

Lean Management Analysis of Iron and Steel Enterprises under the Supply-side Reform

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Abstract: In recent years, China's iron and steel industry has confronted serious overcapacity losses, which has made the entire industry suffer serious losses. Through "Digital Economy Laboratory Economics Comprehensive Simulation Experiment", this paper studies and analyzes the macro and micro data in the experiment as well as the competition game of upstream and downstream enterprises. At the same time, it establishes a value chain model for iron and steel enterprises and optimizes every link of the value chain of iron and steel enterprises through lean management, so as to achieve the goal of reducing cost and increasing efficiency. Taking Shagang as an example, this paper provides the useful reference for iron and steel enterprises in the supply-side reform, and helps to promote the transformation and upgrading of the steel industry.

1. Introduction

1.1. Research Background

1.1.1. "Overcapacity" has Left the Steel Industry in Trouble

As the cornerstone of China's national economic development, the steel industry is more than important for the stable development of the real economy. Since 2012, China's steel industry has confronted a serious problem of overcapacity, with its steel industry enterprises falling sharply from 2016 to 2018. With the completion of the industrial structure optimization, the industrial enterprises showed a minor rebound in 2021. In the first half of 2022, steel demand has not performed as well as expected due to the weak property market and the interference of the epidemic. Steel price fluctuation range compared to the 2021 year has narrowed, but the trend of twists and turns, the price of the entire year is still falling sharply.

1.1.2. The Introduction of National Policies Has Helped the Development of the Steel Industry

In 2016, the National Development and Reform Commission issued the Plan for the Adjustment and Upgrading of the Iron and Steel Industry, requiring the reduction of production capacity, reduced enterprises, increased market concentration and the adjustment of supply and demand

structure. Party and state leaders have also clarified the importance and implementation direction of supply-side reform. In 2020 and 2021, Political Bureau of the Central Committee of the Communist Party of China also emphasized deepening the supply-side reform and coordinating the supply-side reform and demand-side management^[1].

1.2. Study Significance

Supply-side structural reform aims to promote economic development. By optimizing the supply structure and improving the quality and efficiency, enterprises adopt lean management and other measures to adapt to the reform background and improve operating efficiency.

Supply-side structural reform is an important decision made by China's current economic situation and development demand. In the background of supply-side reform, iron and steel enterprises need to take the initiative to adapt to the reform requirements, comprehensively optimize the production mode of enterprises, carefully manage each operation process, in order to improve the core competitiveness of enterprises, which is of practical significance for iron and steel enterprises to achieve cost reduction and efficiency increase^[2].

2. Data Analysis of the Simulation Platform

2.1. Experimental Background

This experiment is an "economics comprehensive game experiment competition". The experiment consists of twenty groups forming a market, including five automobile enterprises, ten home appliance enterprises and five iron and steel enterprises. Steel manufacturers, as suppliers, produce steel to home appliances and auto manufacturers. Enterprises need to grasp the overall micro situation and determine the maximization of benefits from macro operation experiments during the business process. This article analyzes the simulation experimental data of iron and steel enterprises based on the participation roles of seven years of operation.

2.2. Value Chain Model Analysis

2.2.1. Horizontal Value Chain

Horizontal value chain refers to the relationship between the enterprise and the competitors in the competitive environment, and the enterprise can grasp the pricing through the horizontal value chain. In the experiment, there are domestic and foreign competitors in the horizontal value chain of the steel industry, while there are only domestic competitors in the home appliance and automobile industry.

Take the data of the experimental 2 years as an example, the supply of steel is 210,000 tons, and the demand for steel is 97,000 tons, the supply far exceeds the demand. In this case, the main competitors of iron and steel enterprises are domestic iron and steel enterprises. When negotiating prices with automobile and home appliance enterprises, we first list a small amount of steel to observe the market psychological price. If the demand side and other suppliers accept this price, sell the inventory steel recovery funds at a higher price as soon as possible, or adjust the sale price appropriately without loss. In the experiment, the domestic steel supply is limited, and the foreign steel supply is unlimited, the steel market is oversupply situation. However, in the sixth year of the experiment, foreign steel caused a great impact on the domestic steel industry. In the case of increasing cost, the domestic steel price was gradually close to the price of imported steel.

