing route based on the complex part process flow, composed of multiple physical manufacturing units, and supporting remote collaborative production [9]. The optimization allocation of manufacturing resources is different from traditional optimization allocation of manufacturing resources, mainly reflected in the following aspects:

① The range of selected objects is different

Manufacturing resources are not limited to this manufacturing unit, this workshop, or this enterprise, but can be manufacturing resources from other places. The manufacturing resources of the latter are only limited to a small range within this enterprise, this workshop, or even this manufacturing unit.

② Different granularity of tasks

Manufacturing tasks generally involve the processing of product components and parts. Manufacturing tasks are generally larger and have relatively coarse particle sizes, while the latter typically involve processes and steps. Manufacturing tasks are generally smaller and have relatively detailed particle sizes.

③ Different ways to optimize configuration

On the basis of network resource pre selection and bidding, optimization and configuration are carried out, which generally only uses certain optimization algorithms for resource scheduling and optimization configuration in the workshop.

Each feasible equipment resource allocation plan has different factors such as processing cost, processing time, and processing quality during the part production process. Due to the relative independence between each group of schemes, the combination of each optimization scheme is an optimized configuration scheme for the parts. In the set of machine tool equipment, the machining center can complete several processing steps, while ordinary machine tools often can only achieve one or a few processing steps [10].

3. Method and process of manufacturing resource allocation modeling

3.1. Optimal allocation and reconstruction of resources in the whole production cycle

The manufacturing market is gradually moving towards globalization, and the product characteristics have changed from single and standardized to customized and personalized, and the product manufacturing has changed from batch production to single-piece and small-batch production. All these require the manufacturing industry to have the ability to quickly respond to changes in the external environment, and the agile processing route based on the optimal allocation of manufacturing resources is a rapid integration of global manufacturing resources, which can respond to the market in time and has strong agility. On the premise of meeting the technical requirements, the resource allocation scheme should consider the requirements of cost, time and quality in the whole production cycle, in which the cost includes the production cost of parts in each production cycle and the cost of updating and reconstructing equipment resources between two adjacent production cycles. If there are multiple production cycles, theoretically, it is necessary to find out all feasible resource allocation schemes in each cycle, calculate the cost of each allocation scheme and the reconstruction cost between every two schemes in two adjacent cycles, and then use dynamic programming and other methods to find an optimal resource allocation scheme for the whole production cycle. As shown in Figure 1.

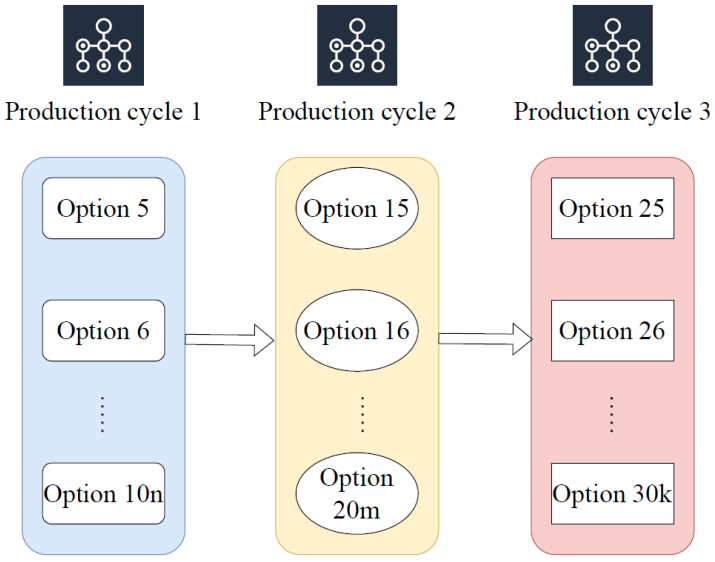

Figure 1. Dynamic programming of Resource Allocation Scheme

Each cycle has several options, and each option has its own cost. The directed arc between the options in adjacent cycles represents the reconstruction path and cost between them. Obviously, this method is cumbersome and not practical. For the existing equipment of the enterprise, its usage and depreciation expenses should be considered in the production cost. The sum of the optimal configuration configurations within each production cycle is the optimal reconstruction strategy for the entire production cycle. However, considering the cost of refactoring, the above design may not necessarily hold true. Because the reconstruction cost between two production cycles is related to the resource allocation of these two cycles.

