The People's Republic of China

Weihe Fertilizer Plant Construction Project (1)(2)(3)

Report Date：April 2002
Field Survey：July 2001

1. Project Profile and Japan's ODA Loan

Site Map：Weinan City of Shenhsi Province

Site Photo： Weihe Fertilizer Plant

1.1 Background

Annual food production of China in 1980s had shifted in the range from 320 million tons to 410 million tons. In 2000, Chinese government set its food production target at 500 million tons based on the population of 1,250 million and per capita food requirement of 400 kg per annum. The government has realized that it is essential to increase the input of fertilizer to increase the volume of food production, which significantly contributes to the improvement in the productivity of food production. On the other hand, there is a considerable gap in the supply and demand of fertilizer in China and the nation is importing fertilizer in great volume every year. Volume of fertilizer imported in 1989 was 13.93 million tons (in weight[1]) and the amount of foreign currency paid for such import was as much as $2,360 million. Because of the situation, there is an urgent need of domestic fertilizer production for stable fertilizer supply and to save foreign currency. To solve this supply and demand gap in fertilizer, Chinese government has established a plan to construct 10 fertilizer plants in the whole nation with a total production capacity of 2.43 million tons (in net volume[2]) in its 8th Five-Year Plan (1991～1995).[3]

In the province of Shenhsi, which is an objective site of this project, production of nitrogenous fertilizer in 1989 (in net volume) was 310,000 tons that is insufficient against the demand (in net volume) of 500,000 tons. And the shortages were filled by the shipments from other provinces. Since Shenhsi Province is located in the loess zone and the soil lacks nitrogen content, it was an urgent task to construct a fertilizer plant in the province. As such, it was decided to construct a nitrogenous fertilizer (urea) plant, which uses coal as raw material, in the suburbs of Weinan City of Shenhsi Province as Shenhsi Province has abundant supply of coal that can be used as a raw material for fertilizer production.

1.2 Objectives

Objectives of this project are to cope with sharply increasing fertilizer demand and to improve productivity in the food production in Shenhsi Province through the construction of urea fertilizer

[1] Total of actual weight of all fertilizer types such as nitrogen, phosphate, potassium and complex type
[2] Total weight of active ingredients (nitrogen, phosphate and potassium) contained in the above fertilizers
[3] Among 10 plants in the 8th Five-Year Plan, six plants became the subject of the loan including this project.

plant with annual production capacity of 520,000 tons (or 240,000 tons in net volume).

1.3 Project Scope

Subject of the loan is the total amount of foreign currency portion of the project cost, such as the construction of ammonia and urea manufacturing facilities to produce urea fertilizer in the volume of 520,000 tons per annum.

1.4 Borrower/Executing Agency

External Trade Department, The People's Republic of China[4]/ Chemical Industry Department, The People's Republic of China

1.5 Outline of Loan Agreement

	First	Second	Third	Total
Loan Amount	4,504 Million Yen	6,160 Million Yen	16,262 Million Yen	26,926 Million Yen
Loan Disbursed Amount	4,504 Million Yen	6,160 Million Yen	16,262 Million Yen	26,926 Million Yen
Date of Exchange of Notes	November 1990	September 1991	October 1992	-
Date of Loan Agreement	November 1990	October 1991	October 1992	-
Terms and Conditions	Interest rate: 2.5% Repayment period: 30 years (including 10 years deferred period) General untied loan	Interest rate: 2.6% Repayment period: 30 years (including 10 years deferred period) General untied loan	Interest rate: 2.6% Repayment period: 30 years (including 10 years deferred period) General untied loan	- - - -
Final Disbursement Date	March 1992	January 1993	September 1997	-

2. Results and Evaluation

2.1 Relevance

This project has a high priority, as it is in line with the basic policy of planned economy of China in its 8th Five-Year Plan. And also, the plan is relevant from a viewpoint of food production increase and foreign currency saving, as it aims to increase fertilizer production. Furthermore, stable food production is a continuously important political issue for China. Even today, relevance of this project does not change at all in view of the production and sales of fertilizer, which contributes to the improved productivity in food production.

2.2 Efficiency

① Project Cost

Actual result of investment amount in RMB has increased from planned 1,033 Million RMB to 1,283 Million RMB, however, total project cost in Japanese currency is still within the planned scope. When the total project cost is reconverted into RMB, the actual cost of 3,192 Million RMB was larger than the planned cost of 2,183 Million RMB because of the fall of RMB in its exchange rate[5].