As the spot price of imported steel is affected by the number of listed steel, we take the way of

cascade listing for pricing. Reference imported steel spot price of 85 million yuan / ten thousand tons and historical orders, we have the following listing strategy: 10000 tons of steel listed price is 84 million yuan, 11000-14000 tons of steel listed price is 83 million yuan, 15000-29000 tons of steel listed price is 82 million yuan, 30000 tons of steel listed price is 81 million yuan. We should make an appropriate adjustment, according to the output of different quantities of steel combination, and combined with the price of other iron and steel enterprises.

2.2.2. Vertical value chain analysis

Vertical value chain refers to internal logistics, production operations, external logistics and market sales. Iron and steel enterprises control costs through the vertical value chain, and rely on upstream suppliers to provide iron powder. After value-added activities in the internal value chain, they finally sell steel to downstream home appliances and automobile enterprises.

(1) Internal Logistics

Internal logistics is to manage procurement through the development of accurate procurement plan and inventory management, the experiment of iron essence powder bidding and management costs.

In terms of iron powder bidding, the cost of steel production is directly affected by the price of iron powder, so it is necessary to estimate the purchase cost of iron powder. In the bidding process, the price and time are the key factors affecting the bidding results. Under the premise of the early submission time, the appropriate quotation of the required quantity of iron essence powder should be considered. According to the experimental rules, the total supply of iron powder is affected by the average price, and increasing the quotation can improve the chance of obtaining the quantity of iron powder needed.

When this group does not get enough quantity of iron powder, we should take the calendar price of iron powder as the reference price of pricing. The error in the first round of bidding often leads to the unit price of the second round of bidding is always higher than that of the first round, so it is necessary to raise the price of the first round of bidding in order to successfully obtain the number of iron essence powder needed.

In terms of administrative expenses, the analysis of the annual income statement of each enterprise finds that the high proportion of administrative expenses will lead to the negative net profit in this year. Experimental provisions: management cost = management cost (20 million yuan in the first year, 15 million yuan in the future) + inventory cost * 5% + unused labor wage + production line clearance fee. In the management cost, the management cost is always fixed and there is no labor surplus, so the cost can be controlled by controlling the inventory management and production line management.

In terms of inventory management, automobile and home appliance manufacturers are easier to achieve "zero inventory management". Due to the existence of steel reservation link, steel companies have to bear higher storage costs. We should abide by the principle of "supply on demand and distribution according to price", determine the quantity of production according to the market demand, and adjust the supply according to the increase of the order price of automobiles and home appliances and the listing of the steel price.

In terms of production line management, the production capacity of the production line decreases as the production time increases. In order to cope with this situation, we considered the two operation modes of sale and reconstruction and renovation, and according to the comparison of long and short term benefits, we finally chose to sell and rebuild. In the short term, the renovation must be operated before production, which cannot be produced this year, but still have to bear the depreciation cost of the production line. Although the renovation can increase the production capacity, since the production line is idle for the whole year, the profit during the operation period.

In contrast, the sale and reconstruction only requires a certain fee after the production of the current year, and the production capacity of the next year can be restored. In the long run, with the same capacity coefficient, production year, labor and overtime pay, the maximum capacity for renovation was 420,000 tons in the fifth year, while the maximum capacity under construction was 430,000 tons sold in the fourth year. Therefore, we chose to sell and rebuild the production line.

(2) Production Operations

Enterprises need to formulate appropriate strategic planning, and determine the management system of production links, in the experiment of iron and steel enterprises to conduct production planning and labor bidding to complete the decision.

