China

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

Report Date：October 2002
Field Survey：July 2001

1. Project Profile and Japan's ODA Loan

Site Map：Jiujiang-city, Jiangxi Province

Site Photo： Jiujiang Fertilizer Plant Facilities

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 Jiangxi, site of this project, fertilizer production in 1990 (in net volume) was mere 280,000 tons (in three fertilizer types) and 170,000 tons (in nitrogenous fertilizer) against the demand (in net volume) of 690,000 tons (in three fertilizer types) and 420,000 tons (in nitrogenous fertilizer) respectively. And the shortages were filled by the shipments from other provinces. Since the province has abundant supply of residual oil, which is a raw material for fertilizer production, and also, to cope with future increase in the demand of nitrogenous fertilizer, urea in particular, in Jiangxi Province, it was decided to construct a nitrogenous fertilizer (urea) plant, which uses residual oil as raw material, in Jiujiang Oil Refinery in Jiujiang-city, Jiangxi Province.

[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

1.2 Objectives

Objectives of this project are to cope with sharply increasing fertilizer demand and to improve productivity in the food production in Jiangxi Province through the construction of urea fertilizer plant with annual production capacity of 520,000 tons (or 240,000 tons in net volume).

1.3 Project Scope

ODA loan covers the total amount of foreign currency portion of the project cost, including 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	2,887 Million Yen	8,713 Million Yen	9,757 Million Yen	21,357 Million Yen
Loan Disbursed Amount	2,887 Million Yen	8,713 Million Yen	9,756 Million Yen	21,357 Million Yen (Note)
Date of Exchange of Notes	September 1991	October 1992	August 1993	-
Date of Loan Agreement	October 1991	October 1992	August 1993	-
Terms and Conditions		2.6%	2.6%	-
Interest rate	2.6%	30 years	30 years	-
Repayment period (Grace Period)	30 years (10 years)	(10 years)	(10 years)	
	General untied	General untied	General untied	-
				-
Final Disbursement Date	November 1996	November 1997	September 1999	-

Note: Executed total amount does not correspond to the total of each loan because of the rounding of figures.

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.

However, according to the drastic change in the economic system of China occurred in the course of this project, operation and maintenance of this project have also been forced to change. Originally, Agency for Chemical Industry of Jiangxi Government was supposed to assume responsibility in the preparation of production plan and procurement of raw fuel material. However, after the completion of the project, it has been changed that the business operator itself is supposed to assume responsibility in all transactions including planning, procurement, production and sales of raw fuel and assumes responsibility in the final balance of the project. As a result of this, production of urea fertilizer in the plant of this project is controlled below the capacity of facility because of the managerial judgment of controlling unit for the operation and maintenance to maximize the profit. In the future, it could not be denied that the market trend might influence the production volume of urea fertilizer and the political priority of this project has dropped from that in the planning stage.

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

2.2 Efficiency

1) Project Cost

Actual result of investment amount in Chinese currency has increased from planned 1,196 Million RMB to 1,469 Million RMB, however, total project cost in Japanese currency is still within the planned scope. When the total project cost is reconverted into Chinese currency, the actual cost of 3,151 Million RMB was larger than the planned cost of 2,218 Million RMB because of the fall of RMB in its exchange rate[5].

2) Construction Period

Construction was started in February 1993 with the basic design and the trial run was initiated in June 1996 or five months later than the original schedule. In August 1996, raw material was supplied to ammonia equipment and urea was produced as product in October 1996. However, a trouble[6] occurred in the equipment of residual oil gasification system and much time was spent with the licensor of gasification system to fix the trouble. Because of such trouble, trial run was only completed in December 1996, which was an 8-month delay against original schedule.[7]

2.3 Effect (Degree of Achievement)

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 80% 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, as the trouble in the system was not fully solved even after the completion of trial run carried out in December 1996, production volume in 1997 was as low as 210,000 tons/year. In 1998, however, production volume reached at 83% of final production target of 520,000 tons/year and 97% in 1999, which was fairly close to the planned volume.