② Construction Period

Construction was started with the basic design in April 1992 and progressed according to the schedule until the start of trial run in December 1994. However, completion of trial run delayed 4

[4] Present External Trade Economic Collaboration Department. Also, after 1999, borrower of the Japanese Loan to China was changed to the government (Finance Department) of the People's Republic of China.

[5] Exchange rate in the planning stage was 1RMB = 23.4 Yen but it was reduced (average during investment period) to 14.1 Yen.

months from the original schedule to March 1996 because much time was spent to choose[6] the quality of raw material coal and to solve a trouble[7] that occurred relative to the equipment in the coal gasification facility after the start of trial run.

2.3 Effect (Degree of Accomplishment)

① Urea Production Volume

Planned volume and the result of urea production in this project are as shown in Table 1 below. Planned production volume in the first year after completion, which was assumed at the time of appraisal, was 70% of final production target of 520,000 tons/year, that in the second year was 90% of final production target of 520,000 tons/year and 100%, thereafter. However, the production in 1996 was as low as 80,000 tons/year because of the trouble occurred at the time of trial run though the trial run was completed in March 1996. Results of production in 1997 and 1998 were 45% and 58% respectively against the final production target of 520,000 tons/year, as the trouble[8] that was derived from the problem of equipment in the coal gasification facility occurred again. However, operation gradually improved after 1999 and the production in 1999 was 76% of the plan and that in 2000 exceeded planned production volume.

Table 1：Urea Production (weight) (Unit: ton/year)

	1996 (Completed)	1997 (2nd year)	1998 (3rd year)	1999 (4th year)	2000 (5th year)	2001 (6th year)
Planned Production (ton/year)	-	364,000	468,000	520,000	520,000	520,000
Actual Production (ton/year)	80,000	236,000	300,000	397,700	524,100	---

Source: Data of Implemented Organization

② Nitrogenous Fertilizer Demand in Shenhsi Province

Gap between the demand for the nitrogenous fertilizer in Shenhsi Province and the supply made in the form of production in the province before the project was implemented (1989) was 190,000 tons (in net volume) and it had gradually increased to 210,000 tons just before the completion of project in 1995. However, since the start of operation in this project, this gap has narrowed down to 50,000 tons in 1999 as shown in Fig. 1.[9] Though a part of urea fertilizer produced in this project is sold to outside of Shenhsi Province as the environment of the market has changed, it can be confirmed that this project has made a certain contribution to improve the balance of supply and demand of fertilizer in Shenhsi Province.

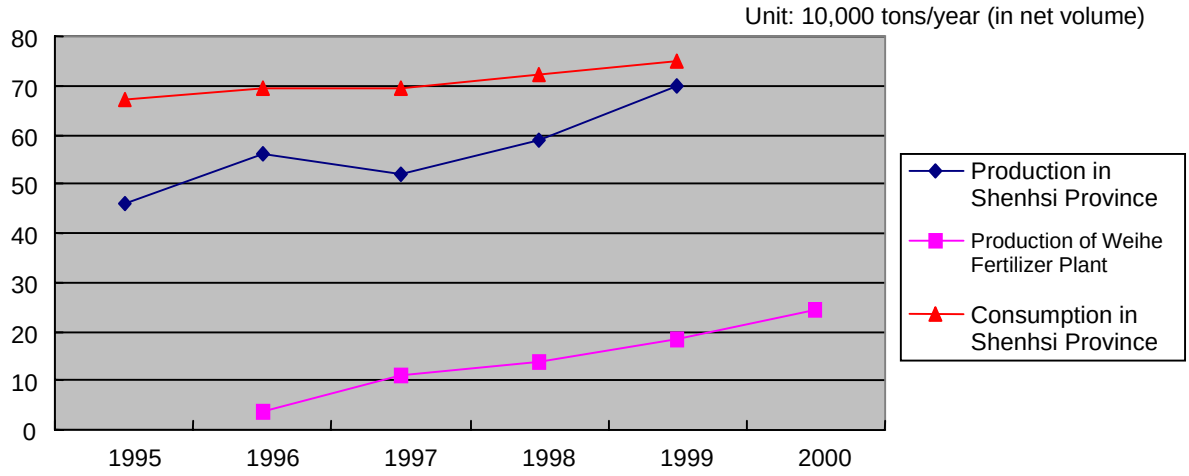
[6] Since operation of coal gasification equipment depends upon the quality of raw material coal, a number of tests must be repeatedly carried out to find optimum operating condition of raw material coal used, as it is technically difficult to express quality of raw material coal used for the gasification.