In labor bidding, the experiment stipulates: $\text{labor cost} = \text{wages} * \text{the number of people required} + \text{overtime pay}$; as the average wage increases, the total labor supply increases. Considering the annual salary of the first year of 120,000 yuan, considering the increase of orders and the decrease of production capacity in the second year, we decided to raise the salary quotation of the second year to 130,000 yuan / year / person. Capacity is affected by wage levels and labor skills. The higher wages and labor skills, the higher the capacity coefficient will be. As the price rises, the capacity coefficient increases, and only the average price and the overtime pay can meet the production demand.

(3) External Logistics

External logistics mainly includes the development of corresponding product planning solutions, the final formation and delivery of products, and the processing of loan and land purchase plans. In the experiment, it refers to commercial loan bidding, land bidding, and order delivery.

Commercial loans and land for land are closely linked to government measures. Low-interest loans can boost business expansion and investment, and new land supplied by the government provides opportunities for businesses. When the government adopts expansion policies, most enterprises choose to set up double lines and subsidiaries to improve the production efficiency and the efficiency of scale.

In terms of loan management, the experiment stipulates that: $\text{loan amount} = \text{cash- (iron fine powder purchase} + \text{labor cost} + \text{land cost} + \text{management cost} + \text{loan due repayment} + \text{interest)}$. Loan management is the key to ensure that business loans are used properly and effectively. By controlling the loan amount, making a production plan and grasping the cash, it can predict and plan the capital demand to avoid problems such as capital flow and usury; strengthening the management of cash flow helps to grasp the use of funds and ensure that the loan interest is within the bearing range.

In terms of land bidding, macro policy factors such as interest rates, tax rates and the land supply should be considered for the expansion of production lines. The loan amount and the order bidding are also an important basis for judging the land competition: From the perspective of loan, the enterprise can directly evaluate the capital conditions needed for land bidding; From the order bidding, it can directly evaluate whether the enterprise has the land bidding intention. All industries that need to bid for 100-200 mu of land need supporting funds of 205 million yuan. Under normal circumstances, enterprises usually only need to bid for 100-200 mu of land. According to the loan situation and capital conditions, we can judge which enterprises have the capital conditions for bidding for land, and adjust the land quotation accordingly.

(4) Market Sales

Market sales mainly include the market forecast, market management and pricing sales, in the experiment middle iron and steel enterprises spot, scheduled matchmaking.

Steel companies can presell steel to meet customers' steel needs the next year and control costs. Similar to the divergent cobweb model, steel companies will sell the products they made that year for the next year. This strategy can help iron and steel enterprises to accelerate the capital turnover,

improve the utilization rate of capital, reduce the loan pressure, and quickly seize the market, help to improve the competitiveness and the operating efficiency of enterprises^[3].

3. Practice and Effectiveness of Jiangsu Shagang Group in the Supply-side Reform

3.1. Basic Situation of Jiangsu Shagang Group

Jiangsu Shagang Group is a large steel company in China, founded in 1975, headquartered in Zhangjiagang city, Jiangsu Province. The group is mainly engaged in steel production, processing and sales business, products including steel, coke, coal and so on. As an important enterprise in China's iron and steel industry, Jiangsu Shagang Group has a complete link in the industrial chain, including mining, ironmaking, steelmaking, steel rolling and so on.

3.2. Practice of Supply-side Reform of Jiangsu Shagang Group

3.2.1. "Capacity Reduction"

In the steel industry, the supply-side reform to reduce capacity reflects the reduction of floor steel capacity. In 2010, it began to implement the task of cutting capacity in advance, and reduce the output of floor steel. As the country launched a comprehensive supply-side reform task in 2016, Shagang Group has basically completed the internal capacity reduction target, increasing from the original 4.785 million tons in 2011 to 4.988 million tons in 2016. Starting from 2017, Shagang Group further reduced the production of strip steel through the merger of several steel mills, until 2022, the volume of strip steel reached 6.399 million tons.(Source: World steel statistics per year). The above data shows that Shagang Group has actively responded to the national capacity reduction policy and has taken measures to reduce the production of floor steel.

