Comparative Study on Industrial Concentration Degree of China, Japan, USA, Korea Steel Industry

Pian Feng¹, Yao Xue¹, Pang Shihua¹

¹School of Maritime Economics and Management Dalian Maritime University Dalian, China

Abstract. The steel industry is the basic industry of the national economy. This paper aims at the problems that the organization structure and scale efficiency of the steel industry in China are not completely reasonable. By analyzing the evolution data of the industrial concentration of China, Japan, the United States and South Korea, the steel industry can be optimized for China. The structure can learn from and learn from the experience and lessons. The results of the study show that: Steel companies should pay attention to clear market positioning and improve their own competitiveness, rather than blindly seeking to expand their scale; the increase in industrial concentration of the steel industry is the result of an objective choice to adapt to market competition, not the result of subjective decisions; the development of enterprises must have an international perspective, and attach importance to strategic cooperation with related industrial enterprises.

1 Introduction

Today's constantly changing environmental regulations and the control of fresh water consumption have put tremendous pressure on the world's steel industry [1]. China's share of crude steel production accounts for 53.3% of the world's total in 2019, making it the largest steel producer. From the perspective of EI, there is still a gap between China's steel industry and the world's advanced level, and China has great potential in energy saving [2]. The steel industry is a resource-intensive and capital-intensive industry, and its technical characteristics determine that economies of scale are the key to the efficiency and competitiveness of this industry [3]. At the same time, China can cooperate with the countries along the "Belt and Road" to develop international production capacity cooperation in the steel industry. This is a new opportunity for China's steel industry [4]. However, the current organizational structure of China's steel industry is not very reasonable, the industry concentration is not high, and enterprises decentralization, low level of socialization and specialization, lack of large enterprises that can lead the healthy development of the industry, which leads to prominent problems such as repeated construction, overcapacity, and vicious competition, and will have long-term overcapacity [5], hindering the transformation of China's industrial structure Upgrade and social management system reform. From the experience of developed countries, steel powers such as the United States, Japan and South Korea have basically formed an "oligopolistic" steel market structure. However, the development of China's steel industry is very different from that of other major steel powers. It is not appropriate to directly apply the steel industry concentration standards

of other steel powers to guide the optimization of China's steel industry organizational structure. This paper analyzes the research situation and evolution of industrial concentration in the steel industry in developed countries, based on China's national conditions, and draws lessons and lessons that can be used for reference in optimizing the organization structure of the steel industry in China, and strives to inherit and deepen the basis of previous research. In the above, it can provide certain reference and theoretical support for the country to formulate steel industry development policies. The data in this article comes from the corresponding years of "World Steel Statistics", "China Iron and Steel Industry Yearbook" and some corporate official websites. Unavailable data is replaced by the average value. For example, the crude steel output of AK Steel in the United States in 2018 was replaced by the average value obtained from the previous four years of crude steel output data.

2 The development of China's steel industry and the evolution of industrial concentration

2.1 Analysis of the development status of the iron and steel industry

China's crude steel output has continued to rank first in the world since 1996, reaching 928.3 million tons in 2018, an increase of 6.6% year-on-year, and its share in the world has increased from 50.3% in 2017 to 51.3% in 2018. , An increase of approximately 1.0 percentage point year-on-year. As of the end of 2018, the number of enterprises in China's steel industry was 5,138, a decrease of 3,407 compared with the previous year, and the effectiveness of