On the other hand, planned production volumes for 2000 and 2001 were modified to less than 520,000 tons/year and production in 2000 was 310,000 tons/year. This was simply the managerial decision made by China Petrochemical Jiujiang Company, since Jiujiang Oil Refinery who supplies raw material to the subject plant of this project is owned by China Petrochemical Jiujiang Company who is the controlling unit for the operation and maintenance of this project. Because it is more profitable for the business as a whole to market the residual oil produced by Jiujiang Oil Refinery as by-product rather than to use it just for the production of urea. China Petrochemical Jiujiang Company explains that their production will not exceed 400,000 tons.

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

	1997 (Completed)	1998 (2nd year)	1999 (3rd year)	2000 (4th year)	2001 (5th year)
Planned Production (When appraised)	416,000	468,000	520,000	520,000	520,000
Planned Production (Modified)	270,000	466,000	520,000	305,000	400,000
Production Result	210,047	431,354	505,485	306,903	---

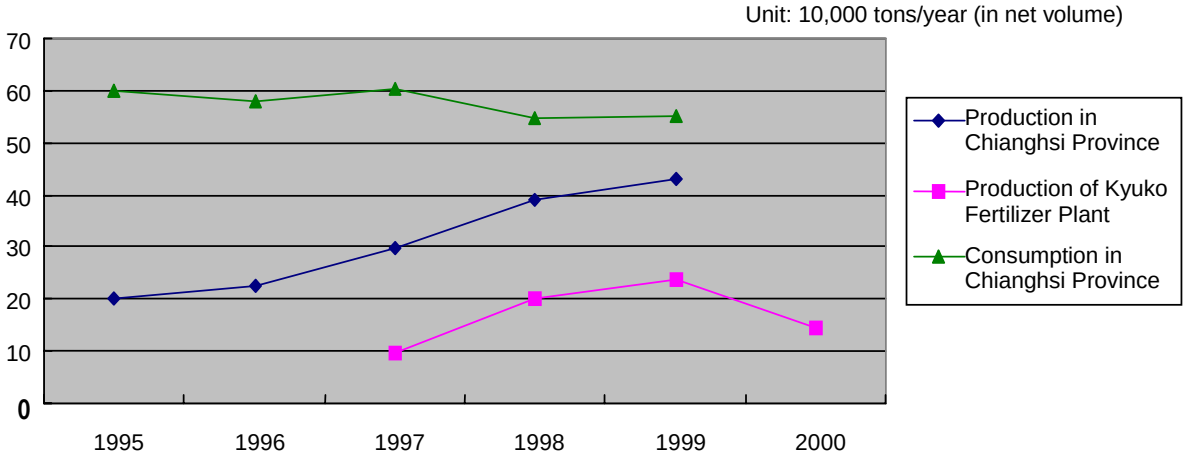
Source: Data of Implemented Organization

[5] Exchange rate in the planning stage was 1RMB = 20.9 Yen but it was reduced (average during investment period) to 12.7 Yen.
[6] Since jet nozzle of residual raw oil wore much faster than expected, reproduction and test of the nozzle was repeated.
[7] Shape and operating condition of the nozzle type that matches to the properties of raw residual oil is normally determined after a number of tests have been repeated. In some instances, it may require a period of several months.

2) Nitrogenous Fertilizer Demand in Jiangxi Province

Gap between the demand for the nitrogenous fertilizer in Jiangxi Province and the supply made in the form of production in the province before the project was implemented (1990) was 250,000 tons (in net volume) and it had increased to 350,000 tons just before the completion of project in 1996. However, since the start of operation in this project, this gap has narrowed down to 120,000 tons in 1999 as shown in Fig. 1.[8] Urea fertilizer produced in this project is mainly used to fill the demand within Jiangxi Province. As far as the results up to 1999 are concerned, it is appreciated that this project is coping with the demand of fertilizer in Jiangxi Province.