3.2.2. "Deleveraging"

Although under the financial crisis environment, China's steel industry has been greatly affected, the asset-liability ratio of Shagang Group has shown a gradual downward trend. In the 12 years from 2011 to 2022, the asset-liability ratio plummeted from 52.41% to 41.91%, and reached a record low of 34.64% in 2018 (data source: Oriental Wealth).

The negative assets of Shagang Group showed a downward trend, mainly through the debt transfer in advance. After signing a contract with other steel mills, the company transferred part of the debt to other institutions, thus reducing the company's debt burden. This transfer has gradually improved the company's debt situation, which in turn has improved the company's operating conditions.

3.2.3. "Destocking"

Over the years, Shagang Group has learned from the experience of excellent companies in the industry, constantly summarized, and carried out a series of innovative work in the management of accessories and accessories. The Group's inventory is continuously reduced to achieve the role of improving quality, reducing inventory and costs, and strengthening core competitiveness.

3.2.4. "Cost reduction"

Shagang Group has taken a variety of measures to reduce costs and improve economic benefits. First of all, Shagang Group replaced the outsourcing team with independent maintenance personnel and successfully saved 20 million yuan of labor costs. Secondly, by exploiting potential and

improving efficiency, Shagang Group reduced the loss of resources and reduced the production cost per ton of steel by 15.13 yuan. Finally, Shagang Group invested in the construction of Jiulong Logistics Park and collaborated with 1800 companies. By reducing logistics costs and improving logistics efficiency, it finally achieved a GDP growth of 120 billion yuan for the whole year.

This series of fine operation management and saving measures, successfully implemented the task of cost reduction, and affected their own financial indicators.

3.2.5. "Making Up for Weakness"

Shagang Group actively takes measures in the supply-side reform. According to the capital structure and future development goals, the development strategy of developing high-end customers and producing high-value goods has been formulated. In 2016, the R & D expense of Shagang Group was 123 million yuan, which will be increasing every year. In 2022, the R & D expenditure will increase to 545 million yuan (data source: company annual report). At the same time, by increasing the added value of products, it can increase sales and profits, enhance the company's core capabilities, and better adapt to market demand^[4].

4. Countermeasures and Suggestions to Promote Lean Management under the Background of the Supply-side Reform

4.1. Government Perspective

4.1.1. Implement Comprehensive Tax Support Policies to Reduce the Tax Burden of Enterprises

The government can consider formulating targeted tax preferential policies for different types of enterprises to ensure that they receive tax support specific to their category. More tax deductions or larger reduction rates can be given to innovative enterprises, small and micro enterprises, and green enterprises. For more mature enterprises, longer-term tax preferential policies can be provided to encourage their sustained development and innovation.

4.1.2. Encourage Innovation of Financial Products and Broadens Financing Channels for Enterprises

The government can introduce financial innovation policies to encourage financial institutions to launch new financing products and services, lower financing thresholds, and meet the diversified financing needs of enterprises. The government should encourage traditional financial institutions to provide financial services to small and medium-sized enterprises, simplify approval procedures, provide incentive measures such as loan risk compensation, and promote the development of financial products specifically targeting small and medium-sized enterprises. The government should also encourage non bank financial institutions to innovate financial products and services, and provide more financing channels and flexible financing methods for enterprises by conducting supply chain finance, small and micro enterprise financing, and other businesses.

4.1.3. Formulate Industrial Policies and Plans to Strengthen the Supervision and Service of Lean Management of Enterprises

The government can formulate industrial policies and plans, clearly support and encourage enterprises to carry out lean management, such as financial subsidies and special funds, and also set up demonstration enterprises to guide other enterprises to learn and learn from lean management

experience. At the same time, the government can set up special agencies or departments, establish industry standards and certification systems, supervise and evaluate the implementation of lean management of enterprises, and improve the management level of the whole industry.