deleveraging continued to show. Statistics show that since 2006, the utilization rate of crude steel capacity in China has shown a downward trend, especially since 2012, the utilization rate of crude steel capacity has continued to be below a reasonable level. In 2015, China's crude steel capacity utilization rate was less than 67%, and after the supply-side structural reforms in 2016, the "three, one, one, one subsidy" was solidly promoted in 2017. The national industrial capacity utilization rate was 78.0%, an increase of 2.2 percentage points from 2017, the highest level in recent years. Although China's steel industry's short-term capacity reduction will cause unemployment, it can release idle factors, absorbed by other industries, promote the development of other industries, and promote the transformation and upgrading of the economic structure [6]. In 2017, China's iron and steel industry not only completed the task of reducing capacity by 50 million tons, but also completed the task of eliminating 140 million tons of "ground strip steel" on schedule. After two years of hard work, the country eliminated 110 million tons of backward production capacity. Shut down 722 intermediate frequency furnace manufacturers, involving 140 million tons of production capacity. In 2018, the steel production capacity was reduced by more than 30 million tons, optimizing the steel production capacity, especially the construction structure of steel production capacity. In fact, steel companies are basically producing at full capacity, with equipment utilization rates exceeding 80%. Since there is no severe excess pressure on crude steel production capacity, this basic balance between supply and demand is actually the basic condition that supports the future high fluctuations in steel market prices. Affected by the combination of supply-side structural adjustment, environmental protection inspection, and strong market demand, in 2018, China's steel industry's main business income was 7.65 trillion yuan, an increase of 13.8% year-on-year; profit was 470.4 billion yuan, an increase of 39.3% year-on-year. As of the end of 2018, the asset-liability ratio of key large and medium-sized steel companies was 65.02%, a year-on-year decrease of 2.6 percentage points. With the profound changes in the international

environment and the weakening of the marginal driving effect brought about by supply-side reforms, and the remaining problems such as insufficient production specialization and unbalanced product structure in the steel industry, the capacity utilization rate of China's steel industry should reach 80%. The best level is recognized, which shows that the task of China's steel industry is arduous.

2.2 Four stages of industrial concentration development

Figure 1 shows the crude steel output, growth rate and industrial concentration of China's steel industry from 1990 to 2018. As can be seen from the figure, crude steel production has maintained a growing momentum since the 1990s, with annual growth rates of more than 10% from 2001 to 2011, even in the difficult situation of the global economic downturn in 2008 A small increase was achieved.

It can be seen from the changes in the industrial production concentration (CR4 and CR8) of the four major and eight major manufacturers in the steel industry from 1990 to 2018 that the production concentration of the steel industry is generally not high, and its development and evolution can be divided into four stages. The first stage is from 1990 to 1997, during which the industrial concentration remained basically stable, CR4 and CR8 hovered around 30% and 45%, respectively. The second stage is from 1997 to 2004, during which the industry concentration is continuously decreasing. CR4 and CR8 decreased from 32.97% and 44.81% in 1998 to 17.86% and 28.60% in 2004. The third stage is from 2004 to 2011. The industrial concentration in this stage began to recover slowly. By 2011, CR4 and CR8 had risen to 28.41% and 47.35%, basically returning to the level of 1998. The fourth stage is from 2011 to 2018, during which the industry concentration has declined again. CR4 and CR8 decreased from 26.49% and 40.73% in 2012 to 20.51% and 36.90% in 2018.

Fig1. Schematic diagram of the evolution of China's industrial concentration from 1990 to 2018

2.3 Analysis of the reasons for changes in industry concentration

China's crude steel output maintained sustained growth from 1990 to 2014. After negative growth in 2015, it has continued to grow from 2016 to the present, while the industry concentration has followed four different stages of development. The main reasons for the different development characteristics of each stage of industrial concentration are as follows:

From 1990 to 1997, China's iron and steel industry was still in the initial stage of development, and the number of iron and steel enterprises basically remained at around 1,580. The increase in crude steel output relied on the expansion of existing iron and steel enterprises. Therefore, the industrial concentration at this stage has remained basically stable, with fluctuations within three percentage points. The reason for the increased concentration in 1998 was that Shanghai Baosteel jointly acquired several large state-owned enterprises and established Baosteel Group.

The reason for the sharp increase in concentration in 1998 was that Shanghai Baosteel Co., Ltd. jointly acquired several large state-owned enterprises and established Baosteel Group. After the Asian financial crisis in 1998, real estate development, urbanization and large-scale infrastructure construction generated a large demand for low-end steel products. The huge investment of steel enterprise projects can solve a large number of labor employment and create huge taxes and GDP. Governments at all levels have adopted policies to encourage investment and development of steel enterprises and failed to set reasonable market entry barriers for the steel industry. During the "Eleventh Five-Year" and "Twelfth Five-Year" periods, 19 provinces and cities successively established the iron and steel industry as the pillar industry for economic regional development [7]. The low-end steel production process is simple, the investment return period is short, and the market benefits are very obvious. With the support of the government, a large amount of capital has flowed into the steel industry. The number of steel companies has surged from 1078 in 1998 to 4992 in 2004. The number of companies has grown significantly faster than the growth of large-scale steel companies, and the industry concentration has declined significantly.