Fig 1: Nitrogenous Fertilizer Balance in Jiangxi Province



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

3) Recalculation of Internal Rate of Return (IRR)

When the financial internal rate of return (FIRR)[9] of this project was recalculated by counting initial investment (such as construction cost) and operation and maintenance expense as expense and sales revenue of fertilizer as income based on the annual production volume of 400,000 tons, rate of return became to negative figure compared with the planned figure of 10.5% at the time of appraisal. Contributing factors are the business plan just to produce 400,000 tons with production capacity of 520,000 tons, increased investment (increase in investment made in Chinese currency and that in RMB value invested in foreign currency due to the fall of Chinese currency), increase in the price of residual oil of raw material oil and difficulty to increase the sales price of urea.[10] Likewise, when economical internal rate of return (EIRR) was recalculated using urea fertilizer production of this project as an effective alternative to the import (saving in foreign currency), recalculation resulted to 0.7% against 7.5% 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 and adjustment in the volume of production and sales, in addition to the increased investment, like in the case of FIRR.

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.

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

[9] FIRR is based on the total capital. Initial investment (such as construction cost) and cost of operation and maintenance were counted as expense and sales revenue of fertilizer was counted as revenue.

[10] When an inductive analysis was carried out on the factor of FIRR drop, it was confirmed that the cost increase, sluggish sales price, and sales quantity adjustment gave considerable influence among four factors pointed out in this paper.

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

	Manufacturing/Sales Cost (Note 1)	Domestic Sales Price	Import CIF Price (Note 2)	Exchange Rate (Note 3)
When appraised	475 RMB/ton	1,000 RMB/ton	814 RMB/ton	20.9 Yen/RMB
When evaluated	910 RMB/ton	1,073 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 import price is a value converted into RMB per US$150/ton.

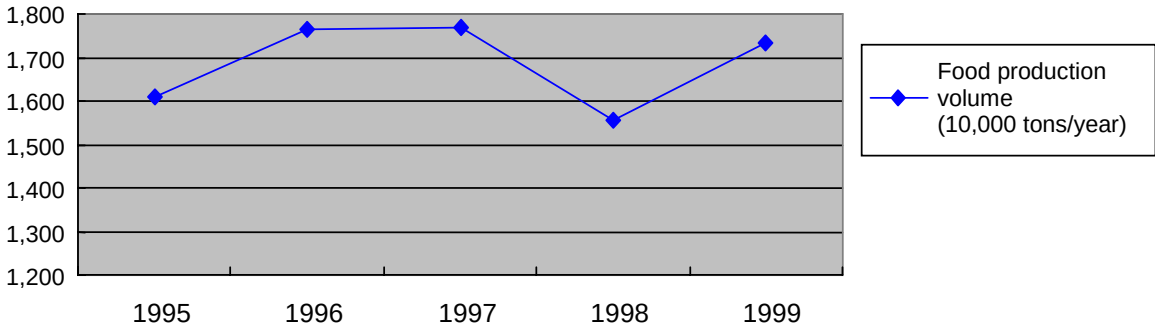
Note 3: Exchange rate used for evaluation is average of January-March 2001 in IMF Data.

