

**Technology and Management
of the W. Metallurgical Industry Group Co. Ltd.**

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ABSTRACT

In this paper, we analyze the W. Metallurgical Industry Group Co. Ltd. We will show the features of the W. Group's technology and management based on the data obtained from research conducted in October 1999. The W. Group adopts the relatively modern technology compared with the other small-scale iron and steel companies in Shanxi province. The W. Group takes a positive attitude in introducing the recycling process and environmental apparatus. However, it has some problems with its production management. With the start of a new corporate strategy, the introduction of modern production management will become more and more important.

1. INTRODUCTION

We visited the W. Group Company located in Jiaokou County, Shanxi province, China from October 18 to 22, 1999. It is a real company, though "W" is a fictitious name. We visited the plant and interviewed the managers and workers. This visit was a part of a Research Project on "Environmental Technology Transfer from Japan to China" (Representative: Professor Reijiro Takahashi, Tohoku University). The investigation record has been published as a working paper.

In this paper, we analyze the features of the W. Group's technology and management based on the data obtained from the investigation done at that time.

2. THE POSITION OF SHANXI PROVINCE IN THE CHINESE IRON AND STEEL INDUSTRY

Table 1 shows some interesting figures when we consider the position of Shanxi province in the Chinese iron and steel industry.

Table 1 The position of Shanxi province in the Chinese iron and steel industry

	Value(RMB\ 100 million)		Output(10 thousand tons)				
	Gross industrial output value (at 1990 constant prices)	Industrial value added (At current prices, by production)	Pig iron	Crude steel	Finished steel products	Iron ore	Coke
Whole nation(a)	2040.22	886.03	11511	10891	9986	26861	13901
Shanxi province(b)	72.1	32.05	1464	398	278	3171	5449
(b)/(a)	3.5%	3.6%	12.7%	3.7%	2.8%	11.8%	39.2%
Ranking of Shanxi in 30 provinces	9	10	1	10	14	3	1
Taiyuan Iron and Steel (Group) Co. Ltd.(c)	48.03	22.82	200.2	240.4	212.8	593.16	117.49
Linfen Iron and Steel Co.(d)	7.61	2.79	57.16	43.29	5.82	N.A.	N.A.
Changzhi Iron and Steel Co.(e)	4.23	1.6	60.55	56.4	39.38	N.A.	N.A.
<(c)+(d)+(e)>/<(b)>	83.0%	84.9%	21.7%	85.4%	92.8%	N.A.	N.A.

Source: Calculated from the data on the Editorial Board of the Yearbook of the Iron and Steel Industry of China ed. [1998].

Obviously Shanxi is one of the main steel producing provinces. It especially occupies a large share of the whole nation in the production of iron ore, coke, and pig iron. This is due to the abundant mining resources available in that province.

Three companies represent the big or the medium scale steel production in Shanxi province. One is the Taiyuan Iron and Steel Group Co. Ltd. that is classified by the Chinese government as the "Key Iron and Steel Enterprise", others are the Linfen Iron and Steel Company and the Changzi Iron and Steel Company that are classified as the "Local Major Iron and Steel Enterprise". Table 1 shows the significance of these three companies in the iron and steel industry in Shanxi. As for industrial output value, value added, output of crude steel, and output of finished steel products, concentration ratios are 80% or more. However, the concentration ratio is only 21.7% as for output of pig iron. About 80% of the pig iron is made by the small-scale enterprises.

We actually saw many mini blast furnaces on the way from Taiyuan to Jiaokou County. Photo 1 is the example. According to equipment statistics in 1995, there were 1,556 blast furnaces whose internal volume was less than 100 cubic meters(Kodama[1997]). The number of blast furnaces shows an up and down trend every year. It suggests that there is cutthroat competition among small enterprises.



Photo 1 Mini blast furnaces in Shanxi province

Source: Photographed by one of the authors.

Most of the coke plants and sintering plants are old style. Actually, we saw many beehive coke ovens by the roadside (Photo 2), and our project members saw some burn off

sintering processes. We guess, based on the data of the local government of Shanxi province, beehive ovens made up 93% of the coke production in Shanxi in 1995.



Photo 2 Beehive coke ovens in Shanxi province

Source: Photographed by one of the authors.

Those old style or small-scale plants have problems with productivity and environmental pollution. They cannot make use of by-products. They discharge many kinds of air pollutants. Now the government of China is ordering the shut down of all mini blast furnaces less than 100 cubic meters in volume.

3. THE W. METALLURGICAL INDUSTRY GROUP CO. LTD

3.1 The outline of the W. Group

The W. Group is a manufacturing industry whose production base is located in the north of Jiaokou County in Shanxi province. Annually it produces 100,000 tons of pig iron, 200,000 tons of foundry coke (or 300,000 tons of metallurgy coke), 20,000,000 bricks, chemical by-products of tar, benzol etc. It sells all pig iron, part of coke, bricks, and chemical by-products. It possesses 4.3 hundred million yuan of assets with an annual production value of 3 hundred million yuan. It earns foreign exchange of US 25 million. The government of Shanxi province awards the W. Group as "the best enterprise in Shanxi province".