Both the "Steel Industry Development Policy" issued in July 2005 and the "Steel Industry Adjustment and Revitalization Plan" promulgated in March 2009 set high requirements on the scale and concentration of individual steel companies [8]. Under the influence of the national industrial policy, from 2006 to 2011, various provinces have reorganized and integrated their high-quality steel enterprise resources, and formed Shanghai Baosteel Group, Hebei Iron and Steel Group, Shandong Iron and Steel Group, Anben Group and Bohai Iron and Steel Group with annual crude steel output exceeding 20 million tons. In addition, private steel companies have also embarked on the road of scale expansion, forming large-scale steel companies such as Jiangsu Shagang Group and Hebei Xinwuan Iron and Steel Group. With the large-scale merger and reorganization of steel companies, the

concentration of the steel industry has increased significantly. It is worth noting that under the influence of the US financial crisis in 2008, although China's GDP growth rate fell by about 7 percentage points from 2007 to 2008, the concentration of the steel industry is still rising, but after the financial crisis, the capacity utilization rate reversed the characteristics of the cycle increase [9], which shows that the role of national industrial policy is significantly effective.

In 2012, the growth rate of crude steel production in China fell sharply, a year-on-year decrease of 6 percentage points, and the industrial concentration also declined slightly. In 2012, the growth rate of steel demand decreased significantly, and the oversupply situation in the steel market further intensified. Steel prices continued to decline in the first three quarters and remained low and volatile in the fourth quarter. In 2012, the price of steel (using the price of 25mm rebar in Beijing as the reference price) was 3,400 yuan / ton, a decrease of 16.26% compared with the same period last year. The average profit of steel companies producing tons of steel was less than one yuan. An effective market exit mechanism has not yet been formed in the steel industry, and many poorly managed steel companies cannot exit the market in a timely manner. Under such circumstances, China's large steel companies have reduced production to prevent losses, and small and medium-sized enterprises have to continue to expand production capacity to increase production in order to maintain income levels and meet the bank's requirements for financing qualifications [10]. In 2013, crude steel output returned to the previous level of rapid growth, with a growth rate of 12.44%. In 2014, China's measures to eliminate outdated production capacity and compress excess capacity began to bear fruit. The growth rate of crude steel output fell rapidly to 0.09%. The phenomenon of overcapacity has volatility in stages, so in the process of resolving overcapacity, industrial policies also have the characteristics of times and innovation [11]. In 2015, China's crude steel output showed a negative growth for the first time, a year-on-year decrease of approximately 2.27%. During this period, domestic key large and medium-sized steel companies have responded to the national policy of eliminating backward production capacity and compressing excess production capacity to achieve production reduction, thereby further reducing the concentration of China's crude steel output growth in the steel industry. 2016 became the first year of domestic capacity reduction, China's crude steel production began to grow slowly, an increase of 1.2% year-on-year. In 2016, the merger and reorganization of steel companies showed signs of speeding up. In September, Baosteel Group and Wuhan Iron and Steel Group implemented a joint reorganization. Baosteel Group changed its name to China Baowu Iron and Steel Group Co., Ltd. The whole group of Wuhan Iron and Steel Group was transferred into the company for free and became a wholly-owned subsidiary. The implementation of merger and reorganization actions significantly increased CR8 and CR20 in 2017. The deleveraging in 2017 benefited from the profit restoration of the steel industry and the implementation of debt-to-equity swaps, and achieved certain results, with a year-on-year increase of 5.7%. In 2018, we adhered to market-

based and rule-of-law methods to reduce production capacity, and the industrial concentration of the steel industry declined again.