2.4 Impact

1) Food Production Volume and Productivity in Jiangxi Province

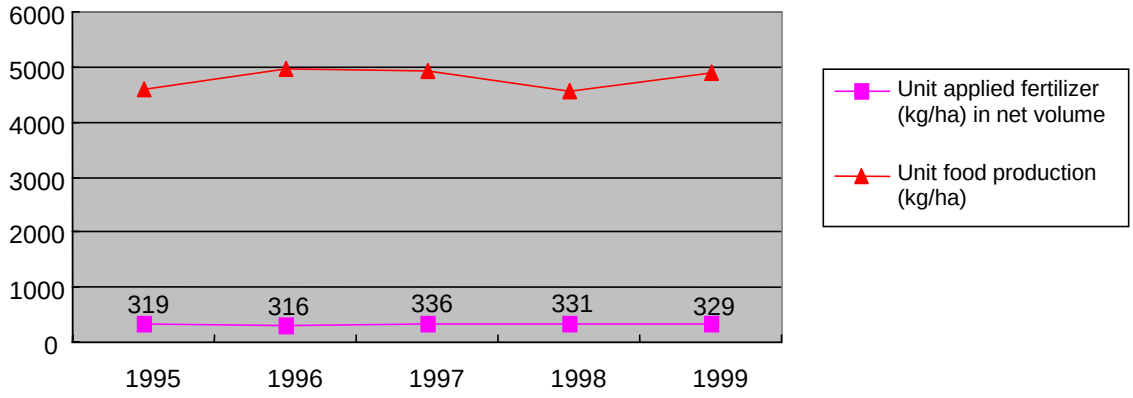
As a result of this project, increased supply or input of urea fertilizer improved productivity of food production (unit production volume) including rice, which is a key agricultural product of Jiangxi Province. Thus, an impact to increase food production was expected. In Fig. 2 and Fig. 3, food production volume, unit applied fertilizer and unit food production in Jiangxi Province are shown. However, it is rather difficult to realize the existence of expected impact from these data.

Fig 2: Food Production Volume in Chinghsi Province



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

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



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

2) Promotion of Employment in Jiangxi Province

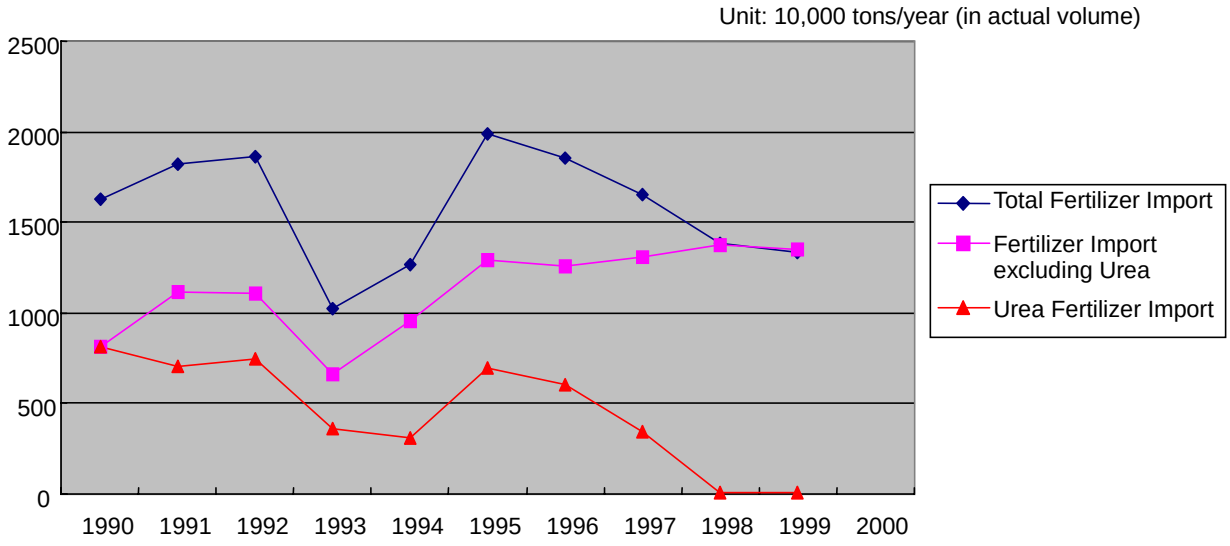
Number of direct employment of this project is 603 (including 107 female employees) and, therefore, this project has contributed to the increase in the number of employment opportunity.