The layout of ironworks in the W. Group is like that in Figure 1. The ironworks have the production processes from materials pretreatment to ironmaking, and do not have the process of steelmaking and rolling. Its foundry only makes machinery parts used in the

company. The scale of production of the ironworks is much smaller in comparison with integrated steelworks in Japan and the "Key Iron and Steel Enterprises" in China. But the ironworks form a miniature industrial complex in which plural processes are arranged continuously. And the recovery and use of by-products are carried out.

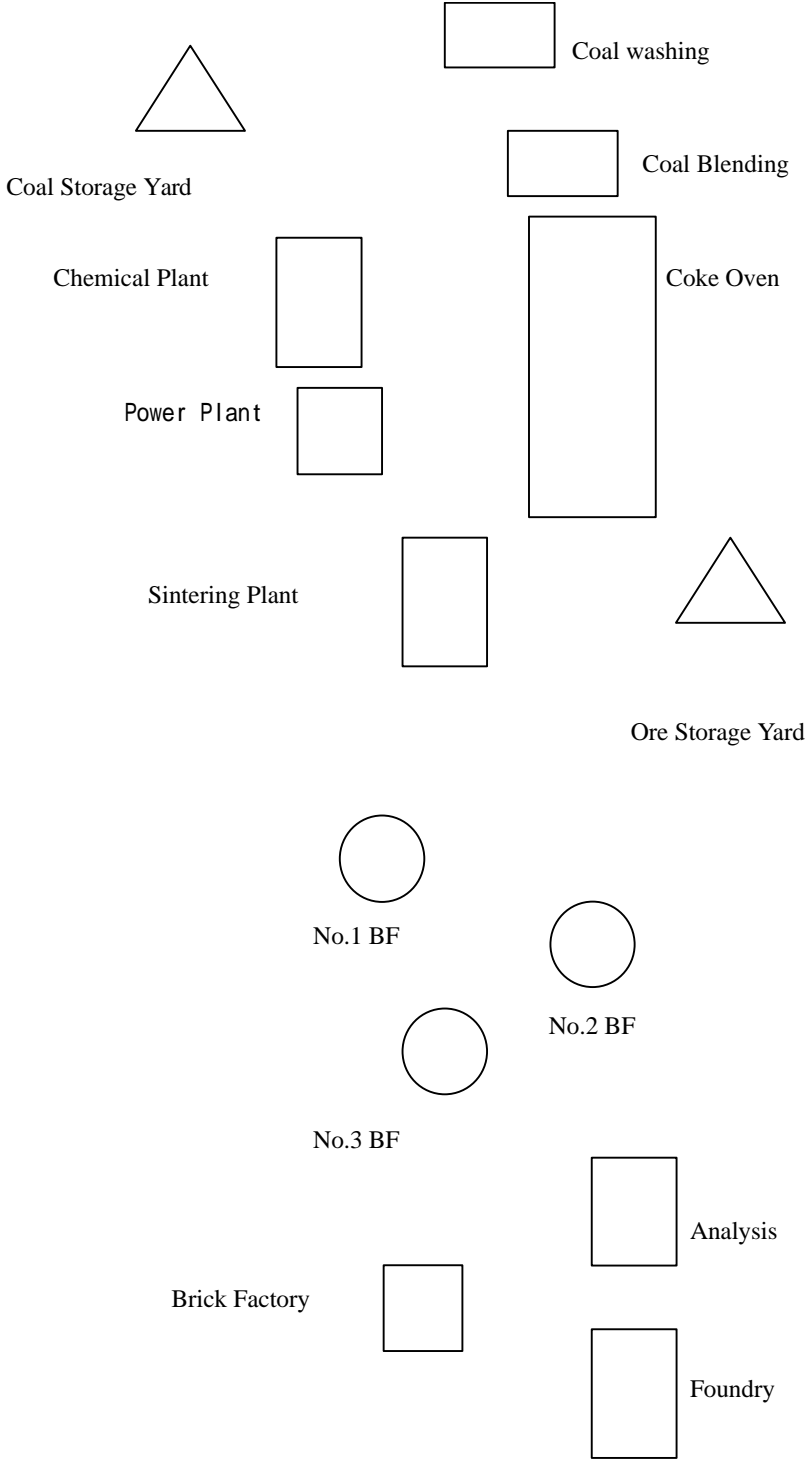


Figure 1 The layout of ironworks in the W. Group
 Source: Plant visit.