3 Research on the development of industrial concentration of steel industry in Japan, the United States and South Korea

Iron and steel industry is the basic industry of national economy and the leading industry to speed up

industrialization. The comparative analysis of the relations and differences between the development of Chinese and foreign iron and steel industry is conducive to promoting the development of China's iron and steel industry. The development of China's iron and steel industry can reasonably learn from the relevant experience and lessons of developed countries according to its own specific reality. The annual crude steel production and industrial concentration of Japan, the United States and South Korea in 2000-2018 are shown in Table 1.

Table1. crude steel production and industrial concentration of Japan, the United States and South Korea in 2000-2018

Country	Index	Crude steel output/ 10000 tons	growth rate/%	CR1/%	CR2/%	CR3/%	CR4/%
Japan	2000	10644.4	13.0243	27.31	46.63	58.85	69.79
	2001	10286.6	-3.3614	26.34	45.99	58.95	70.32
	2002	10774.5	4.7431	28.64	43.98	56.72	67.68
	2003	11051.1	2.5672	28.32	55.65	67.23	73.84
	2004	11271.8	1.9971	27.87	55.48	66.42	73.23
	2005	11247.1	-0.2191	29.26	55.55	67.54	74.41
	2006	11622.6	3.3386	29.00	56.38	67.84	74.50
	2007	12020.3	3.4218	28.70	56.82	68.05	74.77
	2008	11873.9	-1.2179	31.06	59.53	71.22	78.05
	2009	8753.4	-26.2803	31.54	61.56	73.91	80.70
	2010	10959.9	25.2073	32.97	62.77	74.73	81.67
	2011	10760.1	-1.8230	33.59	62.83	74.82	81.90
	2012	10720.0	-0.3727	42.94	73.30	79.84	83.32
	2013	11059.5	0.0317	45.33	73.50	80.31	83.65
	2014	11066.6	0.0006	44.55	72.93	79.77	83.45
	2015	10513.4	-0.0500	44.11	72.48	79.63	83.26
	2016	10480.0	-0.0032	50.66	74.72	81.65	85.08
	2017	10470.0	-0.0010	45.23	74.03	81.42	82.34*
	2018	10430.0	-0.0038	47.19	75.14	82.34*	85.92*
U.S.A	2000	10180.3	5.9885	10.49	20.53	29.46	36.73
	2001	9010.4	-11.4918	14.24	26.64	35.48	42.12
	2002	9158.7	1.6459	15.78	29.27	38.14	44.08
	2003	9367.7	2.2820	19.11	35.97	47.29	53.05
	2004	9968.1	6.4093	20.90	38.86	44.48	47.64
	2005	9489.7	-4.7993	20.30	39.74	45.68	49.13
	2006	9855.7	3.8568	21.56	42.17	47.90	52.22
	2007	9810.2	-0.4617	20.94	41.37	47.36	52.41
	2008	9135.0	-6.8826	25.42	45.34	51.82	56.57
	2009	5819.6	-36.2934	26.17	47.96	54.33	59.87
	2010	8049.5	38.3171	27.65	48.23	54.61	60.15
	2011	8639.8	7.3334	25.76	44.93	50.87	55.81

	2012	8870.0	2.6644	24.18	44.49	50.00	55.35
	2013	8687.8	-0.0205	23.46	44.24	50.08	55.59
	2014	8817.4	0.0147	24.28	46.66	53.41	58.56
	2015	7884.5	-0.1058	24.88	43.30	51.13	56.38
	2016	7850.0	-0.0044	24.59	42.71	53.69	60.68
	2017	8160.0	0.0395	29.89	47.57	57.71	64.66
	2018	8660.0	0.0613	29.43	47.18	57.48	64.20*
	2000	4310.7	5.0365	66.07	79.96	85.48	88.45
	2001	4385.2	1.7283	65.22	80.43	86.40	89.41
	2002	4539.0	3.5073	63.58	79.73	85.79	88.76
	2003	4631.0	2.0269	62.41	77.95	84.11	87.15
	2004	4752.1	2.6150	65.34	82.01	88.26	91.26
	2005	4782.0	0.6292	65.70	82.79	88.52	91.41
	2006	4845.5	1.3279	64.39	82.80	88.72	91.59
	2007	5151.7	6.3193	63.63	82.98	88.67	91.39
	2008	5362.5	4.0919	64.71	83.10	88.41	90.98
South Korea	2009	4857.2	-9.4228	60.80	78.19	84.31	87.21
	2010	5836.3	20.1577	57.78	79.90	84.88	87.08
	2011	6851.9	17.4014	49.21	68.05	72.17	86.18
	2012	6910.0	0.8479	54.97	79.65	84.45	87.28
	2013	6606.1	-0.0440	58.15	84.35	89.39	90.37
	2014	7154.3	0.0370	58.14	86.90	91.14	94.56*
	2015	6967.0	-0.0262	60.25	89.65	94.41	98.48
	2016	6860.0	-0.0154	60.93	89.88	94.68	98.57
	2017	7100.0	0.0350	59.42	89.32	94.58	98.80
	2018	7250.0	0.0211	59.12	89.30	94.26	98.17*