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. 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

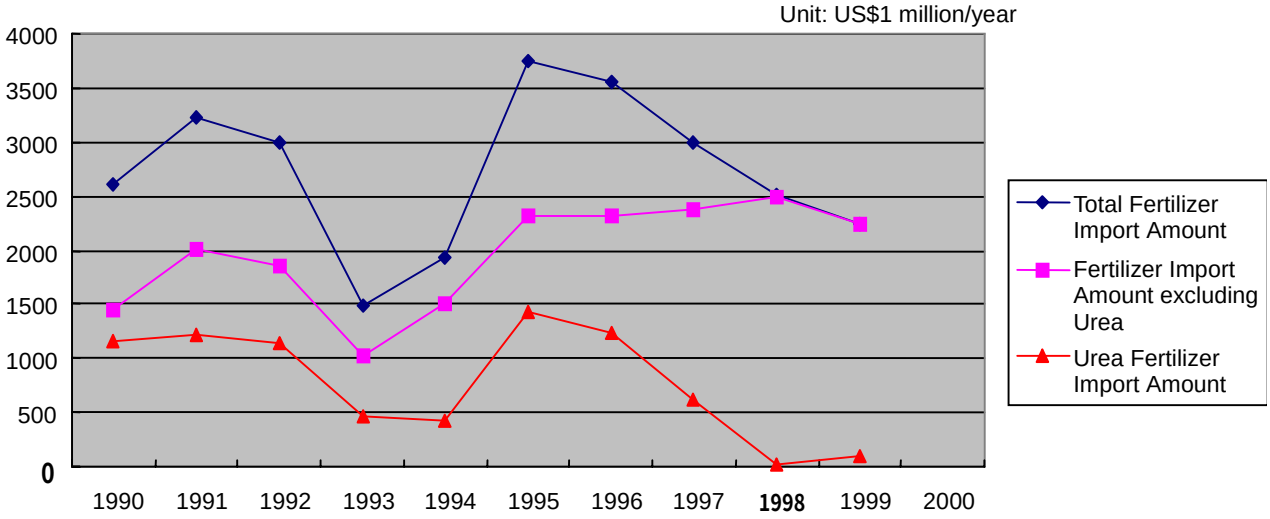


Source: China Almanac and Chemical Industry Almanac

[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

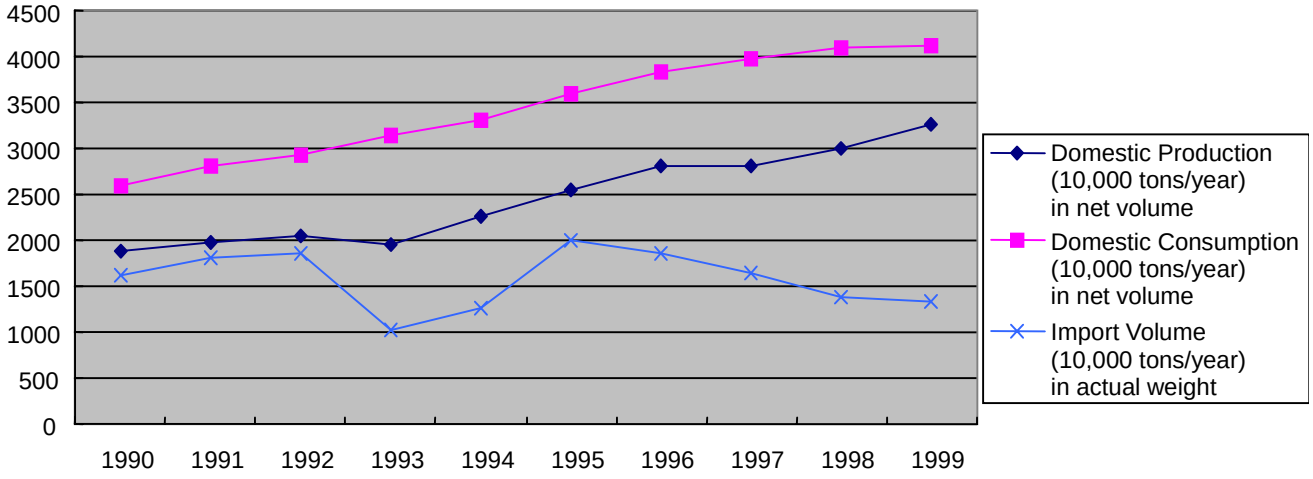


Source: China Almanac and Chemical Industry Almanac

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 by setting food production target at 500 million tons based on the population of 1.25 billion and per capita food requirement of 400 kg per an num,"" 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 3: 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