[7] Since the jet nozzle of raw material coal did not reached required performance, ash content in the raw material coal was not separated and removed in the gasification furnace and accompanied to the following equipment.

[8] Ash content accompanied to the equipment in the downstream of gasification furnace accumulates on the surface of catalyst to deteriorate the function of catalyst and accumulated in the equipment to cause clogging and so forth.

[9] Data on the quantity of production as well as that of consumption in the province for 2000 could not be obtained.

Fig 1: Nitrogenous Fertilizer Supply/Demand Balance in Shenhsi Province



Source: Shenhsi Province Almanac, Chemical Industry Almanac and China Almanac

③ Recalculation of Internal Rate of Return (IRR)

When the financial internal rate of return (FIRR)[10] of this project was recalculated by counting initial investment (such as construction cost) and operation and maintenance expenses as expense and sales revenue of fertilizer as income based on the annual production volume of 520,000 tons, rate of return became to 2.8% compared with the planned figure of 7.8% at the time of appraisal. Main cause of drop in FIRR is an increase in the residual oil price as raw material in addition to the increased investment (increase in investment made in RMB and that in RMB value invested in foreign currency due to the fall in the exchange rate of RMB). Similarly, when economical internal rate of return (EIRR) was calculated using urea fertilizer production of this project as an effective alternative to the import (saving in foreign currency), recalculation resulted to 4.6% against 9.0% at the time of appraisal. Main cause of such drop in EIRR may be considered due to the increase in the price of residual oil used as the raw material in addition to the increased investment. Table 2 below shows comparative calculations in price at the time of appraisal and that of evaluation used for the calculation of rate of return. As the system was in the transition period to the market economy and it seemed that the method to calculate breakdown of expenses by the implementing organization was not fully established, costs of manufacturing and sales were calculated based on the information obtained from the implementing organization at the time of field survey.

Table 2: Comparison of Manufacturing/Sales Cost and Sales Price per Unit Product

	Manufacturing/Sales Cost (Note 1)	Domestic Sales Price	Urea Import Price (Note 2)	Exchange Rate (Note 3)
When appraised	304 RMB/ton	754 RMB/ton	814 RMB/ton	23.4 Yen/RMB
When evaluated	530 RMB/ton	1,040 RMB/ton	1,242 RMB/ton	14.3 Yen/RMB

Source: JBIC data and Data of Implemented Organization

Note 1: Cost of product and sales does not include depreciation expense.

Note 2: CIF price is a value converted into RMB per US$150/ton.

Note 3: Exchange rate used for evaluation is an average of January-March 2001 in IMF Data.

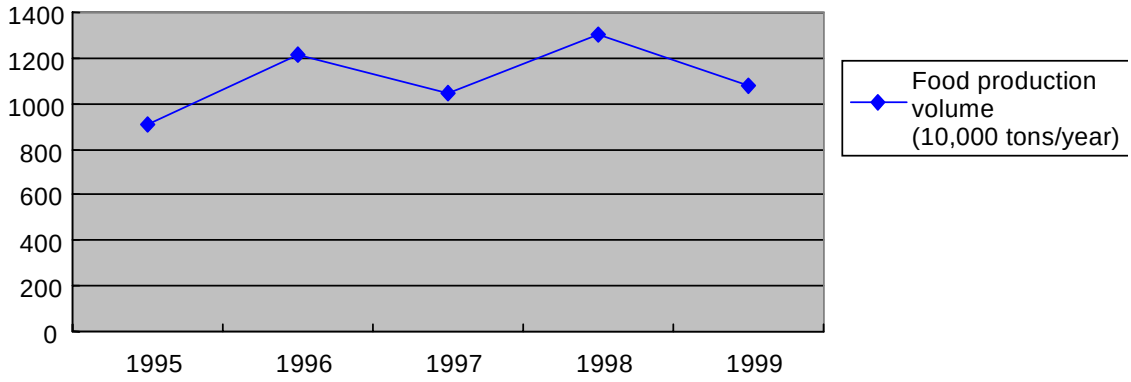
[10] FIRR is based on the total capital.