Note: The data marked with "*" in the table is the average value of the crude steel production data of the enterprise instead of the unavailable crude steel production data of the enterprise, and then the concentration of the enterprise is calculated.

3.1 Development status and industrial concentration evolution of steel industry in Japan

Japan's crude steel output ranked first in the world from 1993 to 1995, and ranked second in the world after China from 1996 to 2017. In 2018, it was overtaken by India as the third largest steel producer in the world, but its comprehensive competitiveness of steel products in the international market is still the highest in the world. In 2018, Japan's annual output of crude steel reached 104.3 million tons.

It can be seen from the table of crude steel production and industrial concentration over the years 2000-2018 that in recent years, Japan's crude steel production has been basically maintained at the level of about 11000000 tons. In addition to 2009 and 2010, the annual growth rate of crude steel production is relatively stable. Especially since 2011, the growth rate of crude steel production has been more stable, and the industrial concentration has been rising all the time. Nippon Steel Group (now renamed

Nippon Steel Co., Ltd.) ranks first in crude steel production in Japan. It was formed by the merger of Japan's Bafan and Fuji systems in 1970. In the 30 years since its establishment, Nippon Steel has been the world's largest steel company in crude steel production. In 2002, Nippon Steel Group successively sought to acquire Sumitomo Metal and Kobe Steel, but it failed due to the restrictions of Japanese anti-monopoly law. In May 2002, Japan's second largest steel company, Japan steel pipe and Japan's third largest steel company, Kawasaki iron, merged to form JFE group. In 2003, CR2, CR3 and CR4 in Japan's iron and steel industry were greatly improved due to the reorganization and establishment of JFE group.

Japan is very short of natural resources and its own steel market is relatively small, the iron ore and coke needed for steel smelting also need to be imported from overseas. Therefore, its iron and steel enterprises are mainly coastal port layout to facilitate the import of raw materials and the export of finished steel products[12]. Japan's major iron and steel enterprises are directly facing deep-water ports, and the raw material import and product export are basically dependent on low-cost shipping. The

rise of energy price makes Japan adopt energy-saving measures of technical energy conservation and elimination of backward production capacity to maintain the competitiveness of steel industry. With the frequent occurrence of natural disasters and the developed manufacturing industry, Japan has invested heavily in improving the quality of construction materials and industrial steel products. Since the beginning of the new century, Japan has realized the rapid development of the iron and steel industry by means of improving product quality and added value rather than expanding product capacity[13].

3.2 Development status and industrial concentration evolution of American steel industry

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads. At present, the United States is the fourth largest steel producer in the world, and India surpassed the United States in steel production in 2015, becoming the second largest steel producer. In 2018, crude steel production in the United States reached 86.6 million tons, an increase of 0.06% year on year.

In terms of production, since the beginning of the new century, the crude steel production in the United States has basically maintained at the level of 80 million tons, except for 2009, which was affected by the financial crisis. In terms of industrial concentration, CR1 and CR2 have maintained a sustained growth momentum in the past decade. CR1 gradually increased from 10.5% in 2000 to 29.43%, and CR2 gradually increased from 20.5% in 2000 to 47.18%. CR3 and CR4 experienced a significant decline in 2004. For the rest of the year, 2009 and 2014 are the dividing points. Before that, growth continued, then decreased slowly, and then grew slowly. The development of major enterprises in the United States in recent years is shown in Table 2.