An electric dust collector is installed in the boiler of this plant to remove the dust contained in the exhaust gas and also, a biochemical processing equipment is installed to prevent water pollution by the waste water from the plant. Environment Protection Bureau of Jiujiang 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.

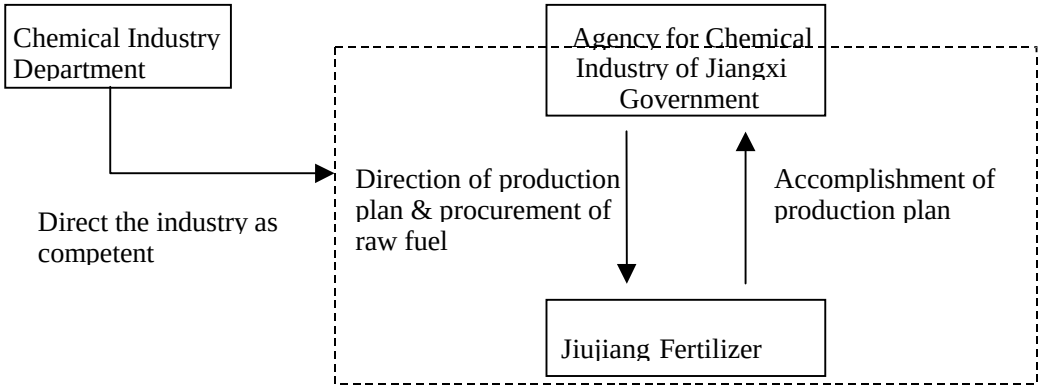
2.5 Sustainability

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 Jiujiang Fertilizer Plant carries out actual operation and maintenance based on the production plan prepared by the Agency for Chemical Industry of Jiangxi 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: Control and Operation System at the time of Appraisal



Source: JBIC Data

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

Source: Data of Implemented Organization

Jiujiang Fertilizer Plant, which was a lower organization of Chemical Industry Department of Agency for Chemical Industry of Jiangxi Government, was merged as a department under the China Petrochemical Jiujiang Company at the end of 1999. China Petrochemical Jiujiang Company is currently organized from three departments of oil refinery, petrochemical plant and fertilizer plant under the parent company of SINOPEC. Number of employees who are directly employed by Fertilizer Plant of China Petrochemical Jiujiang Company (hereafter referred to as Fertilizer Plant of Jiujiang Company), which operates and maintains this project, is 603 or 557 in manufacturing department and 46 in administration at the time of evaluation. This Fertilizer Plant inherited proper organization and personnel for their maintenance system from Jiujiang Fertilizer Plant in their series of business activities such as the purchase of raw materials and services, production in the plant and the marketing of product urea. And thus, no important problem is found in their organization and/or system to carry out this project.

2) Situation of Operation and Maintenance

Generally speaking, in the ammonia plant that uses residual oil as raw material and coal as fuel, receiving and storage facility of fuel coal, gasification facility of fuel oil and waste water treatment equipment are in most cases contaminated. However, as a result of field inspection, it was found that there is no problem in the maintenance of the facilities of this project, as the plant was kept clean, warehouse for urea or supplies were kept in good order, and road and passages were well weeded and thoroughly cleaned. Also, in view of the behavior of operator and others in the central control room, no problem was found in the technical competency of the staffs for their operation and maintenance. In view of well-functioned management of the plant, and technology and system demonstrated in their operation and maintenance on the equipment in the Fertilizer Plant of Jiujiang Company, we do not see any specific problem to accomplish future planned production volume as far as their technical competency is concerned.