2.4 Impact

① Food Production Volume and Productivity in Shenhsi Province

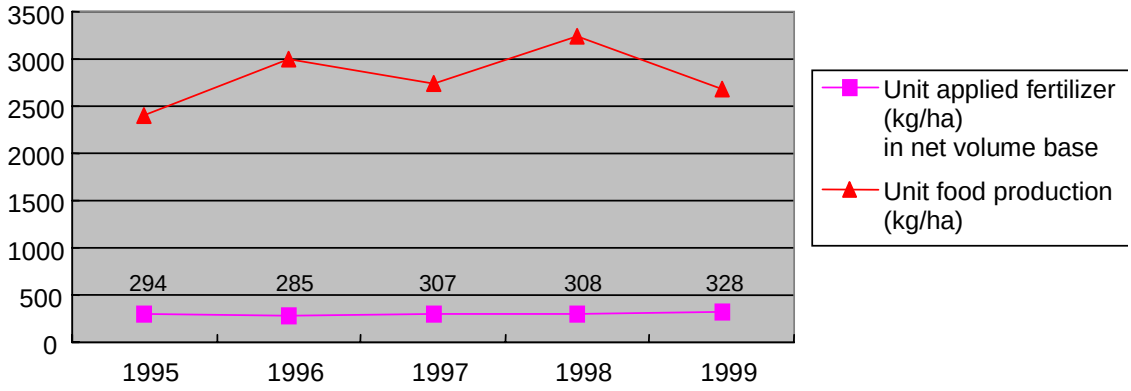
Since Shenhsi Province is located in the loess zone and the soil lacks nitrogen content, an impact to increase food production has been expected as a result of this project because of increased supply or input of urea fertilizer improves productivity of food production (unit production volume). In Fig. 2 and Fig. 3, food production volume, unit applied fertilizer and unit food production in Shenhsi Province are shown. These data indicate that unit food production has been gradually increasing as a trend according to the increase in the unit applied fertilizer.

Fig 2: Food Production Volume in Shenhsi Province and Productivity



Source: China Almanac, Shenhsi Province Almanac and Chemical Industry Almanac

Fig 3: Unit Applied Fertilizer and Unit Food Production in Shenhsi Province



Source: China Almanac, Shenhsi Province Almanac and Chemical Industry Almanac

② Promotion of Employment and Regional Development in Shenhsi Province

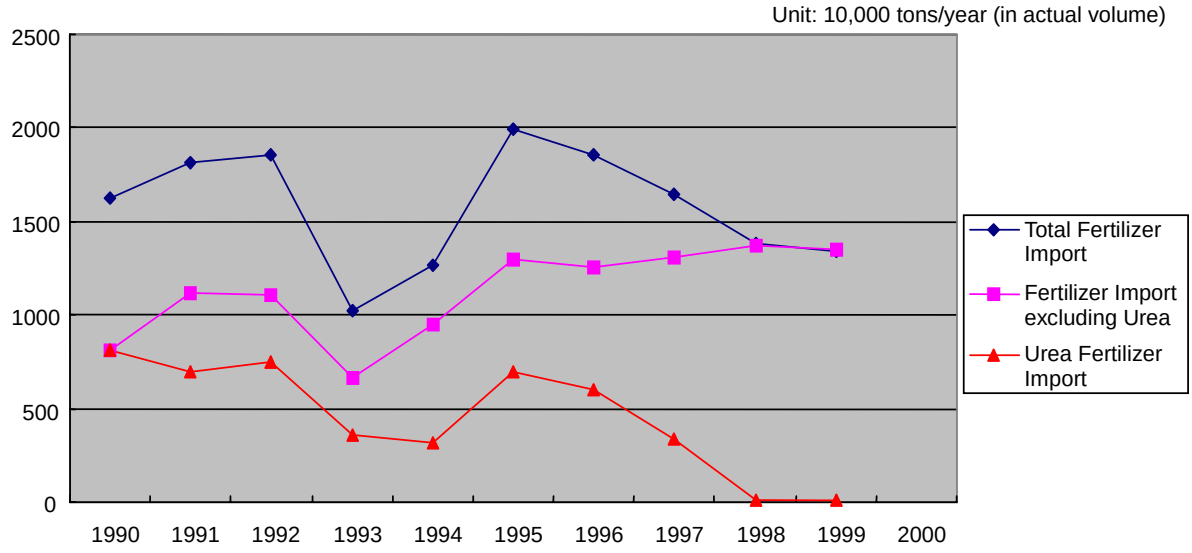
Since subject plant and related plants of this project were constructed in the suburbs of Weinan City of Shenhsi Province, which was an agricultural region, a site of approximately 85 hectares was developed for the plant and its peripheral area and a private railway line in the length of 20km was built. Also, according to the people concerned in the Weihe fertilizer plant, a number of direct employees of this project are about 1,640 (including about 540 female employees) and that under temporary contract are about 350 and a number of residents increased in the surrounding area of this project are approximately 10,000. As such, it can be said that this project has contributed to the increase of employment opportunity.