It can be seen from table 2 that the crude steel production of American steel company and Newco steel company has been rising steadily before 2009. Although the production fell sharply in 2009 due to the impact of the financial crisis, it immediately started to enter the road of strong recovery in 2010 and has basically recovered to the level before the financial crisis. The crude steel production has almost doubled in the past decade, and its own scale expansion speed is higher than the growth speed of the crude steel production in the United States, which enables

the CR1 and CR2 of the steel industry in the United States to keep rising. After 2011, the output of U.S. steel companies began to decline while the output of Newco steel company increased. In 2014, Newco steel company became the largest steel group in the United States through a series of mergers and acquisitions, and continues to be the largest crude steel production in the United States. In 1969, Newco steel was only the first short process steel plant in the world with scrap as the main raw material and its annual capacity is only 200000 tons[14].

Since entering the new century, there has been a wave of merger and reorganization in American steel industry. In February 2002, WL. Ross & Co. LCC financial investment company and the United Steelworkers union of America jointly acquired LTV steel company, the fourth largest crude steel production company in the United States, and established the international steel group (ISG). In May 2003, International Steel Group acquired Bethlehem Steel Company. In 2002, Newco successfully acquired Birmingham iron and steel company, which made the crude steel production of that year have a significant increase. The CR3 and CR4 of the U.S. steel industry decreased significantly in 2004, because the international steel group with annual output of 20 million tons of crude steel was acquired by Mittal Steel Group in October 2004. American Steel Group acquired national steel company from Japan NKK group in 2003 and acquired Canadian steel companies in 2007[15]. So far, the second wave of steel industry M & A in the United States has basically ended. It is worth noting that the two waves of large-scale M & A in the United States are basically inter firm behavior under the role of the market. Moreover, after the wave of merger and reorganization, the steel industry in the United States also failed to produce large iron and steel enterprises. In recent years, AK steel company, which ranks fourth in crude steel production, basically maintains an annual output of 5.5 million tons without much change. And trade protection led to the highest steel price in the United States in 10 years. In April 2018, the United States issued a list of commodities subject to tariff increase, imposing 25% tariff on steel, aluminum and other commodities exported from China to the United States, which came into effect in two batches from July and August. In addition, the United States has imposed 25% and 10% tariffs on steel and aluminum products of the European Union, Canada and Mexico since June. Affected by this factor, steel prices in the United States reached the highest level in 10 years in 2018.

Table2. major steel enterprises in the United States 2000-2018

	U.S. steel	Nucor Steel	Bethlehem Steel	LTV Steel	International Steel	AK Steel	Power steel
2000	1068	1022	909	740	-	590	-
2001	1283	1117	797	598	-	553	-
				Merge into international steel			
2002	1445	1236	812		522	544	-
			Merge into international steel				
2003	1790	1580		-	1060	540	-
					Merge into Mittal		
2004	2083	1791	-	-		560	315
2005	1926	1845	-	-	-	564	328

2006	2125	2031	-	-	-	565	426
2007	2054	2004	-	-	-	588	496
2008	2322	1820	-	-	-	592	434
2009	1523	1268	-	-	-	371	322
2010	2226	1656	-	-	-	514	426
2011	2199	1775	-	-	-	517	472
2012	2144	1802	-	-	-	489	474
2013	2038	2016	-	-	-	509	484
2014	1973	2141	-	-	-	595	454
2015	1452	1962	-	-	-	617	414
2016	1421.8	1930.7	-	-	-	549	862.1
2017	1443	2439	-	-	-	567	827
2018	1537	2549	-	-	-	582*	892

3.3 Development status and industrial concentration evolution of Korean steel industry

South Korea's crude steel output in 2018 was 72.5 million tons, up 0.02% year on year. Since the 1970s, with the help of the government's strong support policies, the Korean steel industry has embarked on the road of rapid development. Before 2006, South Korea ranked fifth in the global crude steel production list, and in 2007, it was surpassed by India and fell to sixth place. In 2018, it ranked fifth in the global crude steel production again.