The W. Group is a joint-stock company which is not listed on the stock market. Its stocks are held by the Agricultural Bank of China, the board of directors, and employees with each owning a third of stocks. The governmental organizations do not hold any equities.

Organization of the W. Group is like Figure 2. The W. Group, which had been one company originally, has changed into a group company. Some functional departments have become subsidiaries which supports themselves.

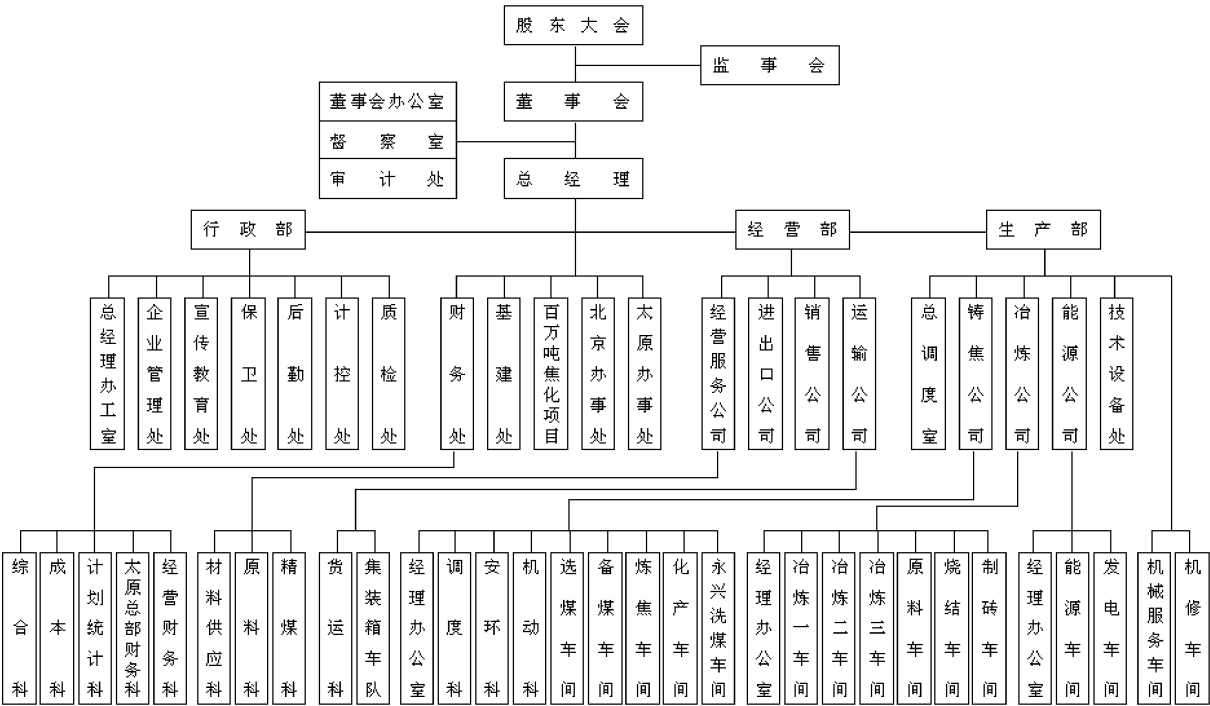


Figure 2 Organization of the W. Group

Source: Company documents of the W. Group

3.2 Technology for production and environmental management in the W. Group

The main iron manufacturing plants in the W. Group is shown in the Table 2. The W. Group is a technological leader among the small iron enterprises in Shanxi province.

The coke furnace of the W. Group is a new style and chamber type oven (Photo 3) . It also has a dust collector. After being treated in a chemical by-products plant, C gas is partly used at power plant, used as fuel for a sintering plant, and sold as chemical by-products. The sintering furnace is old, but is not burn-off style.

Table 2 The main iron manufacturing plants in the W. Group

Name of plants	Type and Scale	Results
Coke oven	Chamber type oven with stamping equipment 60 ovens	200,000-300,000 tons per year
Sintering plant	25 m ³	7,000 tons per month
First blast furnace	45 m ³	Coke ratio: 1.1 Ore ratio: 2.1
Second blast furnace	47 m ³	Coke ratio: 1.0 ~ 1.05 Ore ratio: 1.9 ~ 2.0 Productivity: 1.8 tons/m ³ /day
Third blast furnace	28 m ³	Coke ratio: 1.0 ~ 1.1 Ore ratio: 2.1 Productivity: 2.2 tons/m ³ /day

Source: Company documents and personal interview with the company staffs.



Photo 3 The coke furnace of the W. Group

Source: Pamphlet of the W. Group

The performance of the mini blast furnaces is noteworthy. Until 1995, the performance of mini blast furnaces had been as poor as the other mini furnaces in that area. They had been operated on based on the experiences of workers, not on the metallurgical knowledge.