③ Urea Fertilizer Import and Foreign Currency Payment of China

Five-year average import of urea fertilizer in China under 8th Five-Year Plan (1991～1995) had reached to 5.64 million tons/year or US$932 million/year though it had somewhat fluctuated by the year as shown in Fig.4 and Fig.5. Because of the increase in the national production of urea fertilizer including this project, import of urea fertilizer started to fall from its peak of 1995. Furthermore, since Chinese government banned import of urea fertilizer because of excessive buildup of domestic inventory in 1997, volume of import had drastically dropped to 120,000 tons in 1998 and 70,000 tons in 1999. Because of this, amount of payment made for the import of urea fertilizer in foreign currency had suddenly dropped to US$17 million/year in 1998. Abrupt drop of import in China, which was a prominent importing country of urea fertilizer in the world, gave a considerable impact on the international price of urea and as shown in Table 3, price of urea after 1997 had considerably dropped.

On the other hand, import of fertilizer other than urea such as Nirinan, NPK conversion, NP conversion, potassium chloride, potassium sulfate and ammonium nitrate has been gradually increasing since 1995 and thus, decrease in the total fertilizer import and payment in foreign currency are being checked. Background or future prospect of this could not be confirmed in this report, however. For instance, a separate study would be required from a viewpoint of changes in the selection of fertilizer type (due to high polymerization[11] and increased complexity[12] of fertilizer) by the consuming farmers caused by the shift of overall economic system into market economy,

Fig 4: Total Fertilizer Import Volume of China

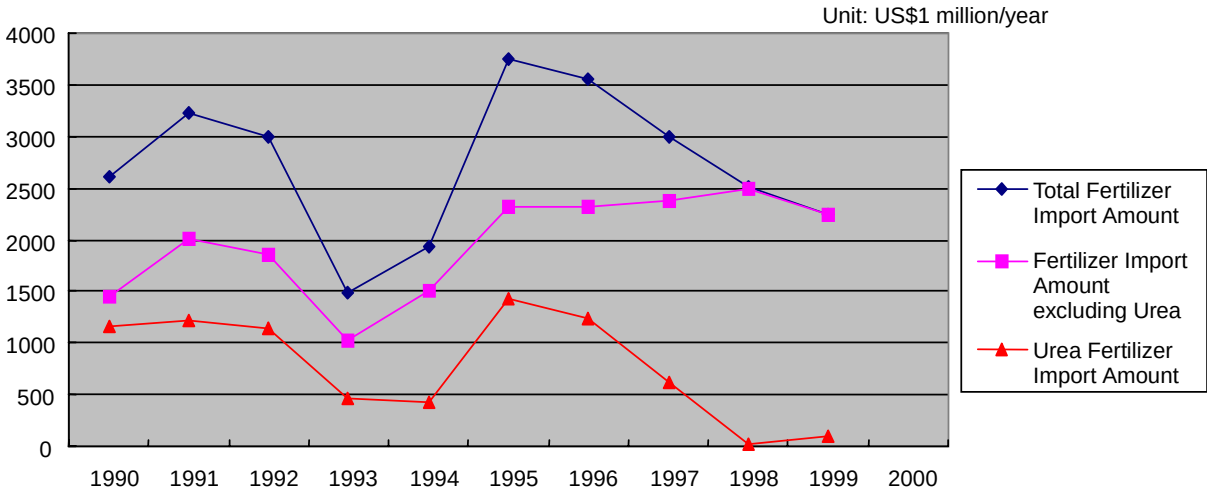


Source: China Almanac and Chemical Industry Almanac

[11] High polymerization means increase of active ingredients (nitrogen, phosphate and potassium) contained in the fertilizer.

[12] Means to contain at least two ingredients of three elements (nitrogen, phosphate and potassium) of fertilizer. For example, urea is a monolithic fertilizer that contains approximately 21% nitrogen and triple superphosphate (TSP) is also a monolithic fertilizer that contains approximately 56～58% phosphate, while Nirinan (DAP) is a composite fertilizer that contains approximately 18% nitrogen and approximately 46% phosphate. Trend of fertilizer is shifting towards high polymerization and increased complexity for efficient farming and high-added-value farm produce harvest in the farming industry.