3.2. Optimization of manufacturing resource allocation based on economics

In addition to the cost, when selecting the resource allocation scheme, many factors such as processing time, reconstruction time, product quality and equipment failure rate should be considered comprehensively. It is set up for the collaborative manufacturing process of specific parts in different places. Market and product are prerequisites for the existence of agile processing route. According to the dynamic changes of market and product, agile processing route also changes dynamically, and according to the new market and product opportunities, a new agile processing route is formed by optimizing the allocation of resources again. Economics believes that policy inaction is the best government, and the role of market price mechanism will make economic operation balanced and stable. If the government takes measures to intervene in the market, it will destroy the normal operation of the economy. However, the actual development involves a wide range, and the government needs to pay attention to multiple issues such as people's livelihood, politics and environment. Many policies and systems will inevitably affect economic development, and the market is not simply in a state of anarchy and freedom. Therefore, according to different production requirements, this paper uses economics to select the optimal and a few suboptimal resource allocation schemes in each production cycle, that is, to reduce the number of schemes to be considered, and then consider the reconstruction cost between these configurations, so as to quickly choose an optimized resource allocation strategy. Through the above analysis, this paper constructs the process model of optimal allocation of manufacturing resources as shown in Figure 2.

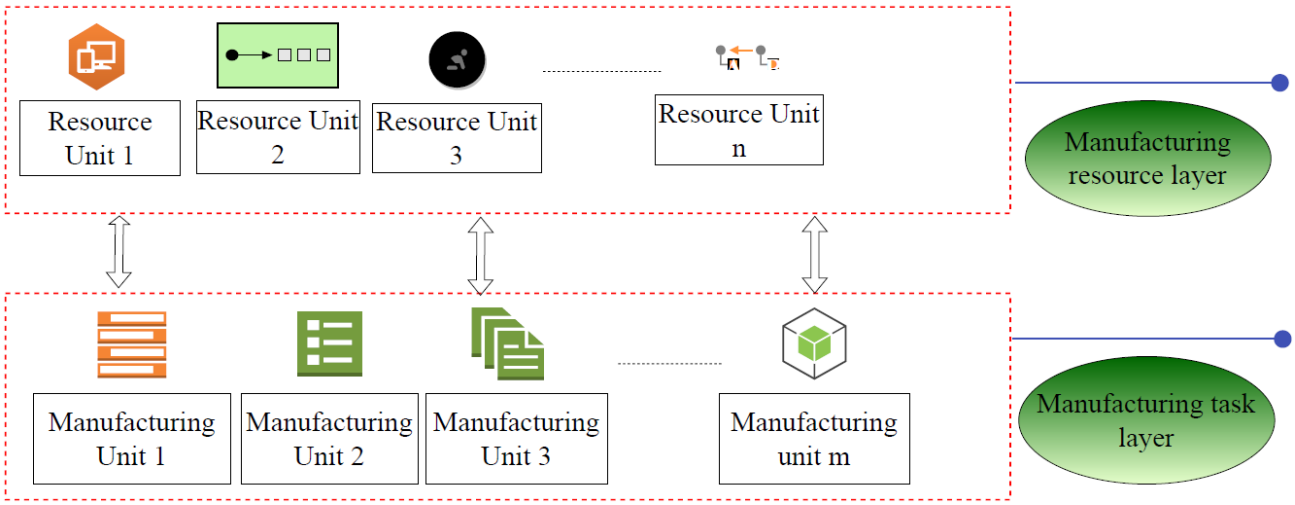

Figure 2. Manufacturing Resource Optimization Configuration Process Model

On the basis of the economic school, it is proposed that the market can be cleared, Aggregate supply is more important than total demand, and the government's intervention policy is invalid. Although New Keynesianism also recognizes Rational expectations, it believes that due to the existence of price and wage stickiness, the market cannot be cleared quickly, and the policy of active government intervention is effective. Using quantitative indicators such as shortest processing time, lowest processing cost, and optimal processing quality as constraints, the process of selecting the optimal executable processing route from numerous executable processing routes using certain optimization methods, and generating agile processing routes. There are many device resource

allocation schemes, and when generating a polychromatic graph, some technical requirements and empirical rules should be adopted as much as possible to reduce the complexity of the polychromatic graph and the number of reachable paths. This process is also known as the optimization process. The traditional processing route can be defined as a sequence of equipment groups that a part passes through during the manufacturing process. Each equipment group completes a certain batch of parts in the process. The dynamic alliance of manufacturing enterprises can be seen as a collaborative manufacturing process involving multiple manufacturing enterprises. From an economic perspective, each member manufacturing enterprise completes the corresponding component optimization.