It can be seen from the table of crude steel production and industrial concentration in South Korea over the years 2000-2018 that the crude steel production in South Korea has maintained the momentum of growth until 2012, except for 2009. In the past five years, South Korea's crude steel production has experienced negative growth, which is - 0.04% in 2013, - 0.03% in 2015 and - 0.02% in 2016, respectively. However, the crude steel output in 2017 is growing, and the crude steel output in 2018 is the highest level in nearly 19 years. The annual output of crude steel increased from 43.11 million tons in 2000 to 72.5 million tons in 2018. The industrial concentration of South Korean steel industry has been declining slowly from 2000 to 2011, and began to pick up from 2012 to 2018. South Korea's steel industry concentration has been at a high level, far ahead of other major steel producing countries in the world. Since South Korea decided to develop its steel industry, it has adopted policies to ensure that POSCO steel, which it invested in, maintains a monopoly position. In 1998, POSCO steel surpassed Nippon Steel Group of Japan to become the world's largest steel enterprise in crude steel production. Since entering the new century, POSCO has been expanding its scale by actively seeking cooperation and alliance with international competitors. South Korea's second largest iron and steel enterprise, modern iron making, was reorganized by Incheon iron making company and Jiang Yuan Industrial Company in 2000. From 2000 to 2018, the annual output of major steel enterprises in South Korea increased steadily, of which POSCO steel increased from 28.48 million to 42.86 million, modern iron manufacturing rapidly increased from 5.99 million to 21.88 million after merger and reorganization, and the East steel manufacturing increased

from 2.38 million to 3.6 million. From the perspective of the status of the national economy, the Korean steel industry as a core basic industry plays a continuing role in the continued growth of the main part of the national economy and contributes to job creation [16].

4 Relevant enlightenment and LESSONS

Iron and steel enterprises should not blindly pursue the expansion of production capacity, but should pay attention to the improvement of product quality and the application of energy saving and emission reduction technology to improve their competitiveness. Crude steel production in the United States peaked as early as the 1960s. In the past 50 years, the development trend has been steady, moderate and declining. Japan's crude steel production has remained at about 100 million tons since the decade of last century. The large-scale steel industry in the United States, Japan and South Korea has invested a lot of capital in the research and development of energy-saving and emission reduction technologies and advanced production processes. POSCO iron and steel group of South Korea, Japan's Nippon Steel Co., Ltd. of Japan and Newco iron and steel group of the United States all come out in front in the latest "Competitiveness of world-class iron and steel enterprises" list published by WSD over the years.

The expansion of the scale of iron and steel enterprises is an inevitable trend. The expansion of the scale of a single iron and steel enterprise and the improvement of the industrial concentration of the iron and steel industry are objective choices to adapt to market competition, rather than the results of subjective decisions. The industrial organization structure has the characteristics of inheritance and continuity. The industrial centralization should be based on the original industrial organization structure and completed under the guidance of the market. The fundamental purpose of industrial concentration is to enhance the competitiveness of enterprises and industries, and the way to realize it should mainly rely on capital operation.

In the oligopoly competition pattern, if small and medium-sized enterprises can accurately position themselves, there is still a large living space. For example, the output of special steel companies and AK steel in the

United States has been maintained at the level of 5.5 million tons in the past decade, but they still stand in the wave of merger of American steel enterprises in the early 21st century. This shows that to improve the industrial concentration, not all enterprises are required to develop into a larger scale. As long as the small and medium-sized enterprises grasp the market demand, constantly innovate the production process and improve the management level, they can also win a broad living space.

The development of enterprises should have an international perspective and attach importance to the strategic cooperation with relevant industrial enterprises. With the continuous acceleration of the process of global economic integration, International alliance cooperation, merger and reorganization of iron and steel enterprises are common. Arcelo Mittal, a super large multinational steel company, Japan's Nippon Steel Co., Ltd. and POSCO steel group of South Korea have targeted the direction of merger at China, India and Russia, which are relatively backward in production level. At the same time, strengthening strategic cooperation with iron ore enterprises, coal enterprises and international shipping enterprises will also become an important measure for steel enterprises to reduce production costs.

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