Fig 5: Total Fertilizer Import Payment of China



Source: China Almanac and Chemical Industry Almanac

Table 3: Change in International Price of Urea Fertilizer (Unit: US$/ton)

	1994	1995	1996	1997	1998	1999	2000
Price (Note)	123.46	186.49	166.01	116.92	84.39	66.79	101.61

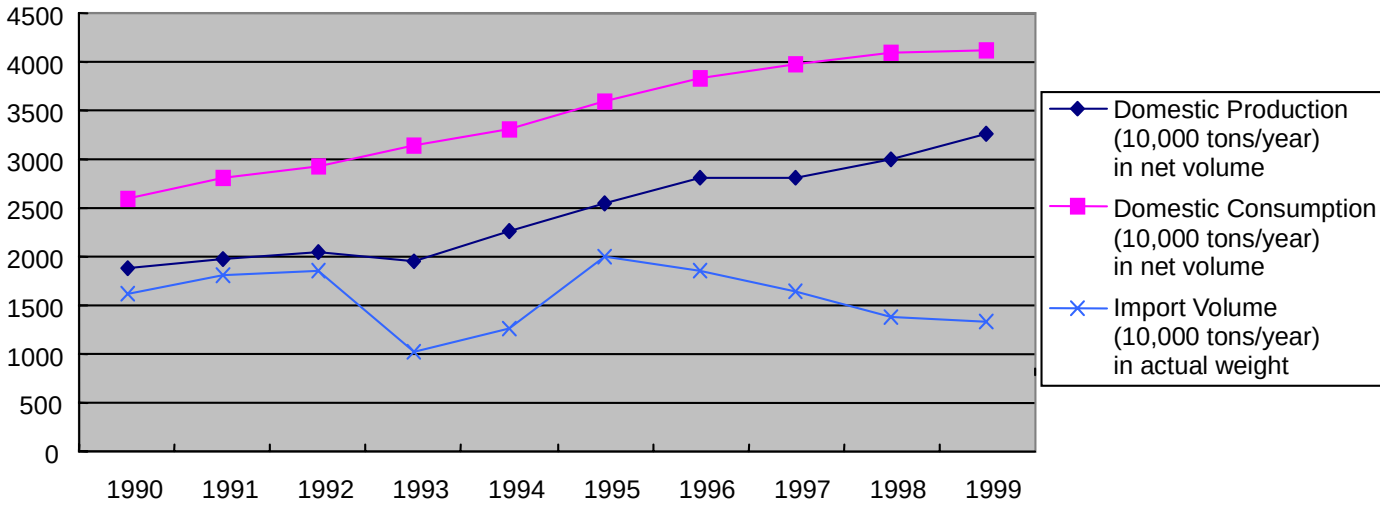
Source: FADINAP Data

Note: FOB Price of East European Bulk Shipment

④ Stable Fertilizer Supply in China

Recent supply and demand balance of fertilizer of whole China shown in Fig. 6 indicates a sort of decrease in the gap between consumption and production of total fertilizer in China. This project, which is supposedly to contribute to the stable domestic supply of fertilizer in 8th Five-Year-Plan, has somewhat contributed to the improvement in the balance of supply and demand.

Fig 6: Fertilizer Demand-Supply Balance of China



Source: China Almanac

⑤ Improved Food Production and Productivity in China

A policy target, “to increase food production to 500 million tons in 2000 based on the population of 1.25 billion and per capita food requirement of 400 kg per annum,” which was established in 8th Five-Year Plan, high level plan of this project, was materialized as shown in the data of Table 4. We believe that this project to construct urea fertilizer plant with annual production volume of 520,000 tons (or 240,000 tons in net volume) has somewhat contributed to the materialization of the above higher-level target.

Table 4: Improved Food Production and Productivity in China

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Food Production (10,000 tons/year)	44,624	43,529	44,266	45,649	44,510	46,662	50,454	49,417	51,230	50,839
Population (x10,000)	114,333	115,823	117,171	118,517	119,850	121,121	122,389	123,626	124,810	125,909
Per Capita Food Production (kg)	390	376	378	385	371	385	412	400	410	404
Fertilizer applied acreage = Planted acreage (x1,000 ha)	113,466	112,314	110,560	110,509	108,544	110,060	112,548	112,912	113,787	113,161
Unit applied fertilizer (kg/ha) Net	228	250	265	285	306	326	340	353	359	364
Unit food production (kg/ha）	3,983	3,876	4,004	4,131	4,102	4,240	4,483	4,377	4,502	4,493

Source: China Almanac

⑥ Impact on Natural Environment

Environment Protection Bureau of Weinan City, which is a controlling government agency for environmental protection, has carried out regular or spot environmental inspection on this project; however, business operator has reported that they have not received any instruction or recommendation relating to the environmental protection of this project.