It must be noted, however, that the share of the sales of Fertilizer Plant in the total sales of China Petrochemical Jiujiang Company is only about 10%[13] and the residual oil required for the production of urea in Fertilizer Plant will not be allocated from the by-product of oil refinery with priority. But the management policy of the company determines considering total balance of the entire business of the company whether the residual oil is used as raw material for the production of urea or sold to outside as it is. As a result of this, planned urea production volume in the Fertilizer Plant of Jiujiang Company after 2000 is set below the capacity of the facility, as it is more profitable for the entire China Petrochemical Jiujiang Company to sell residual oil as it is, because the profit that can be realized from urea production is less than this.

3) Financial Situation

Although we were unable to obtain detailed data worth to analyze on the financial situation of Fertilizer Plant in the data of China Petrochemical Jiujiang Company, we have tried to calculate three-year financial situation from 1998 to 2000 based on the information learned at the time of field survey. The result of our calculation is shown in Table 5.[14] Because of the increased raw material residual oil price and the sluggish market price of urea as product, it is estimated that the figure at the stage of gross profit excluding that of 1999 is in the red. Also, at the time of field survey, business operator explained that the financial situation of whole China Petrochemical Jiujiang Company, which owns three departments of oil refinery, petrochemical plant, and fertilizer plant, is sound

Table 4: Financial situation of Fertilizer Plant of Jiujiang Company (x 10,000 RMB)

Year	(a) Sales revenue	(b) Production/ sales cost (Note)	(c) Gross profit	(d) Paid interest	(c)- (d)
1998	52,280	55,521	-3,241	16,870	-20,111
1999	62,124	53,142	8,982	27,713	-18,731
2000	32,931	38,640	-5,709	7,001	-12,710

Source: Prepared based on the data heard 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, financial side of this project indicates that the situation is more difficult, because of the increase in the price of raw material residual oil or sluggish market price of the product. If there is a further increase in the

[13] China Petrochemical Jiujiang Company consists of three departments of oil refinery, petrochemical plant and fertilizer plant and their ratio of sales within the company is 8:1:1.

[14] 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.

market price of residual oil or decrease in that of urea, possibility to review the continuation of this project cannot be denied. In order to keep sustainability and autonomous expansion of this project in the future, it is important to have a favorable environment for the production, which reaches as close as the equipment capacity of 520,000 tons, having favorable market price for residual oil and selling price for urea. As such, we must closely watch future management of Fertilizer Plant of Jiujiang Company.

Comparison of Original Plan and Actual Scope

Item	Plan	Result
① Project Scope		
(1) Ammonia Plant	300,000MTPY	300,000MTPY
(2) Urea Plant	520,000MTPY	520,000MTPY
② Construction Period		
(1) Preparatory works	Jan, 1990－Dec. 1992	Jan, 1990－Dec. 1992
(2) Contract	Jan. 1993	Dec. 1993
(3) Ammonia plant construction	Jan. 1993－Dec. 1995	Feb. 1993－Jun. 1996
(4) Urea plant construction	Jan. 1993－Dec. 1995	Feb. 1993－Jun. 1996
(5) Comprehensive trial run	Jan. 1996－Apr. 1996	Jun. 1996－Dec. 1996
(6) Start of commercial run	Apr. 1996	Jan. 1997
③ Project Cost		
Foreign Currency	21,357 Million Yen	21,357 Million Yen
Local Currency	24,991 Million Yen	18,662 Million Yen
	(1,195.78 Million RMB)	(1,469.46 Million RMB)
Total	46,348 Million Yen	40,019 Million Yen
ODA loan portion included	21,357 Million Yen	21,357 Million Yen
Exchange Rate	1 RMB = 20.9 Yen	1 RMB = 12.7 Yen (Note)

Source: JBIC Data and Data of Implemented Organization

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