Collection of data had not been sufficient. An analysis of raw materials and gases had not been conducted. However, under the guidance of Japanese engineer Mr. Gyozo Kawahara, the coke ratio and the quality of products has improved as well as exhaust of carbon dioxide and dust has curtailed (Kawahara[1996][1999b]).

Besides, there are sewage treatment facilities for water recycling. Bricks are produced with granulated slag.

On environmental measures, the section of responsibility named Safety and Environment Section was established. This section receives inspectors who belong to the Ministry of Environmental Protection in Shanxi province and inspect dust, noise, air, and the quality of water. The manager says that outlays for plant and investment has been done along the line of "three simultaneous" projects which occupies an important position in the environmental management system of China.

Technological superiority has contributed to the growth of the W. Group. The case of the W. Group suggests the importance of the excellence of production equipment on one hand and the importance of the human side of technology on the other. It is not correct to regard all mini blast furnaces as inefficient and the origin of pollution. Production cost, quality of products, and environmental control can be improved to some extent through upgrading the operation and management. The guidance of Mr. Kawahara demonstrated it. Conversely, even if mini blast furnaces are abolished and changed for larger plants, we think that problems would remain unsolved unless the human side of technology has a solid foundation. Necessary policies for small iron enterprises are not only to magnify the scale of plants but also to improve the operating technology, the skills of workers, and the production management systems.

3.3 The problems of production management

We feel there are still some problems regarding the production management of the W. Group, though our investigation is not sufficient. Operation standards are not sufficiently prepared. Many tasks for control are in the hands of the superintendent of each workshop, though planning for production is made on the level of the whole group. For example, maintenance workers are placed not only at the staff organization but also at each workshop.

Superintendent is a heavily responsible position. Either the superintendent or the assistant superintendent must stay at their workshop all day long. We met a superintendent of the second blast furnace. He sleeps in his office at the workshop everyday, though he goes

home for supper to a company house. He gets up at 6 a.m. and works till 1 a.m. As standardization and planning at the whole group level is insufficient, stability of operation depends on the discretion of the superintendents. And it also depends on the penalty system, emotional mobilization on the "W. spirit" that is chanted at the morning gathering everyday, and leadership by the chairman.

3.4 Business leadership of Mr. R

Mr. R is a founder, chairman of the board of directors, president, and secretary of the communist party at the W. Group. Most of the members of the board of directors are his friends who have shared his joys and sorrows with him. Mr. R takes a positive attitude toward working out the corporate strategy and introduction of foreign technology. Candidates to become the general manager must serve as an assistant of the chairman. In general, the W. Group is managed under the charismatic leadership of Mr. R.

4. CORPORATE STRATEGY OF THE W. GROUP

The W. Group's construction work for the production base at Jiakou County is almost completed. Now it has a new construction plan. The new plan includes the construction of coke ovens with a capacity of 1,000,000 tons per year, 2 blast furnaces each of which have an internal volume of 150 cubic meters, and the equipment for spheroidal graphite cast iron with a capacity of 100,000 tons per year. As mentioned above, there is cutthroat competition among many small iron companies in Shanxi. The W. Group adopts a strategy to improve the competitiveness by scaling up the plants and downstreaming integration to high grade products. In addition, it plans to found a metallurgical laboratory to reinforce the research and development activity. It also plans the diversification to the production of medicine and mineral water.

We think such a strategy presents new problems for the business management of the W. Group.

It plans to have its stock listed on the stock market and to increase its capital for financing the new construction plan. Mr. R says he has good prospects in getting new investors. If the stock will be listed and the additional stock will be issued, the share of existing shareholders will be diluted. Then new investors will have their own voice in matters. Then the charismatic leadership of Mr. R may be weakened.

Additionally, the W. Group will have to have good relations with domestic and foreign customers that want high grade products. Some importers in industrialized countries may ask

the exporting company to get the certification of ISO9000 or ISO14000. Strict quality control will be necessary to increase exports and to start spheroidal graphite cast iron businesses. Then introduction of modern production management will become more and more important for the W. Group not only to stabilize operations but also to establish a quality certification system.

In general, it will become the important matter for the W. Group at the next stage of growth to convert from discretion and charismatic leadership to the systematic management.

5. CONCLUSION

We analyzed the features of technology and management of the W. Group. We emphasized the following points.

1. Technological superiority is the source of competitive advantage of the W. Group.
2. It is important for the small iron enterprises not only to magnify the scale of plants but also to improve the human side of technology.
3. It will become the important matter for the W. Group to convert from discretion and charismatic leadership to the systematic management.

However, our research is only in the preliminary stage. In particular, we do not have sufficient information about the market conditions for the growth of the W. Group. We do not have the data on costs and prices of the W. Group and its rivals. In addition, we do not have the information about the motivation systems for raising efficiency in W. Group. Additional intensive investigation is necessary.

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