⑦ Impact on Social Environment

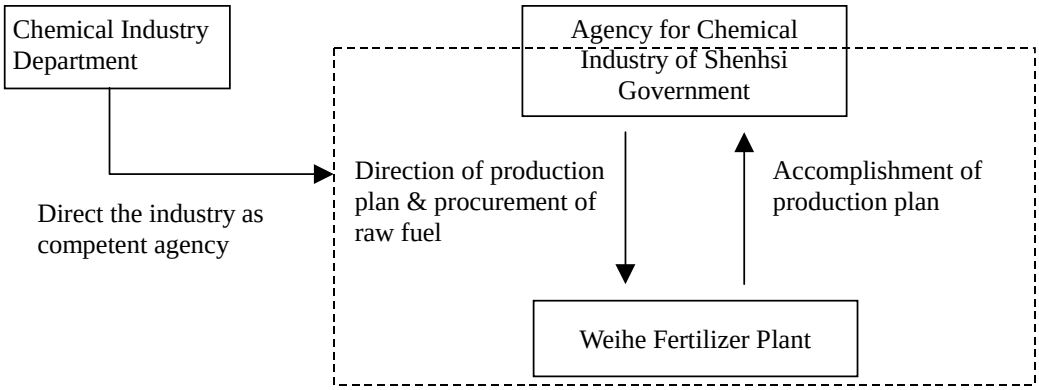
Business operator explained that no negative social impact has been reported on the construction of this project.

2.5 Sustainability

① Operation and Maintenance System

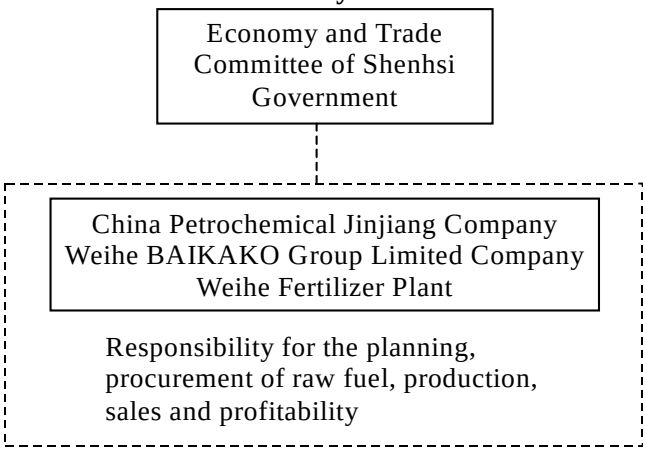
At the time of appraisal, it was agreed that the Chemical Industry Department of the Central Government directs the industry as a competent authority under the planned economy system as shown in Fig. 7 and Weihe Fertilizer Plant carries out actual operation and maintenance based on the production plan prepared by the Agency for Chemical Industry of Shenhsi Government who is also responsible for the procurement of raw fuel. However, in the course of this project, China has made a fundamental change in its economical principle and introduced socialism market economy and fertilizer field has also shifted into market economy around 1996 in the midst of such trend, and the shift is still continuing. According to the shift in the economic system, higher functions of central and provincial governments were abolished. And business operator itself started to carry out all necessary works such as planning, procurement of raw fuel, production, and marketing and assumed responsibility for the profitability of the project. Operation and maintenance system at the time of evaluation was changed as shown in Fig. 8.

Fig. 7: Operation and Maintenance System at the time of Appraisal



Source: JBIC Data

Fig. 8: Operation and Maintenance System at the time of Evaluation



Source: Data of Implemented Organization

Weihe BAIKAKO Group Company is an organization positioned in early 2000 under the Economy and Trade Committee of Shenhsi Government and Weihe Fertilizer Plant, which is responsible for the operation and maintenance of this project, belongs to this company. Total number of direct employees of Weihe Fertilizer Plant at the time of evaluation was 1,640, consisting of 910 in production, 105 in production control, 180 in administration and management, and 445 in other departments. Weihe Fertilizer Plant has proper organization and personnel for the maintenance and for the series of business activities such as procurement of raw materials and services, production in the plant, and marketing of urea product. Management has a good sense of responsibility and, therefore, any significant problem is found in the organization and the system to carry out this project.

② Situation of Operation and Maintenance

Generally speaking, in the ammonia plant that uses coal as raw material, receiving and storage facility of coal, coal gasification facility, and waste water treatment equipment are in most cases contaminated. However, as a result of field inspection, it was found that there was no problem in the maintenance of the facilities of this project, as the plant was kept clean, warehouses for urea and supplies were kept in good order, painting of the whole equipment was controlled, and road and passages were well weeded and thoroughly cleaned. Also, in view of the behavior of operator in the

central control room or movement of maintenance staff, no problem was found in the technical competency of the staffs for their operation and maintenance.