4.2. Enterprise Perspective

4.2.1. Actively Participate in the Government's Supply-side Reform Policies and Projects, and Strive for the Support and Resources of the Government

Enterprises pay attention to the supply-side reform policies and projects issued by the government, understand the policy direction and key areas of the government, adjust their development strategy according to the policy guidance of the government, and incorporate lean management into the important agenda of enterprise development. Through government symposiums and seminars, companies can express their needs and opinions to the government and learn about the government's policy trends and resource allocation.

4.2.2. Formulate Lean Management Strategy, Establish Lean Management System and Improve the Supply Chain Management and Production and Operation Process

When developing a lean management strategy, they first need to clarify their goals and priorities, including optimizing resource utilization, reducing costs and improving product quality. According to the overall strategy and market demand of the enterprise, the lean management objectives are clearly defined to ensure that the lean management is fully supported and promoted in the enterprise.

In the establishment of lean management system, we should improve the process and strengthen the supply chain management. Enterprises can use tools such as value flow charts to help identify waste in processes, and adopt lean tools to improve and standardize processes, such as 6 σ , 5S, Kaizen, etc. In terms of supply chain management, enterprises and suppliers can support each other and collaborative innovation to realize the full use of resources and the efficient operation of supply chain. At the same time, enterprises can use logistics technology and management means to reduce inventory, reduce logistics costs, and achieve more accurate order processing and instant delivery.

4.2.3. Strengthen the Publicity and Training of Lean Management Concept to Improve the Employees' Awareness and Understanding of Lean Management

Enterprises strengthen training employees in lean management knowledge and skills, including conducting training courses on lean management, inviting experts to give lectures and seminars, and providing online learning resources for learning how to apply lean tools and methods to improve workflow and improve efficiency. Enterprises should carry out internal publicity activities to promote employees' understanding of lean management through internal communication and knowledge sharing, and encourage employees to actively participate in and support the implementation of lean management.

4.2.4. Enhance the Credit Image and Comprehensive Strength of Enterprises

When financial institutions consider whether to provide loan support, they attach great importance to the overall strength and profitability of the enterprise. To gain the confidence of financial institutions, enterprises should strengthen financial management, demonstrate stable profitability, and repayment capacity. It is important to enhance overall strength by conveying confidence to financial institutions. Establishing a good credit image is essential - enterprises should

adhere to commercial credit and fulfill contractual obligations in their daily business activities. They should also maintain a good tax credit by paying taxes on time. Additionally, enterprises can actively establish cooperative relationships with financial institutions, providing timely and accurate financial information to enhance their understanding and trust.

4.2.5. Change Their Innovative Thinking, Emphasize Innovation-led and Technology-driven Guidance, and Actively Explore New Production Technologies and Management Methods

Enterprises can use automated production lines and intelligent machine technology to reduce their dependence on human resources. That is, by streamlining the staff, optimizing the work process and improving the skills of employees, improve labor productivity and achieve a more efficient production process. At the same time, enterprises should also increase the investment in technological innovation, improve production efficiency and quality, and further reduce costs. In addition, the introduction of the Internet of Things, big data analysis and other technologies to realize real-time monitoring and data analysis of the production process, help enterprises to optimize production planning and resource allocation, and improve the transparency and controllability of the production process.

Enterprises should continue to improve and innovate lean management, reflect on problems, dare to challenge, take corresponding improvement measures, and promote the continuous development and innovation of lean management in continuous learning^[5].

5. Conclusion

This paper studies how to implement lean management through the value chain model in iron and steel enterprises under the background of supply-side reform. It is found that the supply-side reform puts forward new requirements for the operation mode and management mode of iron and steel enterprises, and it is necessary to shift to the lean management mode focusing on quality, efficiency and sustainable development. However, the implementation of lean management in iron and steel enterprises faces challenges, which requires the participation and joint efforts of all staff. In order to successfully implement lean management, iron and steel enterprises need to take a series of measures, such as scientific analysis of the market, strengthening the skills of employees, optimizing production and management processes.

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