4. Conclusions

To sum up, the unreasonable investment in science and technology in many industries is more serious, and the problem of inefficient technology is more prominent. The overall allocation level is high, and the allocation of scientific and technological resources in different industries is very different. In this regard, this paper optimizes the allocation of manufacturing resources in China from the perspective of economics. The enterprise will put the research and development technology into the production process without interrupting the original production process of the enterprise. However, if we carry out market innovation, input innovation and organizational innovation, we need to make adjustments in this process. Generally, manufacturing enterprises will carry out technological innovation as well as other aspects of innovation. Because each group of schemes is relatively independent, the combination of each group of optimization schemes is an optimal configuration scheme of parts. In the collection of machine tools and equipment, the machining center can complete several processes, while ordinary machine tools can only realize one or a few processes. This paper will promote the technological innovation mode of "production, learning and research" integration under economics, and set up a joint transaction structure of technology, finance and property rights. The government should play its leading role and provide various preferential policies such as finance, taxation and investment for the combination of "production, learning and research". This paper analyzes the variation of enterprise behavior and its influence on market operation performance from the variation of enterprise internal property rights system and organizational structure.

References

[1] Lei-Lei L I, Dan S, Economics S O,et al.Local Environmental Legislation and Optimization of Industrial Resources Allocation Efficiency in China's Manufacturing Industry[J].China Industrial Economics, 2022, 44(14):46-55.

[2] Zhou B, Bao J, Li J,et al.A novel knowledge graph-based optimization approach for resource allocation in discrete manufacturing workshops[J].Robotics and Computer-Integrated Manufacturing, 2021, 71(3):10-20.

[3] Xin-Yu Z, Xiao-Hua T, Shuai Z,et al.Study on Adjustment and Optimization of Manufacturing Industry Structure under Multi-Constraint of Environment, Economy and Employment —— Taking Northeast China as an Example[J].Reform of Economic System, 2019, 58(20):46-58.

[4] Dan M, Shu-Jie Y, Economics S O,et al.Research on the Mode of Industrial Chain Integration to Promote Manufacturing Industry Transformation and Upgrading in Western China —— Concurrently Discussing the Transformation and Upgrading of Yunnan's Manufacturing Industry[J].Academic Exploration, 2019, 61(12):45-69.

[5] Xuan J, Yi Z, Economics S O.The Choice Standard of Advanced Manufacturing Industry and the Development Path of Building a Powerful Manufacturing Country[J].Theoretical Investigation, 2022, 38(14):26-44.

[6] Hua S, Zhihao Z, Economics S O,et al.Research on the Influencing Factors of Value Chain Rising in China's Manufacturing Industry —— Empirical Analysis Based on Foreign Industry Transfer[J].Journal of Industrial Technological Economics, 2019, 46(12):36-55.

[7] Hong G, Economics S O, University F.Spatial Distribution and Determinants of China's Manufacturing Industry:Globalization,Economic Agglomeration and Economic Policy[J].Business Economic Review, 2019, 33(14):20-51.

[8] Shengqi Z, Qiaoling S, Economics S O,et al.Estimation and International Comparison of Investment Rate of Service Industry in China's Manufacturing Industry[J].Statistics & Decision, 2021, 30(10):46-62.

[9] Liangyu J, Business S O.Impact of Technological Innovation on Upgrading of China's Manufacturing Industry Structure:Based on Adjustment of Financing Constraint[J].Technology Economics, 2022, 15(4):22-36.

[10] Dan S, Cheng Z, Economics S O,et al.Systematic Optimization of China's Manufacturing Industrial Structure[J].China Economist: English Edition., 2018, 13(6):15-22.