Although fertilizer production in the Weihe Fertilizer Plant was way below the planned production volume after 1996 when the construction of project plant was completed, but the operation gradually improved since 1999 and the production had exceeded planned production volume in 2000. Weihe Fertilizer Plant is also planning to produce and market 520,000 tons of urea per annum in the future. In view of the purchase of raw fuel coal, system and skill for the operation and maintenance of the plant, functional control of the whole plant, no specific problem was found to accomplish planned production volume in the future as far as technical side is concerned. It seems that there would be no problem in the sales of urea product produced in this project as the quality of the product is kept at higher level in China in its particle size, water content, etc. and they are receiving sales order from various regions outside of the province. Further, they do not leave their marketing activities to any third party sales organization, but they are doing it by themselves.

③ Financial Situation

Although we were unable to obtain detailed data worth to analyze on the financial situation of Weihe Fertilizer Plant, we tried to calculate financial situation of 2000 based on the information learned at the time of field survey. The result of our calculation is shown in Table 5. Certain level of profit is kept in the stage of gross profit. It seems a certain level of profitability is kept after interest payment.[13] Since this project uses coal as raw fuel and China has abundant coal deposit, it has cost advantage over other urea fertilizer plant, which uses residual oil as fuel, so that it is financially better positioned.[14] However, it must be noted that the environment for the end balance has become worse than that at the time of appraisal because of an increase in the price of raw fuel.

Table 5: Financial situation of Weihe Fertilizer Plant (x 10,000 RMB)

Year	(a) Sales revenue	(b) Production/ sales cost (Note)	(c) Gross profit	(d) Interest payment	(c) - (d)
2000	54,506	41,330	13,176	8,910	4,266

Source: Prepared based on the data obtained from Implementing Organization

Note: Including depreciation expense

From the above situation, as far as organization, system and technology are concerned, not much problem is found in the operation and maintenance of this project. However, it must be noted that the environment for the end balance of this project is deteriorating than that at the time of planning because of increasing raw fuel price. Furthermore, as a considerable change is expected in the trend of domestic market for urea fertilizer in China such as the change in the needs of fertilizer by the consumer/farmer according to the development of market economy or the influence on the macro-economy made by the entry into WTO, managing situation of Weihe Fertilizer Plant must be cautiously watched in the future.

3. Lessons Learned

Nothing in particular

[13] It was not possible for us to obtain the data that shows entire financial situation of the total plant including all nonoperating revenues such as repayment of project cost or taxes required by the project.

[14] While production and sales cost of urea of this project was calculated at 530 RMB/ton at the time of evaluation, the same was calculated in other two urea fertilizer plants supported by Japanese Loan, which use residual oil for raw material, at 910 RMB/ton (Jinjiang) and 738 RMB/ton (Inner Mongolia), respectively.

Comparison of Original Plan and Actual Scope

Item	Plan	Actual
① Project Scope		
(1) Ammonia Plant	300,000MTPY	300,000MTPY
(2) Urea Plant	520,000MTPY	520,000MTPY
(3) Air separator	40,000Nm3PH	40,000Nm3PH
② Construction Period		
(1) Fundamental design	Apr, 1992－Sep. 1992	Apr, 1992－Dec. 1992
(2) Detailed design	Oct, 1992－Oct. 1993	Oct, 1992－Dec. 1993
(3) Procurement	Mar. 1992－Jun. 1995	Mar. 1992－Jun. 1995
(4) Civil engineering & construction works	Jan. 1993－Dec. 1995	Mar. 1993－Aug. 1995
(5) Trial run	Dec. 1994－Nov. 1995	Dec. 1994－Mar. 1996
(6) Start of commercial run	Nov. 1995	Mar. 1996
③ Project Cost		
Foreign Currency	26,926 Million Yen	26,926 Million Yen
Local Currency	24,161 Million Yen (1,032.5 Million RMB)	18,090 Million Yen (1,282.95 Million RMB)
Total	51,087 Million Yen	45,011 Million Yen
JBIC loan portion included	26,926 Million Yen	26,926 Million Yen
Exchange Rate	1 RMB = 23.4 Yen	1 RMB = 14.1 Yen (Note)

Source: JBIC Data and Data prepared by Implemented Organization

Note: Result of exchange rate is an average of annual average exchange rate during construction period weighted by the investment made in RMB.